TEXACO OVERSEAS (NIGERIA) PETROLEUM COMPANY UNLIMITED: TOPCON

ANYALA FIELD DEVELOPMENT

REQUEST FOR PROPOSAL

PIPELINE PUMPS

MARCH, 1997

ANYALA PIPELINE PUMP SKIDS
ANYALA "PP"

Table of Contents

TEXACO OVERSEAS (NIGERIA) PETROLEUM COMPANY

ANYALA FIELD DEVELOPMENT PLATFORM "A"

PIPELINE PUMPS

INSTRUCTIONS TO BIDDERS

TEXACO OFFSHORE ENGINEERING DEPT.

MARCH 1997

_

TABLE OF CONTENTS

–

1.0 REQUEST FOR PROPOSAL

Texaco Overseas (Nigeria) Petroleum Company Unlimited (hereinafter referred to as "Company") solicits a proposal (bid) form "Vendor" to furnish Pipeline Pumps for the Anyala "A" Platform offshore Nigeria in accordance with this Request for Proposal (RFP) and the Purchase Order Documents included with this bid solicitation.

2.0 COMPONENTS

Vendor's proposal is to comply with all of the documents listed below which are part of this bid solicitation:

- Request for Proposal
- Purchase Order Documents
  1. Commercial Requirements
  2. Scope of Work & Reference Documents

3.0 PROPOSAL SUBMITTAL

3.1 Submittal Date & Duration

1. Vendor shall submit one original (marked "ORIGINAL") proposal and one copy (marked
"COPY") by 2:00 PM Central Time on the date specified in the bid solicitation letter to the Company address listed under Section 3.2. Proposals (bids) shall be valid for a minimum of sixty (60) days from the date of submittal.

2. Proposals shall be submitted in a sealed package and clearly marked on the outside with:

   Vendor's Name and Address
   Anyala Field Development
   Pipeline Pump Skid

3.2 Submittal Address

Proposals may be sent by either registered mail or delivered by messenger to the following address:

Texaco Purchasing
3336 Richmond Avenue
Houston, Texas 77098
Attn: George Hawkins

Phone: 713/752-3900

3.3 Contents

Vendor's proposal shall include the following minimum information.

- Completed & Signed Bid Form
- Lump Sum Price for all equipment items per specifications
- Schedule per Section 2.0 of the Commercial Requirements
- Equipment description including design capacity, a complete listing of all components with manufacturers' names and model numbers, and any other pertinent details.
- Listing of all sub-vendors
- Vendor's Quality Plan including a description of Vendor's QA/QC organization and role within Vendor's company, role of Vendor's QA/QC with sub-vendors specific to this work, and a form listing Vendor's QA/QC activities for this work with Vendor's and Company's Hold/Witness/Review points identified (minimum requirements per Company specifications)
- Alternate Proposals & Exceptions if applicable.
- Schedule of Rates for labor and equipment.
- Day rate for overseas work based on 12 hours per day, 7 days per week (start-up assistance).
- Technical contact and phone number.

3.4 Conformity

Vendor's proposal shall comply with all of the requirements defined in the documents making up this bid solicitation. Proposals deviating from the requirements may not be considered for future evaluation. Vendor is allowed to additionally quote alternate proposals as described herein.

3.5 Alternate Proposals & Exceptions

1. Vendor may submit alternate technical or commercial proposals or a proposal with qualifications provided that:

    - A proposal meeting all the specified requirements herein is submitted.
    - Alternative proposals are submitted separately, labeled as such, and differences are fully defined.
    - Alternative proposals improve the quality of the product, reduce the Purchase Order price, or improve the schedule with no sacrifice in quality, performance, safety or operability.

2. Vendor may also submit exceptions to the terms and conditions of the Purchase Order documents if they are clearly labeled, the proposed changes and associated costs are defined, and the reasons for the exceptions are given.

3.6 Changes & Costs

1. Vendor's proposal may not be changed after the date of submittal unless requested in writing by Company.

2. Vendor is obligated to notify Company immediately if Vendor discovers any omissions or errors in his proposal. No amendment to the value of Vendor's proposal as a result of errors or omissions is allowed after the bid submittal date.

3. All expenses incurred by Vendor in responding to this Request For Proposal shall be at Vendor's sole expense.

4.0 BID EVALUATION

Vendors shall be prepared to meet in Company's offices at Vendor's expense to discuss their bid proposal. Company reserves the right to reject any or all parts of any bid or to reject all bids.

5.0 PURCHASE ORDER OBLIGATION

The successful Vendor is required to execute a formal Purchase Order through Company's subsidiary, Texaco International Trader Inc. The purchase order documents included herein shall apply.

6.0 ADDENDA

Changes to any of the bid solicitation documents may be made only by written Addenda issued by Company. Each Addendum shall become a part of the bid solicitation documents and the Purchase Order documents if applicable.

7.0 INQUIRIES

Inquiries may be made to Company only by a Vendor receiving a Request For Proposal. Inquiries shall be written and addressed to Company as listed in Section 3.2 with the subject listed as "Anyala "A" Pipeline Pumps RFP".

8.0 CONFIDENTIALITY

The documents presented herein including all drawings, specifications and other related data are the property of Company and are delivered only for the sole purpose of enabling Vendor to prepare and submit a proposal in response. The information contained herein shall not be disclosed nor released for any other purpose.

TEXACO OVERSEAS (NIGERIA) PETROLEUM COMPANY UNLIMITED: TOPCON

ANYALA FIELD DEVELOPMENT PLATFORM "A"

PIPELINE PUMP SKIDS

COMMERCIAL REQUIREMENTS

TEXACO OFFSHORE ENGINEERING DEPT.

MARCH 1997

TABLE OF CONTENTS

1.0 STANDARD TERMS AND CONDITIONS

The Purchase Order is subject to the Standard Terms and Conditions printed on the back of the purchase order form. The Standard Terms and Conditions are reprinted at the end of the Commercial Requirements section.

2.0 SCHEDULING

1. Vendor shall submit to Company a preliminary schedule with proposal and a detailed schedule within two weeks of Purchase Order award and prior to starting fabrication.

2. The scheduling shall include duration's and calendar dates for:

- issue of construction drawings for approval
- procurement of equipment and materials
- fabrication, painting, assembly, testing
- final inspection
- crating and load-out for transport
- delivery of documentation

3.0 PROGRESS REPORTING

1. The Vendor shall submit a brief progress report weekly. The report should indicate the status (current & planned) of the following as applicable and address its relation to the schedule.

- Drawing issue
- Materials acquisition
- Skid Fabrication
- Vessel/Piping Fabrication
- Equipment assembly
- Piping fabrication
- Sandblasting and painting
- Assembly and testing
- Documentation

2. The report is to be furnished to Company's inspector and faxed to 713-432-3290 as follows:

Texaco OED
4800 Fournace
Bellaire, TX 77401
Attention: Stewart Wood
Subject: Anyala Field Development Platform "A"
(Purchase Order #) Progress Report

4.0 PAYMENT PROCEDURES

1. Vendor agrees to accept as full compensation for the equipment items described in the Purchase Order the all inclusive lump sum amount defined in the Purchase Order.

2. Payment will be made according to the following schedule and the attainment of the listed milestones.

- 20% after drawing approval
- 30% after receipt of materials
- 40% after final inspection
- 10% after receipt of all documentation
- Transportation costs (if applicable) after Company receipt of equipment items.

3. The above percentages do not include transportation costs. Company requires observable confirmation that materials have been received.

4. Vendor shall submit an invoice after Company has agreed that a milestone has been attained. Invoices must include the following information:

- Vendor name and remittance address
- Vendor EIN number
- Anyala Field Development, Platform "A"
- Purchase Order number
- Invoice amount and percentage of total price, total purchase price, and amount and percentage invoiced to date.

Invoices shall be paid net sixty (60) days after receipt.

5. Change orders agreed to by Company in writing must be invoiced separately after acceptance by Company. The invoice must additionally reference the change order number provided by Company.

5.0 CHANGES

Changes, additions, or deletions to any of the terms, conditions, or specifications of this Purchase Order shall only be made by Company specifically in writing and in advance of any action taken. Company's acceptance of Vendor's invoices or other documents does not constitute a change in the Purchase Order terms, conditions, or specifications.

6.0 FINAL ACCEPTANCE

Company's final acceptance of equipment items is based on inspection and testing as required by the Purchase Order specifications. Equipment items must meet or exceed the Purchase Order requirements and specifications. The payment schedule will be interrupted until any observed deficiencies are corrected to Company's satisfaction. Final acceptance by Company does not waive Vendor's warranty obligations and performance guarantee.

7.0 INSURANCE

If Company requires Vendor to furnish transportation, Vendor shall acquire the insurance required for transporting all purchase order items. This insurance shall be for the full replacement cost or the full purchase order value.

8.0 WARRANTY & PERFORMANCE GUARANTEE

1. Vendor shall provide a warranty covering all materials, workmanship and design (by
Vendor) for eighteen (18) months from the date the equipment is shipped from Vendor's shop.

2. Approval of Vendor drawings by Company and inspection and acceptance of Vendor's
work by Company does not relieve Vendor of any responsibility covered by the provisions of the warranty.

3. Deficiencies in Vendor's design, workmanship or materials shall be repaired or replaced at Vendor's expense. Repairs in lieu of replacement, must be approved by Company in advance and inspected by Company for compliance after the repair has been made.

4. Vendor shall guarantee the equipment defined in the Purchase Order documents shall be capable of meeting the specified performance requirements under the conditions described herein. Approval or acceptance of Vendor's work by Company does not relieve Vendor of compliance with this performance guarantee.

TEXACO OVERSEAS (NIGERIA) PETROLEUM COMPANY UNLIMITED: TOPCON

ANYALA FIELD DEVELOPMENT PLATFORM "A"

SPECIFICATION FOR PIPELINE PUMP SKIDS

Specification No. AMD.M.515

REV	DESCRIPTION	AUTHOR	CHECK	RVW	APP	ISSUE DATE

TEXACO OFFSHORE ENGINEERING DEPARTMENT

MARCH 1997

TABLE OF CONTENTS

1.0 SCOPE

1.1 This specification defines the minimum requirements for the design, materials, fabrication, assembly, testing, inspection, painting, preparation for shipment, load-out and VENDOR document requirements of two (2) Oil Pipeline Centrifugal Pumps (one spare), natural gas engine driven, each unit to be mounted on a separate skid.

1.2 Each skid shall be designed for installation on the cellar deck of an unmanned offshore platform (Anyala "A" Platform), associated with the Anyala and Madu Fields Development in Blocks OML 83 and OML 85 of the Gulf of Guinea, offshore Nigeria. The service life expectancy is 3-5 years.

1.3 Within the body of the specification, the following definitions shall apply:

COMPANY:	Texaco Overseas (Nigeria) Petroleum Company
VENDOR:	Successful bidder/manufacturer/supplier/contractor
STANDARDS:	Industry Codes, Standards and Recommended Practices referenced herein

1.4 Each skid shall be suitable for outdoor installation and subjected to the following conditions:

Altitude above sea level:	(+) 42'-6" T.O.S. (Deck)
Relative Humidity:	40% Minimum, 100% Maximum
Minimum Ambient Air Temperature:	45 ^{0}F
Maximum Ambient Air Temperature:	97 ^{0}F
Atmosphere:	Outdoor, Salt Laden and Corrosive
Maximum Wind Loading:	69 MPH, Three (3) second gust 58 MPH, one (1) minute mean

2.0 REFERENCE CODES & STANDARDS, SPECIFICATIONS, DRAWINGS, AND DATA SHEETS

The following drawings and data sheets, and the applicable sections of the current editions of the following codes, standards and specifications (including revisions, addenda, and other documents incorporated by reference) shall be considered a part of this specification. When two (2) or more references conflict the more restrictive reference shall govern.

2.1 REFERENCE CODES & STANDARDS

VENDOR shall design, fabricate, and test the each complete package in

accordance with the latest editions of the following standards and codes:

2.1.1	ANSI B31.3:	Chemical Plant and Petroleum Refinery Piping
2.1.2	API RP-14C:	Recommended Practice for Analysis, Design Installation and Testing of Basic Surface Safety Systems for Offshore Production Platforms
2.1.3	API RP-14E:	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
2.1.4	API RP-14F:	Design and Installation of Electrical Systems for Offshore Production Platforms
2.1.5	API RP 500:	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities
2.1.6	API STD 615:	Sound Control of Mechanical Equipment for Refinery Services
2.1.7	API STD 610:	Centrifugal Pumps for General Refinery Service
2.1.8	API SPEC 7B-11C:	Specification for Internal Combustion Reciprocating Engines for Oil-Field Services
2.1.9	API STD 613:	Special-Purpose Gear Units for Refinery Services
2.1.10	API STD 614:	Lubrication, Shaft-Sealing, and Control Oil System for Special Purpose Applications
2.1.11	API STD 671:	Special Purpose Couplings for Refinery Service
2.1.12	AWS D1.1:	American Welding Society, Structural Welding Code
2.1.13	AISC:	American Institute of Steel Construction, Manual of Steel Construction
2.1.14	SSPC:	Steel Structures Painting Council, Surface Preparation Standards
2.1.15	NFPA 37:	Stationary Combustion Engine and Gas Turbine
2.1.16	NFPA 70:	National Fire Code

2.1.17 NEMA: Standards for Enclosures for Electrical Equipment

2.1.18 HIS: Hydraulic Institute Standards for Centrifugal Pumps

2.2 SPECIFICATIONS

NUMBER	REV.	TITLE
TEX.B.300	0	Design and Fabrication of Skids for Equipment
TEX.B.400	0	Painting and Corrosion Protection
TEX.E.115	0	Electrical Facilities for Packaged Equipment
TEX.E.500	0	DC Supply Systems
TEX.H.400	0	Design and Fabrication of Fuel Gas Filter Package
TEX.I.100	0	Design, Materials, and Installation of Instrumentation
TEX.I.210	0	Design and Fabrication of Local Safety Shutdown Panels
TEX.M.220	0	Centrifugal Pumps (API 610)
TEX.P.100		Piping Design Specification
TEX.P.110		Piping Materials Specification
TEX.P.120	0	Valve Specification
TEX.P.130	0	Fabrication, of Piping

2.3 DRAWINGS

DRAWING NO.	REV.	TITLE
AQP-A-400	B	Piping and Instrumentation Legend
AA-A-404	B	Mechanical Flow Diagram - Surge Vessel
AA-A-405	B	Mechanical Flow Diagram - Utility Gas System
AA-A-408	B	Mechanical Flow Diagram - Oil Shipping Pumps
AA-A-409	B	Mechanical Flow Diagram - Pig Receivers, Departing Pipeline
AA-A-411	B	Mechanical Flow Diagram - Oil Shipping Pump (Typical 2)
AA-A-001	B	Process Flow Diagram - Anyala “A”
AA-GA-002	B	Equipment Arrangement - Main & Cellar Deck

2.4 DATA SHEETS

Data Sheet No.	Title

TEX-M-220S1	Centrifugal Pump Data Sheet
TEX-M-220S2	Pump Seals Data Sheet
TEX-M-220S3	Step-Up Gear Box Data Sheets
TEX-M-220S4	Spark Ignition Gas Engine Date Sheets
TEX-M-220S5	Utility Data Sheet

3.0 GENERAL REQUIREMENTS

3.1 EXTENT OF SUPPLY

VENDOR shall have total responsibility for the design, assembly, fabrication, testing and supply of two (2) Oil Pipeline Pump Skids each consisting of the following:

3.1.1 One (1) Centrifugal Pump (Goulds, Byron Jackson, Ingersoll Rand or company approved equal) with the following rated conditions (See Also Data Sheet No. TEX-M-220S1):

Rated Flow	1850 gpm
Available Suction Pressure	8 psig
Rated Discharge Pressure	398 psig
Maximum Pumping Temperature	190 ^{0}F
Liquid Type	Sweet Crude Oil

3.1.2 One (1) natural gas fired, turbo-charged after-cooled, spark ignition engine driver rated at 600 HP, 560 HP available, (Caterpillar Model 3412 or Equivalent) to power pump described in Section 3.1.1.

3.1.3 One (1) speed-increaser gear box.

3.1.4 Two (2) power transmission shaft couplings.

3.1.5 One (1) forced draft radiator air heat exchanger.

3.1.6 All instrumentation items and accessories required for the safe and most reliable operation of the gas engine driven pump package (See Also Data Sheets listed in Section 2.4).

3.1.7 All required Piping, Valves and Fittings piped to edge of the skid.

3.1.8 All Pneumatic tubing required with offskid tubing terminated at a skid edge bulkhead plate.

3.1.9 All wiring, On/Off Switches, Conduit, Fittings and Junction Box.

3.1.10 One (1) Structural Steel Skid with Drip Pan, Drain Connection and all Pipe Supports.

3.1.11 One (1) Engine/Pump Control Panel.

3.2 VENDOR shall clearly indicate in VENDOR's quotation any deviation or exception to this specification or any document listed in Section 2.0 of this specification.

3.3 Any particular design proposed by the VENDOR that is equal or superior to the one specified herein shall be quoted as an alternate. Such alternates, exceptions or deviations from this specification must be clearly listed in VENDOR's quotation under the heading "Deviation from Specifications". Absence of "Deviation from Specifications" in the quotation shall mean the VENDOR has complied with the specifications fully. Any subsequent cost that may arise as a result of non-compliance shall be borne by VENDOR.

3.4 VENDOR shall obtain clarifications from COMPANY for any conflicting requirements contained in the reference materials listed in Section 2.0. Deviations from the agreed design and construction shall require written approval of COMPANY, after the quotation is accepted.

3.5 Approval of VENDOR submitted drawings by COMPANY shall in no way relieve the VENDOR of the responsibility for fulfilling all of the provisions contained in this specification and attachments.

3.6 Firm price and delivery quotations are requested for the VENDOR's normal delivery. The quotation shall include, but not necessarily be limited to, the provisions of all labor materials, equipment and supervision to supply to COMPANY the Oil Pipeline Pump Skids as described in this specification, and all specifications and drawings referenced herein.

3.7 VENDOR shall provide start-up assistance as required by the COMPANY.

4.0 TECHNICAL REQUIREMENTS

4.1 GENERAL

4.1.1 VENDOR shall design, assemble and supply two (2) 1850 GPM, gas engine driven, pipeline pump packages. Each package shall be mounted on VENDOR designed and supplied separate structural steel skids per Section 2 Reference Codes, Standards, Specifications, and Drawings.

4.1.2 In general, only one pump shall be in operation at any time; the second pump shall be spare.

4.1.3 Vendor shall submit to company at the beginning of the project

1. P&ID's
2. Complete skid and equipment layout
3. Skid piping drawings showing connections to edge of skid
4. Complete list of all instruments and controls with size, Model No.
and all required information for specification.

4.2 PIPELINE PUMPS

4.2.1 VENDOR shall size, furnish and install two (2) pipeline pump skids, each consisting of a natural gas engine driven centrifugal pump. Pumps and drivers design shall conform to the requirements of this specification and the Data Sheet as listed in Section 2.4.

4.2.2 Each pump driver HP, and pump RPM shall be determined by using 1850 GPM oil flow rate and 398 psig (maximum) discharge pressure.

4.2.3 All component materials shall be suitable for the chemical and physical properties of the fluid being pumped, offshore environment and shall be within the general guidelines set forth in this specification.

4.2.4 Fluid and pressure rating shall be compatible with the piping to which
each pump is connected. In no case shall the rating be less than 300# ANSI for the suction and for the discharge connections.

4.2.5 All pump materials shall be in accordance with referenced documents, as well as the Project Specification and Centrifugal Pump Data Sheets.

4.2.6 All pumps shall have a minimum five percent positive and negative head tolerance available at design flows by changing impellers.

4.2.7 Where applicable, pumps shall be provided with removable hardened shaft sleeves to isolate the shafting from the product fluid.

4.2.8 Drain and vent connections shall be provided on all centrifugal pumps. The minimum size case connection shall be 1½' flanged with

ANSI B-16.5 flanges, or machined and studded outlets.

4.2.9 The pump(s) shall be provided with spacer type coupling designed to permit removal of bearings, seals and rotor without disturbing the pump driver or piping.

4.2.10 Pumps shall be supplied with the seals specified in the Project Specifications and Centrifugal Pump Data Sheets. All pumps shall be equipped with mechanical seals and same shall be shipped installed in the pump.

4.2.11 All couplings must have rigidly supported, removable coupling guards of anodized 6016-T6 aluminum or other Company-approved corrosion-resistant, non-sparking material, for personnel protection.

4.2.12 Base plates shall be rigid enough to maintain driver, coupling and pump alignment (without grouting) and prevent excessive vibration. Jackscrew shall be furnished to facilitate horizontal and vertical alignment of pump(s) and driver(s).

4.2.13 The baseplate shall be fabricated to meet the requirements of the COMPANY Specification No. TEX-B-300 "Design and Fabrication of Skids for Equipment".

4.2.14 Driver bases shall have slotted holes to facilitate alignment.

4.2.15 A set of ¼" thick 316L stainless steel shims shall be provided under pump(s) and driver(s).

4.3 DRIVER DESIGN

4.3.1 VENDOR shall supply and assemble on each skid, one (1) natural gas fired Spark Ignition engine driver for the pipeline pump. The engine shall be a Turbo-charged Aftercooled, four-cycle, operating at 1800 or less, RPM with a 10:1 compression ratio.

4.3.2 The selected engine shall have a design which provides the necessary power required to operate the pump at its rated output as well as that which is required by all engine driven auxiliaries. Engine horsepower output shall be based on 1800 RPM (maximum) operating speed.

4.3.3 The engine shall be equipped with replaceable dry type air inlet filters, each of which shall be provided with a differential pressure type indicator to visually indicate replacement requirement and rain shield.

4.3.4 The engine shall be equipped with a Coast Guard approved spark arresting muffler-silencer mounted on the skid to discharge exhaust downwind of the prevailing wind. Exhaust must not blow back over the platform with prevailing winds. Noise levels shall meet OSHA standards.

4.3.5 Engine shall be manually started using utility gas from the platform's utility gas system. A carbon steel strainer, lubricator and vane type starter shall be installed in each starting system.

4.3.6 VENDOR shall provide a vent manifold for each skid. Starter exhaust and pre-lube pump exhaust shall be tied into the manifold which shall be routed by VENDOR to the edge of skid.

4.3.7 VENDOR shall provide a complete fuel gas system for the engine. Piping shall be 2" Schedule 80 minimum. All valves shall be carbon steel 150# ANSI class. An orifice meter shall be provided in the fuel gas system to measure the fuel consumption.

4.3.8 All steel regulators, necessary to reduce the fuel gas pressure to engine demand pressure, and 316 SS liquid filled pressure gauges on supply line and carburetor inlet shall also be provided and installed by the VENDOR.

4.3.9 VENDOR shall provide each engine with venturi/nozzle type carburetors. Fuel gas adjusting screws shall be provided for varying fuel heating values from 900 to 1500 BTU per cubic feet.

4.3.10 The engine shall operate at a constant speed to meet the pump requirements. Flow control shall be accomplished by regulating the fuel flow to the engine, i.e. throttling the engine's governor.

4.3.11 VENDOR shall supply the engine with a solid state low tension shielded ignition system with common receptacles, individual shielded transformers, and shielded platinum type spark plugs. Both primary and secondary leads shall be enclosed in flexible SS braided conduit with test switch for each plug. Ignition system shall be UL approved for Class I, Group 2, Division 2.

4.3.12 SAE standard flywheel, ring gear, and flywheel housing shall be provided on the engine. A cranking ("barring") device shall be provided for rotation of the engine during maintenance and inspection.

4.4 LUBRICATION SYSTEM

4.4.1 A pressure type lubrication system shall be provided on the rotating equipment. All pumps, filters, cooling equipment, pressure monitors, pressure indicators, pressure regulators, and relief devices, and any other devices required for a functional, easily maintained system shall be included and completely piped and tubed on the skid.

4.4.2 COMPANY requires a separate lube oil system for the gas engine and gear box. The entire system shall be properly sized by VENDOR for the design conditions and supplied complete on the skid. The crankcase shall be located in the engine base.

4.4.3 VENDOR shall provide the lube oil system with engine driven, positive displacement rotary-gear type oil pumps. Each pump shall be designed to provide sufficient pressure and capacity at engine idling speed.

4.4.4 VENDOR shall equip the lube oil system with full flow dual filters, each sized for 100% flow and piped and valved to permit a change of filter cartridges while the engine-pumps are running without disturbing their normal operation. Filters shall be supplied with differential pressure gauges that indicate service requirements.

4.4.5 VENDOR shall supply the lube oil reservoir sized for at least the capacity of one system refill. The reservoir shall be equipped with at least a level regulator/indicator, a sump with drain, a flame arresting screened vent, a screwed fill valve and low level alarm switch. VENDOR shall equip the lube oil system with an automatic type crankcase fill valve from the reservoir.

4.4.6 VENDOR shall install crankcase/sump drain and oil filter drain lines for the system. Drain lines shall also be installed on the low point of the oil side of each oil cooler. Each drain shall be tied-into a 1" common header and piped to the skid edge for each unit.

4.4.7 Lube oil piping shall be free of rust, scale, weld slag, water and foreign material capable of damaging bearings and other rotating equipment items.

4.4.8 VENDOR shall supply three (3), 55-gallon lube oil day tanks with level indicators, two (2) foot stands, and fill connections for each pump unit.

4.5 COOLING SYSTEM

4.5.1 VENDOR shall supply and skid mount a radiator air exchanger for cooling. The radiator shall be a copper free aluminum, finned vertical type with copon epoxy dipped Admiralty brass tubes. An engine driven non-sparking fan shall also be provided.

4.5.2 The Air-Cooled exchanger shall provide all cooling required for the engine/pump units through the radiator cooled closed circuit glycol/water system with the cooled glycol/water as the cooling medium to all services. An engine driven centrifugal jacket water pump shall provide the necessary pressure and flow to circulate the coolant through the system. This includes lube oil cooling.

4.5.3 Automatic thermostat control valves with bypass shall be provided in the cooling water loop to control water temperature. Bypass shall be arranged so that the flow is never throttled.

4.5.4 The system shall be arranged to allow complete drainage of the entire system; drains shall be piped to skid edge.

4.5.5 The fan shall be engine driven using banded, multi-grooved V-belts. Belts shall be matched set, anti-static, heat and oil resistant. The belt drive system shall be based on a service factor of 1.75 times the calculated transmitted horsepower rounded up to the next whole belt.

4.5.6 VENDOR shall provide a positive belt tensioning means incorporating an adjustable base, with guides and hold-downs, jack screws, and locking bolts.

4.5.7 The belt drive shall be arranged such that V-belt replacement can be accomplished without disturbing any equipment other than belt guards and tensioning devices.

4.5.8 Removable belt and fan guards shall be provided to meet OSHA requirements as applicable. Guards shall be equipped with lifting hooks or eyes for lifting.

4.5.9 Drive bearings provided shall give an L_{10} rated life of 50,000 hours continuous operation (per AFBMA Standard 11).

4.5.10 The fan shall be fixed pitch or manually adjustable only. Air flow control is necessary only to meet VENDOR's requirements. Fan shall be shrouded for forced draft operation with air flow away from the engine.

4.5.11 Drive bearings shall be grease lubricated with all grease points piped to a greasing point which is safely accessible for lubrication during engine operation. Lube piping to bearings shall be SS tubing, screwed fittings at the bearing housing and fitted with grease fittings at the access end. Tubing shall be positively clipped in place with SS clips and screws.

4.5.12 VENDOR shall mount the complete radiator assembly vertically on the engine end of the skid

4.6 GEAR BOX DESIGN

4.6.1 The gear rated horsepower shall be the maximum of:

a) The maximum horsepower (or torque) developed by the engine within its factory recommended operating envelope.

b) The maximum horsepower (or torque) required by the pump when operating at maximum (rated) horsepower input at rated RPM. Efficiencies of each unit shall be considered in this rating and shall be included in the calculations provided by VENDOR.

The gear Service Factor shall be selected by VENDOR per AGMA 420, but shall not be less than 1.7. It shall be applied at the maximum continuous horse power of the prime mover multiplied by any overload capacity it may have.

4.6.2 Cooling systems, if required, shall be designed and supplied by the VENDOR, complete on the skid and integrated into the total skid cooling system. Cooling shall be by a tube and shell exchanger in the close circuit radiator cooled water system.

4.6.3 VENDOR shall design and supply a base plate arrangement for the gear unit which is approved by the gear manufacturer and which permits alignment of the engine-gear-pump train during installation and for later maintenance purposes without cutting, grouting, or other permanent or semi-permanent arrangements.

4.6.4 Gear casing shall not be internally coated with any coating or paint. VENDOR shall pipe gear drains to the skid edge, provide each with a gate valve and terminate in a flanged connection.

4.6.5 VENDOR shall supply and install vibration probes at least at the radial bearings. If thrust bearings are used, then axial position probes

on each shaft shall be provided. Oil temperature probes shall also be provided in the system.

4.6.6 VENDOR shall complete the Special Purpose Gear Unit Data Sheet per the manufacturer's recommendations for the design conditions as noted in this specification. VENDOR shall furnish the completed data sheet to COMPANY with VENDOR's proposal for COMPANY review and approval.

4.7 COUPLING DESIGN

4.7.1 VENDOR shall supply and install couplings for the shafting between the engine and gear, and the gear and pump per API STD 671 and its data sheets.

4.7.2 Couplings shall be the non-lubricated spacer flexible disc, limited end float type and or as approved by the equipment manufacturer. Consideration for coupling selection shall include the location and selection of thrust bearings utilized in the various rotating equipment. (Reference Appendix D of API 613). VENDOR shall provide API STD 671 coupling data sheets to the coupling manufacturer for design and selection of the coupling. The completed data sheets shall be given to COMPANY by VENDOR for review and approval prior to assembly.

4.7.3 If integral type spacer hubs are provided, VENDOR shall furnish jig or template for use in locating holes. Removable hubs provided shall be taper bored, key fitted to the shaft.

4.7.4 VENDOR and the coupling manufacturer shall mutually agree upon actual axial frequencies of the coupling. Application or relaxing of API STD 671, paragraph 2.3.4 requirements shall be presented for COMPANY review and approval prior to fabrication.

4.7.5 The high speed shaft coupling shall be balanced per the requirements of API STD 671, paragraph 2.5.3.1, part 3, component balance and assembly balance. The low speed shaft may be balanced to the part 2 requirement of this paragraph. VENDOR shall be responsible for all balancing procedures.

4.7.6 Any cooling required by the coupling shall be determined and provided by VENDOR.

4.7.7 Coupling spacing element length shall permit coupling element, shaft seal element and shaft bearing replacement without movement of driving or driven equipment.

4.7.8 Coupling components shall be fabricated of materials resistant to corrosion by the salt sea atmosphere. Coatings or paint is not acceptable. Material selection shall be detailed in VENDOR's proposal.

4.7.9 Coupling guards shall meet the OSHA requirements. Detail drawings of guards shall be submitted to COMPANY for review and approval prior to fabrication.

4.7.10 VENDOR shall install the couplings and hubs complete for use during shop testing. Any replacement components required during testing, or for installation on site shall be provided by the VENDOR. Any tools necessary to re-assemble couplings or coupling components which were removed for shipment after testing will be provided by the VENDOR.

4.8 PROCESS PIPING

4.8.1 VENDOR shall furnish, fabricate, assemble and install on skid all piping, valves and fittings as required to provide to COMPANY completely operational Oil Piping Pump Skids. Piping components supplied shall as a minimum be as depicted on Drawing AA-A-411. VENDOR shall adhere to the requirements of COMPANY Specification No. TEX-P-110 "Material for Piping", in the supply of a complete skidded piping system. VENDOR shall supply and install isolation valve upstream of the Safety Relief Valves for testing purpose.

4.8.2 Pump headers and laterals line size and pipe wall thickness shall be designed per the requirements of API RP-14E and ANSI B31.3 respectively for the conditions as given in the Data Sheets and as shown on the Drawing No. AA-A-408. Fluid velocities shall not exceed those recommended by API RP-14E.

4.8.3 VENDOR's piping design, materials selection, fabrication, procedures and practices, assembly, tests, and inspection shall be per ANSI B31.3, and API RP-14E except as noted in this specification, and general specifications referenced in Section 2.2. Design and supply shall be approved by the COMPANY prior to fabrication. No on-skid system shall be supplied by COMPANY.

4.8.4 VENDOR shall supply all piping complete on the skid. Each skid shall

be operable upon tie-in of process and utilities.

4.8.5 Raised face flanged connections shall be used exclusively except at the pump connection which should have as a minimum flat face flanged connections, per paragraph 4.2.4.

4.8.6 VENDOR shall restrict the design of the skid piping off skid tie-ins to the layout as shown on skid layout Drawing AA-GA-002.

4.8.7 VENDOR shall provide skid piping which has been designed and fabricated to the requirements of Specification TEX-P-130.

4.8.8 VENDOR shall in addition to those specifications referenced in Paragraph 4.8.7 and elsewhere in this specification, provide the following:

- Welded carbon steel piping for the fuel gas system downstream of filters
- Tubing may be used as required and shall be 316 SS connected by double ferrule type 316 SS fittings
- Threaded carbon steel, schedule 80, cooling water piping
- SS armored cooling water hoses with SS screwed hose clamps
- Flexible connectors at all tie-ins between off engine steel piping and cast iron engine or engine mounted auxiliaries connections
- Valved high point vents and low point drains for the cooling water
- systems (users); drains shall be piped to skid edge and terminated in a flanged connection

4.8.9 VENDOR shall fabricate and install on each skid one (1) instrument gas and one (1) utility gas headers as shown on Drawing AA-A-411. Design and fabrication shall be per ANSI B31.3 requirements.

4.8.10 VENDOR shall not allow any carbon steel material to come into contact with any SS/exotic metallurgy piping at any time during the handling, fabrication or assembly of these systems.

4.9 STRUCTURAL SKID

4.9.1 VENDOR shall design, assemble, fabricate and paint a one piece structural steel skid complete with four lifting eyes, drip pan sloped to a 2" threaded drain connection and have the skid walking surface covered with galvanized steel grating. Splices shall be made over skid beams or

structural supports. The skid shall be designed for a single point lift using spreader bars, if required. If spreader bars are required to accomplish a single point lift, they shall be provided at VENDOR's expense.

4.9.2 Skid perimeter beams shall be of the same depth to allow for full seal welding of the skid to the deck around the entire perimeter. Drip pans shall be constructed of carbon steel plate; minimum thickness shall be ¼ inch. Pan construction shall not allow accumulation of liquids.

4.9.3 VENDOR shall follow the requirements of COMPANY Specification. No. TEX-B-300, "Design and Fabrication of Skids for Equipment" and AWS D1.1, in the design and fabrication of the skid in addition to the points spelled out in this specification.

4.9.4 All equipment shown on COMPANY Drawing AA-A-411 shall be installed on the skid within envelope dimensions not exceeding those as depicted on AA-GA-002, “Equipment Arrangement - Main & Cellar Deck”.

4.9.5 All equipment shall be arranged to provide ample room for normal operation, inspection and maintenance. No equipment, valve, instrument or piping item shall project beyond the outer plan boundary of the skid. The unit shall be completely packaged and ready for operation upon connection of utilities and interconnecting piping.

4.9.6 Piping, conduit, pushbutton stations, etc. shall be supported by structural supports which are attached to the skid. Pressure piping shall not be used as structural support members.

4.10 ELECTRICAL DESIGN

4.10.1 VENDOR shall provide and install a complete skid electrical system which is suitable for a Class I, Division 2, Group D location as per API RP 500.

4.10.2 VENDOR's design and installation shall conform to the requirements of Specification No. TEX.E.115 "Electrical Facilities for Packaged Equipment".

4.10.3 VENDOR shall install all wiring in plasti-bond PVC coated copper free aluminum conduit. VENDOR shall terminate all on skid wiring per the applicable codes and Specification No. TEX.E.115 at the end element/user to a terminal strip which shall be located in the junction box at the edge of the skid. Terminal strip shall be supplied with 50%

spares.

4.11 INSTRUMENTATION DESIGN

4.11.1 VENDOR shall install on skid all supplied instruments as required for the safe and trouble-free operation of the equipment and as depicted on Drawing AA-A-411.

4.11.2 All installations shall conform to the typical hook-ups as shown in Specification TEX-I-100.

4.11.3 VENDOR shall provide and install a tubing fusible loop field on the skid per the requirements of API RP-14C. VENDOR shall utilize 3/8" x 0.035" wall, 316 SS tubing and 160°F melting point fusible material. VENDOR shall terminate the field at the bulkhead plate.

4.11.4 VENDOR shall provide and install a vibration switch (Murphy) on each pump.

4.12.4 VENDOR shall supply and install one (1) bulkhead plate on the skid. Instrument tubing continuing off skid shall be terminated on this plate for tie-in of interconnect by others. Each connection shall be tagged with the number provided on the Mechanical Flow Diagram, AA-A-411.

4.13.5 VENDOR shall supply and install all instrumentation as shown on MFD AA-A-411, as required by API RP-14C.

4.13.6 VENDOR shall also supply and install the following local instrument items,

- Inlet and outlet temperature indicators on each heat exchanger,
- Cooling water system high-high temperature shutdown and high temperature alarm switch,
- Sight flow indicators on cooling water outlets of each equipment item requiring cooling water,
- Level gauge, low level alarm and low-low level shutdown switches on each radiator surge tank,
- Engine vibration,
- Fan vibration,
- Pump vibration,
- Gear Box vibration

- Each vibration shutdown switch shall be the external, manually re-set, case mounted, velocity type with sensitivity adjustment.

4.13.7 VENDOR shall design, install and test all instrument items per the requirements of the General Specification TEX-I-100.

4.13.8 VENDOR shall supply and install only 316 SS tubing, fittings (double ferrule type) and instrument valving for sensor and control lines. Tubing strapped on pipe is not acceptable.

4.13.9 VENDOR shall design fabricate and install on each skid one (1) SS finish pneumatic control panel; the panel shall be suitable for use in a Class I, Division 2, Group D, hazardous area and for an offshore marine environment. Panel shall have a breather and drain.

4.13.10 VENDOR shall provide the following panel mounted indicators,

- Instrument Gas Control Pressure
- Lube Oil Pressure
- Lube Oil Temperature
- Jacket Water Temperature
- Fuel Gas Pressure
- Starting Gas Pressure
- Engine Vibration
- Engine Speed (RPM)
- Engine Running Hours
- Fuel Manifold Pressure
- Pump Vibration
- Fan Vibration
- Gear Box Vibration

4.13.11 VENDOR shall provide alarm/shutdown switches and install each such that testing of the control circuit, including testing of the actuating element where possible is accomplished without interfacing with the normal operation of the equipment.

4.13.12 VENDOR shall provide the following alarm and shutdown safety switches mounted as required. All shutdown functions shall appear on a first out, lock-out type function indicator with a manual reset

capability only.

	Function	
Safety Device	Alarm	Shutdown
Low Pump Discharge Pressure	X	
High Pump Discharge Pressure	X	
Low Lube Oil Level	X	
Low Lube Oil Pressure	X	X
High Jacket Water Temperature	X	X
Engine Overspeed	X	X
Engine Vibration	X	X
High Cooling Water Temperature	X	X
Low Cooling Water Level	X	
Fan Vibration	X	X
Pump Vibration	X	X
Low Pump Suction Pressure	X	X
Gear Box Vibration	X	X

4.13.13 VENDOR shall supply and mount the following panel mounted controls:

- Engine Speed Control
- Engine Start Sequencing

Panel schematic shall be attached to the inside of the panel door.

4.13.14 VENDOR shall provide the necessary logic, panel mounted devices and switches to enable the panel to send an electrical status signal to a remote transmission unit (by others). Panel shall be wired to receive a shutdown signal from engine and pump critical condition monitoring instrumentation.

4.14 APPROVED COMPONENT MANUFACTURERS

Only the following referenced or listed manufactures are approved. Alternate equipment manufactures are unacceptable without written approval of COMPANY.

4.14.1 Manually Operated Valves

Valve Type	Manufacturer
• Ball	WKM, KF, Jamesbury, Grove, Orbit
• Check	Weatley, Mokveld, KF, Grove

• Needle	AGCO, Whitey, Hoke, KF
• Gauge	AGCO, Whitey, Hoke
• PSV	AGCO, Crosby

4.14.2 Miscellaneous Equipment

Equipment	Manufacturer
• Centrifugal Pump	Goulds, Ingersoll-Rand, Byron Jackson or Company approved equal
• Natural gas fired SI engine	Caterpillar or equal
• Gear Box	Lufkin or equal
• Coupling	Recommended by Vendor
• On/Off Switch	Crouse-Hinds, Appleton, Allen-Bradley, Killark

5.0 SURFACE PREPARATION AND PAINTING

5.1 The entire package shall be painted in accordance with COMPANY Specification No. TEX-B-400, “Painting and Corrosion Protection”. This shall include the skid, piping, valves and fittings. The only exceptions shall be the pumps, transmission, instruments and instrument tubing, which shall be installed then removed before sandblasting and painting or installed after painting.

5.2 VENDOR shall clean and coat those items supplied with the manufacturer's standard coating, i.e., pumps, etc., per Specification No. TEX-B-400.

5.3 Surface preparation shall not begin without COMPANY approval and not until completion of all hydrostatic testing.

6.0 INSPECTION AND TESTING

6.1 COMPANY shall be given the opportunity to perform inspection of the equipment at any time during manufacture/fabrication/assembly. A mutually agreed upon advanced notice shall be given by VENDOR to COMPANY for witness testing by COMPANY's representative.

6.2 VENDOR shall provide all facilities, tools, equipment, utilities, labor, etc.

necessary for completing tests. VENDOR's test procedures shall be submitted to COMPANY for approval prior to beginning fabrication.

6.3 No recalibration of Test Stand devices shall occur during test on any equipment. Tests shall be to COMPANY approved test procedures only.

6.4 Each engine shall be given a factory run-in test to prove operation prior to mounting with the pumps. Each pump shall also be tested at the factory including a NPSH test. Each gear box shall be tested at the factory where it is built.

6.5 All piping shall be hydrostatic tested at 1.5 times the maximum allowable working pressure. VENDOR shall adhere to the requirements of COMPANY Specification No. TEX-P-130.

6.6 Gaskets used on hydrostatic tests shall be of the same type as those required for operation. A rust inhibitor shall be added to the test water during hydrostatic testing of steel piping.

6.7 COMPANY requires a full load test of engine/pump skids performed at VENDOR's fabrication site, after the units have been completely assembled and piped. Such test shall include running each unit at full rated flow and discharge pressure using fresh water doped with corrosion inhibitors. All controls, switches, alarms, shutdowns shall be tested. VENDOR's shall also furnish a complete description of the test procedures to be followed for the full load test.

7.0 PREPARATION FOR SHIPMENT

7.1 After COMPANY acceptance of all tests, VENDOR shall drain completely all lube oil and cooling water from those systems. VENDOR shall also provide and ship with each skid the equivalent of one system fill/replacement lube oil, anti-freeze and new filters for each unit.

7.2 All flange faces and threaded connections subject to damage or corrosion shall be covered with grease or other corrosion preventative and covered with Alliance plastic flange covers, plugs, or caps. In addition, flange covers, plugs, and caps shall be sealed with waterproof tape. Any tape used, shall not be of the type that becomes non-removable with age and/or exposure to sunlight and weather.

7.3 The VENDOR shall recommend and install suitable protection during shipment and storage for the engine/pump set(s).

7.4 The package preservation is to include, but not limited to, at least the following:

- Gaseous fuel system is to be purged with nitrogen
- Preservative oil is to be introduced into the engine, gear and pump lubrication and lubrication cooling systems
- All oil lines, fuel lines, and engine openings are to be capped and sealed

7.5 VENDOR shall load-out and tie-down the completed units on COMPANY furnished transportation.

7.6 In addition to the data appearing on the pumps, drivers and valves nameplates, the skid assembly shall be attached with identification tag with following information stenciled on it.

1) Tag No.: PBA-515, PBA-516
2) Texaco Overseas (Nigeria) Petroleum Co.
   Anyala "A" Platform
3) Description: Oil Pipeline Pump Skids
4) Weight: _____

8.0 SPARE PARTS

VENDOR shall supply spare parts for start-up and commissioning. VENDOR shall furnish a suggested spare parts list for two (2) years operation, indicating the type, quantity and individual prices. The spare parts shall be identical to the installed components. They shall be packed for long term storage.

9.0 VENDOR DATA

Vendor shall provide data requested on document requirements sheet to:

Texaco OED
4800 Fournace
Bellaire, Texas 77401
Attention: Ross Holzle
Subject: Pipeline Pumps - Anyala "A" Platform

DATA SHEETS

A. EQUIPMENT DATA SHEETS

The attached data sheets form an integral part of this specification. VENDOR shall furnish data where shown, and supply completed Data Sheets with his quotation.

VENDOR shall design, fabricate, test and paint each equipment item in accordance with the information and design data in the following Data Sheets:

Data Sheet No.	Title
TEX-M-220S1	Centrifugal Pump Data Sheet
TEX-M-220S2	Pump Seals Data Sheet
TEX-M-220S3	Step-up Gear Box Data Sheets
TEX-M-220S4	Spark Ignition Gas Engine Data Sheets
TEX-M-220S5	Utility Data Sheet

	CENTRIFUGAL PUMPS (API 610)	TEX.M.220S1
	DATA SHEET	PAGE 1 OF 5

Facility Name/Location: ANYALA PRODUCTION PLATFORM / OFFSHORE NIGERIA
Item Name: OI L PIPELINE PUMP — Company Project Number: 2234H01
Item Tag Number: PBA-561A/561B/561C — Purchase Order Number:
Supplier: — Supplier Project Number:

● GENERAL

Applicable to: ☒ Proposal ☐ Purchase ☐ As Built
Information to be completed by: ● Company Supplier ♦ Supplier if not completed by Company
For TEXACO-NIGERIA — Unit
Site ANYALA PRODUCTION PLATFORM — Service PIPELINE
Qty Reqd 3 x 50 % — Pump Size — Type CENTRIFUGAL — Qty Stages 3
Manufacturer — Model — Serial No.
Pumps to Operate in (Parallel)3 — Qty Motor Driven 3 — Qty Gas Engine Driven N/A
(Series) With N/A — Pump Item No. N/A — Pump Item No. N/A
Gear Item No. N/A — Motor Item No. N/A — Gas Engine Item No. N/A
Gear Provided By N/A — Motor Provided By VENDOR — Gas Engine Provided By N/A
Gear Mounted By N/A — Motor Mounted By VENDOR — Gas Engine Mounted By N/A
Gear Data Sheet No. N/A — Motor Data Sheet No. L-2M10S1 — Gas Engine Data Sheet No. N/A

● OPERATING CONDITIONS

Capacity: Normal, gpm 1000 — Rated, gpm 1000
Other
Suction Pressure, psig: Max — Rated 9
Discharge Pressure, psig 490
Differential Pressure, psig 481
Differential Head, ft 1315 — NPSHA, ft 24.5
Process Variation (3.1.2)
Starting Conditions (3.1.3)
Service: ☒ Continuous ☐ Intermittent (Starts/Day)
☒ Parallel Operation Reqd (2.1.11)

● SITE AND UTILITY DATA

Location: (2.1.2.9)
☐ Indoor ☐ Heated ☒ Under Roof
☒ Outdoor ☒ Unheated ☐ Partial Sides
☐ Grade ☐ Mezzanine ☐
Electrical Area Classification (2.1.22/3.1.5) ☐ None
☒ Class 1 — Group D — Div 2
☐ Winterization Reqd ☒ Tropicalization Reqd
Site Data: (2.1.29)
Altitude, ft 42.5 — Barometer, psia
Ambient Temp Range, °F: Min 45 — Max 97
Relative Humidity, %RH: Min — Max 100
Unusual Conditions (2.1.23) ☐ Dust ☐ Fumes
Other SALT/CORROSIVE
Steam Conditions:

	Min: psig	°F	Max: psig	°F
☐ Drivers:				
☐ Heating:				

● SITE AND UTILITY DATA (CONT)

Electricity:

	Drivers	Heating	Control	Shutdown
Voltage	4160			
Phase	3			
Hertz	60			

Cooling Water: (2.1.17)
Temp Inlet, °F — Max Return °F
Press, psig: Normal — Design
Min Return, psig — Max Allow dP, psi
Water Source
Chloride Concentration (3.5.2.6), ppm
Instrument Gas Press, psig: Max 90 — Min

● LIQUID

Type/Name of Liquid SWEET CRUDE OIL
Pumping Temperature:
Normal, °F 100 — Max, °F 190 — Min, °F 68
Vapor Pressure, psia — at °F
Relative Density (Specific Gravity):
Normal 0.86 — Max — Min
Specific Heat, (Cp), Btu/lb °F
Viscosity, cP 4.3 — at °F 100
Max Viscosity, cP 11.5 @ 68 °F
Corrosive/Erosive Agents (2.11.1.8) SALT/SAND
Chloride Concentration, ppm (3.5.2.6)

No.	Date	Revision	By	Apvd.
0	6/97	FOR BID	RKB	

● LIQUID (CONT)

H_2S Concentration, ppm (2.11.1.11) _____
Liquid (2.1.3): ☐ Toxic ☒ Flammable
☐ Other _____

PERFORMANCE

Proposal Curve No. _____ rpm _____
Imp Dia, in. Rated _____ Max _____ Min _____
Rated Power _____ Bhp Efficiency, % _____
● **Minimum Continuous Flow:**
Thermal, gpm _____ Stable, gpm _____
● Preferred Operating Region, gpm 300 to 1000
Allowable Operating Region, gpm _____ to _____
Max Head at Rated Impeller, ft _____
Max Power at Rated Impeller, Bhp _____
NPSHR at Rated Capacity, ft (2.1.8) _____
♦ Suction Specific Speed (2.1.9) _____
● Max Sound Press. Level Reqd, dBA (2.1.14) 90
Est Max Sound Press, Level, dBA (2.1.14) _____
Remarks PUMP IS EXPECTED TO SEE FLOW VARIATION DUE TO SLUG AT SOME FREQUENCY

CONSTRUCTION

♦ **Applicable Standard:**
☒ API 610 8th Edition
☐ Other (See Remarks) _____
♦ **Pump Type:** (1.1.2)

☐ OH2	☐ BB1	☐ VS1	☐ VS6
☐ OH3	☐ BB2	☐ VS2	☐ VS7
☐ OH6	☒ BB3	☐ VS3	☐ Other
	☐ BB4	☐ VS4	
	☐ BB5	☐ VS5	

Nozzle Connections: (2.3.2)

	Size in.	Flange Rating (lb)	Facing	Position
Suction				
Discharge				
Balance Drum				

Pressure Casing Connections: (2.3.3)

	No.	Size (NPS)	Type
Drain			
Vent			
Press Gauge			
Temp Gauge			
Warm-up			
Balance/Leak-off			

CONSTRUCTION (CONT)

☐ Cylindrical Threads Required (2.3.3)
Casing Mounting: (See Separate Sheet for Verticals)
☐ Centerline ☐ Near Centerline
☐ Foot ☐ Separate Mounting Plate
☐ In-line
Casing Split:
☒ Axial ☐ Radial
Casing Type:
☐ Single Volute ☐ Multiple Volute ☐ Diffuser
☐ Overhung ☒ Between Bearings ☐ Barrel
Case Pressure Rating:
☐ Max Allowable Working Press, psig _____
at °F _____
☐ Hydrotest Press, psig _____
● ☐ Suct press regions to be designed for MAWP (2.2.4)
Rotation: (Viewed from Coupling End)
☐ CW ☐ CCW
● ☐ Impellers Individually Secured (5.2.2.2)
Remarks: _____
● ☐ Bolt OH_3 Pump to Pad/Foundation (5.1.2.4)
Shaft:
Shaft Diameter at Coupling, in. _____
Span Between Bearing Centers, in. _____
Span Between Bearing and Impeller, in. _____
Remarks _____
Couplings: (3.2.2)
● Manufacturer _____
♦ Model _____
Rating, hp/100 rpm _____
● Lubrication _____
♦ Limited End Float Required _____
♦ Spacer Length, in. _____
♦ Service Factor _____
● Driver-Half Coupling Mounted By:
☐ Pump Mfr ☒ Driver Mfr ☐ Purchaser
☒ Coupling per API 671 (5.2.7)
Baseplates:
API Baseplate No. (App. M) _____
● Non-Grout Const. (3.3.13/5.3.8.3.5) _____
Remarks _____

MATERIAL

- ● Appendix H Class (2.11.1.1) S6 (TABLE H1 & G1)
- ● Min Design Metal Temp, °F (2.11.4.5) _____
- ■ Barrell/Case _____ Impeller _____
- ■ Case/Impeller Wear Rings _____
- ■ Shaft _____
- ■ Diffusers _____
- ■ Coupling Spacer/Hubs _____
- ■ Coupling Diaphragms, Disks _____

Remarks _____

BEARINGS AND LUBRICATION

Bearing (Type/Number):

Radial sleeve _____ / _____

Thrust ball _____ / _____

- ● ☒ Review and Approve Thrust Bearing Size (5.2.5.2.4)
- ● **Lubrication:** (2.10)

☐ Grease ☐ Flood ☒ Ring Oil

☐ Flinger ☐ Purge Oil Mist ☐ Purge Oil Mist

☐ Constant Level Oiler Preferred

☐ Pressure Lube Sys (5.2.6) ☐ API-610 ☐ API-614

- ● ☐ Oil Side Press to be > Coolside Press (5.2.6.2.b)
- ♦ Oil Viscosity ISO Grade (5.2.6.5) _____

☐ Oil Heater Reqd: ☐ Elec ☐ Steam (2.9.2.9/5.2.6.3)

Remarks _____

MECHANICAL SEAL OR PACKING

Seal Data: (2.7.2)

- ● ☒ See Attached API 682 Data Sheet
- ● ☐ Non-API 682 Seal (2.7.2)
- ● ☒ Appendix H Seal Code (2.11.1.1) BSTFM
- ♦ Seal Mfr _____
- ♦ Size _____ Type MECHANICAL
- ♦ Mfr Code _____

Seal Chamber Data: (2.1.6/2.1.7)

- ♦ Temperature, °F _____
- ♦ Pressure, psig _____
- ♦ Flow, gpm _____

Seal Chamber Size (Table 2.3) _____

Total Length, in. _____ Clear Length, in. _____

MECHANICAL SEAL OR PACKING

Seal Construction:

☐ Sleeve Material _____

☐ Gland Material _____

☐ Auxiliary Seal Device (2.7.3.20)

☐ Jacket Required (2.7.3.17)

♦ **Gland Taps:** (2.7.3.14)

☐ Flush (F) ☐ Drain (D) ☐ Barrier/Buffer (B)

☐ Quench (Q) ☐ Cooling (C) ☐ Lubrication (G)

☐ Heating (H) ☐ Leakage ☐ Pumped Fluid (P)

☐ Balance Fluid (E) ☐ External Fluid Injection (X)

- ● **Seal Fluids Reqd and Available Flush Liquid:**

Note: If flush liquid is pumpage liquid (as in flush piping plans 11 to 41), following flush liquid data is not required.

Supply Temperature, °F Max _____ Min _____

Relative Density (Sp Gr) _____ at °F _____

Name of Fluid _____

Specific Heat (Cp), Btu/lb °F _____

Vapor Pressure, psia _____ at °F _____

☐ Toxic ☒ Flammable ☐ Other _____

Flow Rate, gpm Max _____ Min _____

Pressure Reqd, psig Max _____ Min _____

Temperature Reqd, psig Max _____ Min _____

Barrier/Buffer Fluid: (2.7.3.21)

- ● Supply Temperature, °F Max _____ Min _____
- ● Relative Density (Sp Gr) _____ at °F _____
- ● Name of Fluid _____
- ● Vapor Pressure, psia _____ at °F _____

☐ Toxic ☐ Flammable ☐ Other _____

- ■ Flow Rate, gpm Max _____ Min _____
- ■ Pressure Reqd, psig Max _____ Min _____
- ♦ Temperature Reqd, psig Max _____ Min _____

Quench Fluid:

- ● Name of Fluid _____
- ● Flow Rate, gpm _____

Seal Flush Piping: (2.7.3.19 and Appendix D)

- ● Seal Flush Piping Plan API PLAN 31

■ ☐ Tubing ■ ☐ Carbon Steel

■ ☐ Pipe ■ ☐ Stainless Steel

- ● Auxiliary Flush Plan _____

■ ☐ Tubing ■ ☐ Carbon Steel

■ ☐ Pipe ■ ☐ Stainless Steel

MECHANICAL SEAL OR PACKING (CONT)

☐ **Piping Assembly:** (3.5.2.10.1)
☐ Threaded ☐ Unions ☐ Socket Welded
☐ Flanged ☐ Tube Type Fittings
♦ ☐ Pressure Switch (Plan 52/53) Type
● ☐ Pressure Gauge (Plan 52/53)
♦ ☐ Level Switch (Plan 52/53) Type _____
● ☐ Level Gauge (Plan 52/53)
● ☐ Temp Indicator (Plans 21, 22, 23, 32, 41)
● ☐ Heat Exchanger (Plan 52/53)
Remarks _____

Packing Data: (Appendix C)
Manufacturer _____
Type _____
Size _____ Qty of Rings _____
☐ Packing Injection Required
Flow, gpm _____ at °F _____
Lantern Ring _____

STEAM AND COOLING WATER PIPING

♦ Cooling Water Piping Plan (3.5.4.1) _____
■ Cooling Water Requirements
Seal Jacket/Brg Hsg, gpm _____ at psig _____
Seal Heat Exchanger, gpm _____ at psig _____
Quench, gpm _____ at psig _____
Total Cooling Water, gpm _____
● Steam Piping: ☐ Tubing ☐ Pipe
Remarks _____

● INSTRUMENTATION

Vibration:
☒ Noncontacting (API 670) ☐ Transducer
☐ Provision for Mounting Only (2.9.2.11)
☐ Flat Surface Reqd (2.9.2.12)
☐ See Attached API 670 Data Sheet
☐ Monitors and Cables (3.4.3.3)
Remarks _____

Temperature and Pressure:
☒ Radial Brg Metal Temp ☒ Thrust Brg Metal Temp
☐ Provision for Instruments Only
☐ See Attached API 670 Data Sheet

● INSTRUMENTATION (CONT)

☒ Temp Indicators (With Thermowells) (3.4.1.3)
Other _____
☐ Pressure Gauge Type (3.4.2.2) _____
Location _____
Remarks _____

● SPARE PARTS (TABLE 6.1)

☒ Start-up ☐ Normal Maintenance
☐ Specify _____

MOTOR DRIVE (3.1.5)

♦ Manufacturer _____
♦ Hp 450 ♦ rpm 3600
■ ☒ Horizontal ☐ Vertical
■ Frame _____
♦ Service Factor 1.0
● Volts 4000 Ph 3 Hz 60
● Type _____
♦ Enclosure WPII OR TEFC
● Minimum Starting Voltage (3.1.6) _____
● Temperature Rise 105 ^{0}C
♦ Full Load Amps _____
♦ Locked Rotor Amps _____
♦ Insulation _____
♦ Starting Method _____
♦ Lube GRAVITY
■ Vertical Thrust Capacity
Up, lb _____ Down, lb _____
■ **Bearings (Type/Number):**
☐ Radial SLEEVE / 2
☐ Thrust _____ / _____
Remarks _____

● SURFACE PREPARATION AND PAINT

☐ Manufacturer's Standard
☒ Other (See Below) TEX.B.400, 400I, 400R
Pump:
☒ Pump Surface Preparation TEX.B.400
☐ Primer _____
☐ Finish Coat _____

● SURFACE PREPARATION AND PAINT (CONT)

Baseplate: (3.3.18)
Baseplate Surface Preparation SPEC. TEX.B.400
Primer
Finish Coat
Shipment: (4.4.1)
☐ Domestic ☒ Export ☒ Export Boxing Required
☒ Outdoor Storage More Than 6 Months
Spare Rotor Assembly Packaged For:
☐ Horizontal Storage ☐ Vertical Storage
Type of Shipping Preparation
Remarks

■ WEIGHTS

Motor Driven:
Weight of Pump, lb
Weight of Baseplate, lb
Weight of Motors, lb
Weight of Gear, lb
Total Weight, lb
Turbine Driven:
Weight of Baseplate, lb
Weight of Turbine, lb
Weight of Gear, lb
Total Weight, lb
Remarks

● OTHER PURCHASER REQUIREMENTS

☒ Coordination Meeting Required (6.1.3)
☒ Review Foundation Drawings (2.1.27)
☒ Review Piping Drawings
☒ Observe Piping Checks
☒ Observe Initial Alignment Check
☒ Check Alignment at Operating Temperature
☒ Connection Design Approval (2.11.3.5.4)
☐ Rigging Device Reqd for Type CH3 Pump (5.1.2.7)
☐ Hydro Thrust Brg Size Review Reqd (5.2.5.2.4)
☒ Lateral Analysis Required (5.1.4.3/5.2.4.1)
☒ Rotor Dynamic Balance (5.2.4.2)
☐ Mount Seal Reservoir Off Baseplate (3.5.1.4)
☐ Installation List in Proposal (6.2.3L)
☐ Spare Rotor Vertical Storage (5.2.9.2)
☒ Torsional Analysis/Report (2.8.2.6)

● OTHER PURCHASER REQUIREMENTS (CONT)

☒ Progress Reports Required (6.3.4)
Remarks

REMARKS

FULL STRING TEST REQUIRED FOR ALL THE THREE PUMP UNITS

	CENTRIFUGAL PUMPS (API 610) PUMP SEALS DATA SHEET	TEX.M.220S2 PAGE 1 OF 2

Facility Name/Location: ANYALA "A" / OFFSHORE NIGERIA

Item Name: PUMP SEALS — Company Project Number: 2231 HO1

Item Tag Number: PBA 515 / 516 — Purchase Order Number: _____

Supplier: _____ — Supplier Project Number: _____

GENERAL

Applicable to: ☒ Proposal ☐ Purchase ☐ As Built

Information to be completed by: ● Company ■ Supplier ♦ Supplier if not by Company

● PUMP DATA

Speed, rpm 3400

Shaft/Sleeve Dia at Seal, in. _____ / _____

Stepped Sleeve Min Dia, in. _____

Stuffing Box I.D., in. _____

Stuffing Box Depth, in. _____

Casing Mount:

☐ Centerline ☐ Near Centerline ☐ Foot

☐ Vertical ☐ Separate Mounting Plate

☐ In-Line ☐ Sump

Casing Split:

☒ Axial ☐ Radial

Impeller:

☒ Between Bearings ☐ Overhung

Pump Materials:

Table H-1 Class S6

Shaft _____

Sleeve _____

Gland _____

● SITE AND UTILITY DATA

Unusual Conditions: ☐ Dust ☐ Fumes

☐ Other SALT/CORROSIVE

Utility Conditions:

Steam:	Drivers		Heating	
Min, psig	____ °F	____	psig ____	°F ____
Max, psig	____ °F	____	psig ____	°F ____

Electric Power:	Drivers	Heating	Control	Shutdown
Voltage				
Phase				
Hertz				

Cooling Water:

Temp: Inlet, °F _____ Max Return, °F _____

Press, psig: Norm _____ Design _____

Min Return, psig _____ Max Allow dP, psi _____

Water Source _____

Instrument Gas Press, psig: Max 90 Min _____

Remarks _____

● LIQUID

Type of Liquid SWEET CRUDE OIL

Concentration _____

Pumping Temperature (PT):

Norm °F, 180 Max, °F 190 Min, °F 110

Specific Gravity 0.85 at °F _____

at Max Temperature, °F _____

☐ Specific Heat (Cp), Btu/lb °F, _____

Vapor Press, psia 15 at °F _____

psia _____ at Max Temperature, °F _____

Viscosity, cP 1.3 at °F 190

Melting Point (or pour point), °F _____

Corrosive/Erosive Agents SALT/SAND

Concentration, % or ppm _____

Chloride Concentration, ppm _____

H_2S Concentration, ppm _____

Solids Content:

Name of Solids Present _____

Concentration, ppm or % wt _____

Particle Size _____

☐ Toxic ☒ Flammable ☐ Other _____

◆ PUMP OPERATING CONDITIONS

Pump Capacity, gpm 1850

Suction Pressure: Rated, psig 8

Min, psig _____ Max, psig _____

Discharge Pressure, psig 398

Differential Pressure, psig 390

■ Sealing Pressure, psig at Throat

Service:

☒ Continuous ☐ Intermittent (Starts/Day _____)

Cycling:

☐ Temperature ☐ Pressure Frequency _____

No.	Date	Revision	By	Apvd
0	3/97	FOR BID	RKB	

◆ MECHANICAL SEAL OR PACKING

◆ Seal Data:
- ● API Matl Class (Appendix H) BDPFM
- Seal Type MECHANICAL-TANDEM
- Seal Size
- Manufacture Code
- Seal Drawing Number

◆ Seal Construction:
- Mounting:
  - ☐ Cartridge
  - ☐ Hooked Sleeve or Non-Cartridge
  - ☐ No Sleeve
- ☐ Pumping Ring Required
- ☐ Auxiliary Seal Device

◆ Gland Taps:
- ☐ Flush (F)
- ☐ Drain (D)
- ☐ Vent (V)
- ☐ Cooling (C)
- ☐ Quency (Q)
- ☐ Heating (H)
- ☐ Barrier (B)

■ Seal Design Data:

Seal Mounting: ☐ Rotating ☐ Stationary

	Single Seal	Dbl or Tandem Seal	
		Inboard	Outboard
Balance, %:			
Face Width, in.:			
Max Press Rating:			
Dynamic, psi:			
Static, psi:			
Min Press Rating:			
Dynamic, psi:			
Static, psi:			
Temperature Rating:			
Min, °F:			
Max, °F:			

● Seal Fluids Requirements:
- Flush Liquid: PUMPAGE
- Flush Piping Plan (Fig. D-2) PLAN 31
- Name of Fluid
- Temp: Max, °F Min, °F
- Specific Gravity at °F
- Specific Heat (Cp), Btu/lb°F
- Vapor Pressure, psia at °F
- ☐ Toxic ☒ Flammable ☐ Other

● Seal Fluids Requirements (Cont):
- ■ Seal Heat Generated, Btu/hr
- ■ Flow Rate: Max, gpm Min, gpm
- ■ Press Required: Max, psig Min, psig
- ■ Temp Required: Max, °F Min, °F

● Barrier Fluids:
- Barrier Piping Plan (Fig D-3)
- Name of Fluid
- Temp: Max, °F Min, °F
- Specific Gravity at °F
- Specific Heat (Cp), Btu/lb°F,
- Vapor Pressure, psia at °F
- ☐ Toxic ☐ Flammable ☐ Other
- ■ Flow Rate: Max, gpm Min, gpm
- ■ Press Required: Max, psig Min, psig
- ■ Temp Required: Max, °F Min, °F

● Quench Fluid:
- ☐ Quench Piping Plan (Fig D-3)
- Name of Liquid
- Flow Rate, gpm

● Required Accessories:
- ☒ Reservoir
- ☒ Pressure Gauge
  - Manufacturer
- ☒ Pressure Switch
  - Manufacturer
- ☐ Heat Exchanger
  - Type
- ☐ Cyclone Separator
- ☒ Level Gauge
  - Manufacturer
- ☐ Other

REMARKS

B. DOCUMENTATION REQUIREMENT SHEETS (DRS)

SPEC. NO.	REV.	TITLE
TEX.B.300R	0	Design and Fabrication of skid for Equipment
TEX.B.400R	0	Painting and Corrosion Protection
TEX.B.400SI	0	Painting and Corrosion Protection - Schedule of Paint Colors
TEX.E.115R	0	Electrical Facilities for Packaged Equipment
TEX.H.400R	0	Fuel Gas Filter Package
TEX.H.400S1	0	Fuel Gas Filter Package by Vendor
TEX.I.100R	0	General Instrumentation Specification
TEX.I.210R	0	Local Safety Shutdown Panels
TEX.M.220R	0	Centrifugal Pumps (API 610)
TEX.P.120R	0	Valve Specification
TEX.P.130R	0	Fabrication of Piping

	DESIGN AND FABRICATION OF SKIDS FOR EQUIPMENT DOCUMENTATION REQUIREMENTS SHEET (DRS)	TEX.B.300R PAGE 1 OF 2

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

Contractor shall supply five (5) complete sets of data books. All Documentation included in the data books shall reflect as-built conditions.

No.	Date	Revision	By	Apvd
0	9-22-97	FOR BID	JDV	

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

DOCUMENTATION		WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Calculations-General.		P	2A	P	E	5P, E	5P
2.	Calculations-Seismic.	-	-	-	-	-	-	-
3.	Design Drawings.	-	P	3A	P	E	5P, E	5P
4.	Shop Drawings.	-	-	-	-	-	-	-
5.	Mill Certificates.	-	P	D	P	E	5P	5P
6.	Welding procedures.	P	P	1A	P	E	5P	5P
7.	Welder qualification test results.	-	P	1A	P	E-	5P, E	5P
8.	Forms tabulating tag numbers of piping and handrail removed for shipment.	-	-	-	-	-	-	-
9.	Drawings locating piping and handrail removed for shipment by tag number.	-	-	-	-	-	-	-
10.	Inspection and testing results.	-	-	-	P	E	5P, E	5P

NOTES

	PAINTING AND CORROSION PROTECTION DOCUMENTATION REQUIREMENTS SHEET (DRS)	TEX.B.400R PAGE 1 OF 2

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

Contractor shall supply five (5) complete sets of data books. All documentation in the data books shall reflect as-built conditions.

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

DOCUMENTATION		WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Paint products.		P	1A				
2.	Chemical analysis of abrasive material.	-	-	-	-	-	-	-
3.	Representative sieve analysis of abrasive material.	-	-	-	-	-	-	-
4.	Painting procedures.	P	P	1A	P	E	5P	5P
5.	Application schedule.	-	P	2A	P	E	5P	5P
6.	Daily Paint Quality Control Report.	-	P	D	-	-	5P	5P
7.	Coating Maintenance Manual.	-	P	1B	P	E	5P, E	5P
8.	Inspection and Testing results.	-	P	D	P	E	5P, E	5P

NOTES

1.0 PLATFORM COATING MAINTENANCE MANUAL

A Coating Maintenance Manual shall be prepared and shall include:

1. A list of the coating systems and their generic equivalents.
2. A list of the paint manufacturer's recommended offshore field maintenance painting products and generic equivalents.
3. A set of the paint manufacturer's product specifications for coating systems used.
4. A set of the paint manufacturer's maintenance product specifications for the coating system.

	PAINTING AND CORROSION PROTECTION	TEX.B.400S1
	SCHEDULE OF PAINT COLORS	PAGE 1 OF 1

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

GENERAL

VOC Compliant Paint Systems: ☐ Yes ☐ No

Regulatory Authority _____

SCHEDULE OF PAINT COLORS

Structural Components:	Color
Subsea Templates and Assemblies	INTRNL ORANGE
Jacket, Subsea Portion	INTRNL ORANGE
Splash Zone and Boat Landing	INTRNL ORANGE
Deck Legs and Cross Braces	INTRNL ORANGE
Exterior Perimeter	
Cellar Deck Beams	GRAY
Main Deck Beams	GRAY
Firewalls, Columns,	
and Braces Between Decks	GRAY
Deck Surfaces, Main and Cellar	GRAY
Underdeck Surfaces, Beams,	
Joists, and Plates	WHITE
Bridges	
Heliport Substructure	GRAY
Heliport Surface	GRAY
Flare/Relief Boom or Tower	
Personnel Accommodations	
Survival Craft Substructure	
Other _____	
Safety Warning:	
Fire Protection Equip. Locations	RED
Stair, Walkways, and Handrails	YELLOW
Personnel Hazard Warnings	
Escape Routes	
Helicopter Approach Hazards	
Helideck Walkways and Markings	
Other _____	
Process and Utility Equipment:	
Process Vessels and Piping	GRAY
Gas Compressor Module	
Electric Generator Module	

SCHEDULE OF PAINT COLORS (CONT)

Process and Utility Equipment: (Cont)	Color
Control/Workshop Buildings	
Crane Cab, Drawworks, and Boom	
Crane Pedestal	
Drilling Rig	
Other Pipeline Pump	
2nd Skid	Grey
Process Piping:	
Produced Fluid Mixtures	GRAY
Crude Oil	GRAY
Condensate	GRAY
Natural Gas	GRAY
Flare/Relief	GRAY
Produced Water	GRAY
Vessel Drains	GRAY
Other _____	
Utility Piping:	
Instrument Gas	GRAY
Instrument Air	GRAY
Utility Air	GRAY
Diesel	GRAY
Fire Water	GRAY
Sea Water	GRAY
Fresh Water	GRAY
Cooling Water	GRAY
Heating Medium	GRAY
Fuel Gas	GRAY
Deck Drains	GRAY
Waste Effluent	GRAY
Other _____	GRAY

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

	ELECTRICAL FACILITIES FOR PACKAGED EQUIPMENT **DOCUMENTATION REQUIREMENTS SHEET (DRS)**	**TEX.E.115R** **PAGE 1 OF 2**

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

_____

_____

_____

_____

No.	Date	Revision	By	Apvd
0	7-27-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

	DOCUMENTATION	WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Contractor Furnished Drawings (Note 2).	-	P	2A	P	E	5P, E	5P
2.	Contractor Furnished Equipment Supplier Drawings (Note 3).	-	P	2A	P	E	5P, E	5P
3.	As Built Drawings (Note 4).	-	P	E	P	E	5P, E	5P
4.	Manuals, Spare Parts Lists, Test Reports, etc. (Note 5).	-	-	-	P	E	5P	5P
5.	Test Records (Note 6).	-	-	-	P	E	5P	5P

NOTES

1. Checkout and commissioning documentation shall be as specified in TEX.E.110.
2. Drawings shall be submitted for approval prior to fabrication/installation and shall include:
   a. Layout drawings.
   b. Wiring diagrams.
   c. Schematic diagrams.
3. Company shall furnish electrical Supplier drawings for all Company supplied equipment. Contractor shall furnish Supplier drawings for all equipment supplied by Supplier.
4. Contractor shall make as built corrections to Company supplied and Contractor supplied drawings.
5. Documentation shall be clearly marked with manufacturer's name, equipment description, and Company tag number.
6. Detailed check sheets, developed as part of checkout and commissioning procedure, shall certify that various individual equipment items are properly installed and in compliance with specified performance and safety requirements and are suitable for operation.

	PAINTING AND CORROSION PROTECTION DOCUMENTATION REQUIREMENTS SHEET (DRS)	TEX.B.400R PAGE 1 OF 2

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

Contractor shall supply five (5) complete sets of data books. All documentation in the data books shall reflect as-built conditions.

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

DOCUMENTATION		WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Paint products.		P	1A				
2.	Chemical analysis of abrasive material.	-	-	-	-	-	-	-
3.	Representative sieve analysis of abrasive material.	-	-	-	-	-	-	-
4.	Painting procedures.	P	P	1A	P	E	5P	5P
5.	Application schedule.	-	P	2A	P	E	5P	5P
6.	Daily Paint Quality Control Report.	-	P	D	-	-	5P	5P
7.	Coating Maintenance Manual.	-	P	1B	P	E	5P, E	5P
8.	Inspection and Testing results.	-	P	D	P	E	5P, E	5P

NOTES

1.0 PLATFORM COATING MAINTENANCE MANUAL

A Coating Maintenance Manual shall be prepared and shall include:

1. A list of the coating systems and their generic equivalents.
2. A list of the paint manufacturer's recommended offshore field maintenance painting products and generic equivalents.
3. A set of the paint manufacturer's product specifications for coating systems used.
4. A set of the paint manufacturer's maintenance product specifications for the coating system.

	FUEL GAS FILTER PACKAGE DATA SHEET	TEX.H.400S1 PAGE 1 OF 3

Facility Name/Location: ANYALA PUMP SKID

Item Name: Pipeline Pump Skid — Company Project Number: _____

Item Tag Number: _____ — Purchase Order Number: _____

Supplier: _____ — Supplier Project Number: _____

DESIGN CRITERIA

Service _____

Primary Fuel Gas Description _____

Flow Rates, scfm: _____ _____

Temperature, °F: Operating _____ Design _____

Pressure, psig: Operating _____ Design _____

Specific Gravity: _____ at °F _____

Viscosity, cP: _____ at °F _____

Secondary Fuel Gas Description _____

_____

Specific Gravity: _____ at °F _____

Viscosity, cP: _____ at °F _____

Entrained Liquid _____

Ratio, Liquid to Gas, % _____

Entrained Solids:

Max Solids Content:

Weight % _____ or lb/scf _____

Other _____

☐ Finely Divided ☐ Moderately Coarse ☐

☐ Crystalline ☐ Slimy

Specific Gravity _____

To Be: ☐ Recovered ☐ Discarded

Min Particle Size to be Retained (microns) _____

Max Allowable Pressure Drop

Clean, psig _____ Dirty, psig _____

ELECTRICAL

Area Classification: ☐ Unclassified

Class _____ Group _____ Div _____

Electric Power: V _____ Ph _____ Hz _____

Elect Pwr, Control: V _____ DC _____ AC _____

Other _____

CONSTRUCTION

Filter Element: Type _____ Material _____

Flow Direction: ☐ Inside Out ☐ Outside In

Qty Reqd _____ Est Service Life, Days _____

Coalescer Element: Type Material _____

Flow Direction: ☐ Inside Out ☐ Outside In

Qty Reqd _____ Est Service Life, Days _____

CONSTRUCTION (CONT)

Mist Extractor:

Mesh Material _____

Description _____

_____

_____

Horizontal Separator:

Vessel Cap, Gas/Liquid, scf _____ / Gal _____

Vessel Size, L x OD, ft-in. _____ x in. _____

Shell Thk/Corrosion Allow, in _____ / in. _____

Head Thk/Corrosion Allow, in _____ / in. _____

Max Allow Working Pressure, psig _____

Single Sump with Partition:

1st Stage Cap, Gas/Liquid, scf _____ / Gal _____

2nd Stage Cap, Gas/Liquid, scf _____ / Gal _____

Vessel Size, L x OD, ft-in. _____ x in. _____

Shell Thk/Corrosion Allow, in _____ / in. _____

Head Thk/Corrosion Allow, in _____ / in. _____

Max Allow Working Pressure, psig _____

Two-Sump Configuration:

1st Stage Cap, Gas/Liquid, scf _____ / Gal _____

Vessel Size, L x OD, ft-in. _____ x in. _____

Shell Thk/Corrosion Allow, in _____ / in. _____

Head Thk/Corrosion Allow, in _____ / in. _____

2nd Stage Cap, Gas/Liquid, scf _____ / Gal _____

Vessel Size, L x OD, ft-in. _____ x in. _____

Shell Thk/Corrosion Allow, in _____ / in. _____

Head Thk/Corrosion Allow, in _____ / in. _____

Sump Max Allow Working Pressure, psig _____

Vessel and Sump Supports:

Pipe, Size/Schedule, in. _____ / _____

Angle, Size, in. _____

Other _____

_____

_____

No.	Date	Revision	By	Apvd

CONSTRUCTION (CONT)

Filter Removal Opening:
Location _____ / _____
Opening Diameter, in. _____
Gasket/Seal Material _____
Other Openings _____
Description _____
Materials
Gaskets _____ Cover _____
Elements _____
Heads _____ Corrosion Allow, in. _____
Shells _____ Corrosion Allow, in. _____
Lining _____ Thickness, in. _____
Mounting: ☐ Horizontal ☐ Vertical
Support Legs: ☐ Pipe ☐ Angle
☐ Other _____
Solids Storage Capacity, ft^3 _____
Active Filtration Area, ft^2 _____
Weight: Empty, lb _____ Full, lb _____
Size, ft: Length _____ Width _____ Ht _____
ASME Code Construction: ☐ Yes ☐ No
Code Stamp Required: ☐ Yes ☐ No
Backwash (Auto Cleaning): ☐ Yes ☐ No
Backwash Rate, gpm Pressure, psig _____

CONNECTIONS

	Size	Rating	Facing
Inlet			
Outlet			
Drain			
Vent			
Interface, Separator-to- Pressure Gauge			
Level Gauge			
Relief Valve			
Auxiliary Pressure Relief Valve			
Manways			
Other			

AUXILIARY EQUIPMENT

Gauges:
☐ Differential Pressure:
☐ Direct Reading
☐ Nondirect Reading
☐ With Dead Hand
☐ Other _____
☐ Liquid Level:
☐ Reflex ☐ Tubular ☐ Transparent
☐ Other _____
☐ Vent Valve: ☐ Automatic ☐ Manual
☐ Drain Valve: ☐ Automatic ☐ Manual
☐ Sump Heater Assembly:
☐ Steam Coil
☐ Electric
☐ Jacketed
☐ Insulation Type _____
☐ Liquid Drainer Ball Float:
Manufacturer _____
Model/Size _____ / in. _____
☐ Liquid Drainer Block Valves:
Material _____
Manufacturer _____
Model/Size _____ / in. _____
☐ Liquid Drainer Vent Valves:
Material _____
Manufacturer _____
Model/Size _____ / in. _____
☐ Liquid Level Gauges:
Material _____
Manufacturer _____
Model/Size _____ / in. _____
Gauge Cocks _____
Manufacturer _____
Model/Size _____ / in. _____
☐ Liquid Level Switches:
Manufacturer _____
Model/Size _____ / in. _____
☐ Pressure Regulator:
Manufacturer _____
Model/Size _____ / in. _____

AUXILIARY EQUIPMENT (CONT)	NOTES
☐ Pressure Gauge:	
Type _____	
Manufacturer _____	
Model/Size _____ / in. _____	
☐ Pressure Relief Valve:	
Type _____	
Manufacturer _____	
Model/Size _____ / in. _____	
☐ Auxiliary Pressure Relief Valve:	
Type _____	
Manufacturer _____	
Model/Size _____ / in. _____	
AUTOMATIC DISCHARGE SYSTEM	
☐ Float Operated Pilot	
☐ Discharge Control Valve	
☐ Flow Rate Control Valve	
☐ Water Dump Valve	
☐ Pressure Relief Valve	
WEIGHTS AND DIMENSIONS	
Dry Weight, lb _____	
Max Operating, lb _____	
Installed Dimensions, ft-in:	
Length _____ Width _____ Height _____	

	GENERAL INSTRUMENTATION SPECIFICATION DOCUMENTATION REQUIREMENTS SHEET (DRS)	TEX.I.100R PAGE 1 OF 2

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

_____

_____

_____

_____

_____

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

	DOCUMENTATION	WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Schematic Drawings (Notes 1 & 2)		3P	3A	3P	6A	4P, 1R, 1S, E	5P
2.	Layout Drawings (Notes 1 & 2)		3P	3A	3P	6A	4P, 1R, 1S, E	5P
3.	Documents, including equipment manuals, spare parts lists, test/calibration certificates, or any other document supplied with equipment or materials (Note 3)							5P

NOTES

1. These drawings shall be submitted for approval work prior to any fabrication / installation.
2. Drawings shall define offshore work required to complete a manufacturer's installation.
3. Documentation shall be clearly marked with manufacturer's name, equipment description and Company tag number.

	LOCAL SAFETY SHUTDOWN PANELS **DOCUMENTATION REQUIREMENTS SHEET (DRS)**	**TEX.I.210R** **PAGE 1 OF 2**

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

_____

_____

_____

_____

_____

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

	DOCUMENTATION	WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Panel Layout Drawings		3P	1B	P	E	5P, E	5P
2.	Control Logic Drawings		3P	1B	P	E	5P, E	5P
3.	Panel Installation Details		3P	1B	P	E	5P, E	5P
4.	Pneumatic Supply Capacity		3P	1B	P	E	5P	5P
5.	Complete Mfg. Literature		3P	1B	P	E	5P	5P
6.	Shipping and Storage Instructions		3P	1B	P	E	5P	5P
7.	Commissioning Procedure		3P	E	P	E	5P	5P
8.	Start-up/Commissioning Spare Parts with Pricing		3P	E	P	E	5P	5P
9.	2-year Spare Parts with Pricing		3P	E	P	E	5P	5P
10.	Special Tools with Pricing		3P	E	P	E	5P	5P

NOTES

	CENTRIFUGAL PUMPS (API 610) DOCUMENTATION REQUIREMENTS SHEET (DRS)	TEX.M.220R PAGE 1 OF 3

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: Pipeline Pump Skid — Company Project Number: _____

Item Tag Number: _____ — Purchase Order Number: _____

Supplier: _____ — Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: _____

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

CONTRA CTOR shall supply five (5) complete sets of data books. All docementation included in data books shall reflect as-built conditions.

No.	Date	Revision	By	Apvd
0	3-3-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

	DOCUMENTATION	WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Certified dimensional outline drawing.		3P	1B	P	E	P5, E	P5
2.	Cross-sectional drawings and bill of materials.		3P	1B	P	E	P5, E	P5
3.	Shaft seal drawing and bill of materials.		3P	1B	P	E	P5, E	P5
4.	Coupling assembly drawing and bill of materials.		3P	1B	P	E	P5, E	P5
5.	Primary and auxiliary sealing schematic and bill of materials.		3P	1B	P	E	P5	P5
6.	Cooling or heating schematic and bill of materials.		3P	1B	P	E	P5	P5
7.	Lube-oil schematic and bill of materials.		3P	1B	P	E	P5	P5
8.	Lube-oil system arrangement drawing and list of connections.		3P	1B	P	E	P5, E	P5
9.	Lube-oil component drawings and data.		3P	1B	P	E	P5, E	P5
10.	Electrical and instrumentation schematics and bill of materials.		3P	1B	P	E	P5	P5
11.	Electrical and instrumentation arrangement drawing and list of connections.		3P	1B	P	E	P5, E	P5
12.	Performance curves.		3P	1B	P	E	P5	P5
13.	Vibration analysis data.		3P	1B	P	E	P5	P5
14.	Damped unbalanced response analysis.		3P	1B	P	E	P5	P5
15.	Lateral critical speed analysis.		3P	1B	P	E	P5	P5
16.	Torsional critical speed analysis.		3P	1B	P	E	P5	P5
17.	Certified hydrostatic test data.		3P	1B	P	E	P5	P5
18.	Progress reports.		3P	1B	P	E	P5	P5
19.	Casting repair procedure.		3P	1B	P	E	P5	P5
20.	Performance test data.		3P	1B	P	E	P5	P5
21.	Certified rotor balance data for multistage pumps.		3P	1B	P	E	P5	P5
22.	Residual unbalance check.		3P	1B	P	E	P5	P5
23.	Rotor mechanical and electrical runout.		3P	1B	P	E	P5	P5
24.	As-built data sheet.		3P	1B	P	E	P5, E	P5
25.	As-built clearances (running): where applicable, thrust and radial-bearing clearances.		3P	1B	P	E	P5, E	P5
26.	Installation, operation, and maintenance instruction manuals.		3P	1B	P	E	P5, E	P5
27.	Welding procedures.		3P	1B	P	E	P5	P5
28.	Welder qualifications.		3P	1B	P	E	P5	P5
29.	NDT procedures.		3P	1B	P	E	P5	P5

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

DOCUMENTATION		WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
30.	NDT personnel qualifications.		3P	1B	P	E	P5	P5
31.	Quality control and assurance manual.		3P	1B	P	E	P5	P5
32.	Performance curves.		3P	1B	P	E	P5	P5
33.	Performance data sheets.		3P	1B	P	E	P5	P5
34.	Descriptive literature.		3P	1B	P	E	P5	P5
35.	Speed reducer or increaser drawings with bill of materials.		3P	1B	P	E	P5	P5
36.	Drawings of furnished piping and bill of materials.		3P	1B	P	E	P5	P5
37.	Baseplate drawing.		3P	1B	P	E	P5	P5
38.	Certified test curves and data.		3P	1B	P	E	P5	P5
39.	Material certificates.		3P	1B	P	E	P5	P5
40.	NDT reports.		3P	1B	P	E	P5	P5
41.	Parts list of pump and accessories.		3P	1B	P	E	P5	P5
42.	Warm-up/Cool-down requirements.		3P	1C	P	E	P5	P5
43.	Any start-up, shutdown or operating restrictions required to protect the integrity of the equipment.		3P	1C	P	E	P5	P5
44.	Special weather and winterizing protection required of all equipment supplied for start-up, operating and idleness.		3P	1C	P	E	P5	P5
45.	Supplier to submit preservation and packaging procedures for review.		3P	1C	P	E	P5	P5
46.	List of similar machines installed and operating under analogous conditions.		3P	1C	P	E	P5	P5
47.	Recommended spare parts list for start-up with prices.		3P	1C	P	E	P5	P5
48.	Recommended spare parts list with prices for 2 years operation.		3P	1C	P	E	P5	P5

NOTES

	VALVE SPECIFICATION DOCUMENTATION REQUIREMENTS SHEET (DRS)	TEX.P.120R PAGE 1 OF 2

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

_____

_____

_____

_____

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

DOCUMENTATION		WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	**MANIFOLD VALVES**							
1.1	Independent fire test certification (each type and size of valve).		3P	1B	P	E	P5	P5
2.	**BALL VALVES**							
2.1	Independent fire test certification (each type and size of valve).		3P	1B	P	E	P5	P5
2.2	Independent torque test data verifying stated torques for floating ball valves (5.0).		3P	1B	P	E	P5	P5
3.	**CHECK VALVES**							
3.1	Independent fire test certification of API valves (each size and type).		3P	1B	P	E	P5	P5

NOTES

	FABRICATION OF PIPING **DOCUMENTATION REQUIREMENTS SHEET (DRS)**	**TEX.P.130R** **PAGE 1 OF 2**

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

Notes

1. **SUBMITTAL OF DOCUMENTATION IS A CONDITION OF INVOICE PAYMENT. REFER TO CONTRACT OR PURCHASE ORDER.**
2. Company review of documentation shall not relieve Supplier of responsibility.

Instructions

1. Complete and return this form with quotation.
2. Submit "With Quote" documentation with quotation.
3. Supplier shall submit documentation in compliance with Documentation Requirements Sheet(s) as regards timing, quantity, and form of documentation.
4. Documentation shall be identified by project, purchase order or contract number, and item number.
5. All drawings and documents shall be black on white with clear image and be suitable for reproduction. Drawings and documents shall show information for this project only. Company, at its sole discretion, may accept preprinted standard data if applicable information is clearly indicated and non-applicable information is cross hatched out.
6. "As Built" documents and data books shall be submitted at time of equipment completion.
7. Data for data books shall be provided on three-hole paper and bound in hard covers. Unless clarity is adversely affected, drawings shall be reduced to scale on 11 inch by 17 inch paper. Where the clarity of reduced drawings is adversely affected, large drawings shall be folded and placed in heavy-duty three-sided plastic covers and inserted in the binders.
8. Identify Supplier representative responsible for documentation:

   Name: "CONTRACTOR"

   Title: _____

   Phone: _____

Definitions

1. **Approval:** Submitted for Company review and comment.
2. **Certified:** Certified correct by Company/Supplier and incorporates comments by Company from Approval copy.
3. **As Built:** Incorporates modifications made during fabrication.

Remarks

No.	Date	Revision	By	Apvd
0	7/23/97	FOR BID		

Document Type Legend
X = Original
P = Print
R = Reproducible
S = Shotdown
E = Electronic media (Disk, tape, etc.)

Time Legend
A = Weeks after contract award
B = Weeks before work starts
C = Weeks after work complete
D = Weekly
E = Shipment

DOCUMENTATION		WITH QUOTE	APPROVAL COPIES		CERTIFIED COPIES		AS BUILT COPIES	DATA BOOK COPIES
		QTY TYPE	QTY TYPE	TIME	QTY TYPE	TIME	QTY TYPE	QTY TYPE
1.	Shop (isometric) drawings.		3P	1B	-	-	P5, E	P5
2.	Layout drawings.		3P	1B	P	E	P5, E	P5
3.	As-Built specifications.		3P	1B	P	E	P5, E	P5
4.	Mill certificates for piping flanges and fittings.		3P	1B	P	1B	P5	P5
5.	Mill certificates for all pipe.		3P	1B	P	1B	P5	P5
6.	Material handling and storage procedure (8.3).		3P	1B	P	1B	P5	P5
7.	Welding procedure specifications.	YES	3P	1B	P	1B	P5	P5
8.	Welder qualification records.	YES	3P	1B	P	1B	P5	P5
9.	Weld records.	YES	3P	1B	P	1B	P5	P5
10.	Valid Ameron certification for personnel working on Bondstrand.	NO	-	-	-	-	-	-
11.	Test procedures.	YES	3P	1B	P	1B	P5	P5
12.	Inspection and testing results.	YES	3P	1B	P	1B	P5	P5

NOTES

1. Company review of drawings shall not relieve Contractor of his responsibilities and obligations to fabricate all items in accordance with the Contract, Contract Drawings, and Specifications. Company review is intended only to determine if Contractor has correctly interpreted the Work and to identify possible errors or omissions in a timely, efficient and economic manner.

C. INSPECTION & TESTING REQUIREMENTS SHEETS (ITRS)

SPEC. NO.	REV.	TITLE
TEX.B.300I	0	Design and Fabrication of Skid for Equipment
TEX.B.400I	0	Painting and Corrosion Protection
TEX.E.115I	0	Electrical Facilities for Packaged Equipment
TEX.E.500I	0	DC Supply Systems
TEX.H.400I	0	Fuel Gas Filter Package
TEX.I.100I	0	General Instrument Specification
TEX.I.210I	0	Local Safety Shutdown Panels
TEX.M.220I	0	Centrifugal Pumps (API 610)
TEX.P.120I	0	Valve Specification
TEX.P.130I		Fabrication of Piping

	DESIGN AND FABRICATION OF SKIDS FOR EQUIPMENT INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.B.300I PAGE 1 OF 1

Facility Name/Location: ANYALA /MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.0	**GENERAL VISUAL INSPECTION**					
1.1	Check appearance and workmanship	YES	YES	YES	YES	
1.2	Check that all material is complete	YES	YES	YES	YES	
1.3	Check access for operability and maintenance	YES	NO	YES	YES	
1.4	Check for safety hazards such as tripping hazards, burrs on structural steel, etc.	YES	NO	YES	YES	
2.	**PIPING**					
2.1	Dimensional check on interconnecting piping	YES	NO	YES	YES	
3.	**STRUCTURAL**					
3.1	Ultrasonic inspection of 100% of structural welds	YES	YES	YES	YES	
3.2	Magnetic particle inspection of 100% of structural welds	-	-	-	-	

NOTES

1. ULTRASONIC INSPECTION

1. Ultrasonic examinations and written reports shall be performed in accordance with API RP 2X.
2. Acceptance criteria shall be Level C.

No.	Date	Revision	By	Apvd
0	9-22-97	FOR BID	JDV	

	PAINTING AND CORROSION PROTECTION INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.B.400I PAGE 1 OF 1

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.	Blaster/Painter Qualification Test.	YES	YES			
2.	Visual inspection of equipment.	YES	YES			
3.	Visual inspection of blasted surfaces prior to application of any coating.	YES	YES			
4.	Check dry film thickness of each coat using "Elcometer", Mikrotest", or other calibrated film thickness gauge (Note 1).	YES	YES	YES	YES	
5.	Visually inspect each coat prior to application of next coat. Check for runs, overspray, roughness, pinholes, sags, holidays, or other signs of improper application.	YES	YES			
6.	Check the entire surface of the final coat for holidays using a "Tinker Rasor" or equal holiday detector set at resistance recommended by paint manufacturer. Include weld areas, edges, and corners.	YES	YES	YES	YES	

NOTES

1. Per SSPC-PA 2.

No.	Date	Revision	By	Apvd
0	9-22-97	FOR BID	JDV	

	ELECTRICAL FACILITIES FOR PACKAGE EQUIPMENT INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.E.115I PAGE 1 OF 3

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 3 days prior to inspection or test.						
1.	Visual Inspection of Devices (Note 4).	YES	YES	YES	YES	
2.	Check of Fuses and Circuit Breakers (Note 5).	YES	YES	YES	YES	
3.	Wire Inspection and Insulation Test (Note 6).	YES	YES	YES	YES	
4.	System Functional Test (Note 7).	YES	YES	YES	YES	
5.	Test of Safety Devices and Fail Safe Functions (Note 8).	YES	YES	YES	YES	
6.	Component Assembly Test (Note 9).	YES	YES	YES	YES	

NOTES

1. Contractor shall perform all tests and inspections prior to load-out and start-up offshore to ensure that all electrical equipment and materials are installed correctly, ready for load-out, and/or ready for operation to the satisfaction of Company in accordance with TEX.E.110.
2. Detailed inspection and testing shall be performed in accordance with TEX.E.110.
3. Company shall be notified 15 working days in advance of all scheduled major inspections and tests.
4. Devices shall be examined for broken parts, indication of shipping damage, and tightness of wire connection.
5. Fuses and circuit breakers shall be checked for proper voltage and current rating.
6. Wire shall be visually inspected for faulty insulation prior to installation. After installation of 600 volt wire and terminations is complete, but before connections to equipment are made, wire shall be tested for resistance to
ground with a 500 volt insulation megger. Test shall not read less than 25 megohms.
7. Electrical system shall be given a functional test to ensure total system operation. Test shall confirm proper interaction of all control and safety devices.
8. All interlockable safety devices and fail safe functions shall be tested.
9. Units shipped in more than one piece shall be fully assembled at Supplier's plant and tested with all components assembled.

No.	Date	Revision	By	Apvd

	0	9-22-97	FOR BID	JDV	

10. Further testing shall be performed as indicated in the specification for the main equipment. Medium voltage cable shall be tested with potential DC test set similar to those manufactured by Associated Research, Inc., James G. Biddle Co., or Hill Research. Tests shall be performed in accordance with cable Supplier's recommended test procedures and as specified by Company. Generators, transformers, and medium voltage motors shall be excluded from test.

	DC SUPPLY SYSTEMS	TEX.E.500I
	INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	PAGE 1 OF 4

Facility Name/Location: ANYALA/MADU DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.	**Documentation Review**					
1.1	Specifications					
1.2	Data Sheets					
1.3	Drawings					
1.4	Test Reports	YES	YES	YES	YES	
2.	**Unit and Component Inspection**					
2.1	Dimensional Check	YES		YES	YES	
2.2	Unit Arrangement	YES		YES	YES	
2.3	Unit Accessory and Auxiliary Verification	YES		YES	YES	
2.4	Terminal Block Location and Numbering	YES		YES	YES	
2.5	Unit Nameplate Location	YES		YES	YES	
2.6	Nameplate Legend	YES		YES	YES	
2.7	ACB or Fuse Ratings	YES		YES	YES	
		YES				
3.	**Final Inspection**					
3.1	Equipment Tagging	YES	YES	YES	YES	
3.2	Start-up Spare Parts	YES	YES	YES	YES	
3.2	Special Tools	YES	YES	YES	YES	
3.3	Lifting and Handling Provisions	YES	YES	YES	YES	
3.4	Packing and Preparation for Shipment	YES	YES	YES	YES	

No.	Date	Revision	By	Apvd
0	9-22-97	FOR BID	JDV	

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
4.	**Performance Testing (Standard Tests)**					
4.1	Test Procedures	YES	YES	YES	YES	
4.2	Routine Factory Test	YES		YES	YES	
4.3	Functional Test	YES	YES	YES	YES	
5.	**Performance Testing (Non-Standard Tests)**					
5.1	Boost Charge Test	YES	YES	YES	YES	
5.2	Protection Test	YES	YES	YES	YES	
5.3	Short Circuit Test	YES	YES	YES	YES	
5.4	Heat Run Test	YES	YES	YES	YES	

NOTES

PERFORMANCE TESTING (NON-STANDARD TESTS)

1.0 Boost Charge Test

1. Operation of the off-line equalize interlock shall be checked (High rate charge upon loss of power).
2. With the charger in the equalizer condition, measurements shall be made of input voltage, frequency, current and power factor.
3. The equalize timer shall be checked for proper operation.

2.0 Protection Tests

The following protection systems shall be tested by simulating the relevant abnormal condition:

1. Mains failure
2. Charger failure
3. High voltage

3.0 Short Circuit Test

A short circuit test shall be conducted with the battery disconnected. Procedure for conducting the short circuit test shall be as follows:

1. A short circuit of 15 minutes duration shall be applied to the charger terminals.
2. Temperature measurement of the charger shall be made at the end of the test to ensure that the temperature class of the charger insulation was not exceeded during the test.

4.0 Heat-Run Test

A heat-run test shall be conducted at full load.

1. Test duration shall be 3 hours or until all components have maintained an equilibrium temperature for at least 15 minutes, whichever is longer.

2. Temperature measurements of all DC system components shall be made at frequent intervals (at least every 15 minutes) to ensure that the temperature class of the component insulation is not exceeded at any time during the test.

	FUEL GAS FILTER PACKAGE INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.H.400I PAGE 1 OF 3

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: Pipeline Pump Skid — Company Project Number: _____

Item Tag Number: _____ — Purchase Order Number: _____

Supplier: _____ — Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice ___ days prior to inspection or test.						
1.	**Hydrostatic or air test.**	YES	YES	YES	YES	
2.	**Material verification.**	YES	YES	YES	YES	
3.	**Components/parts inspection:**					
3.1	Shell	YES	YES	YES	YES	
3.2	Nozzles	YES	YES	YES	YES	
3.3	Cover	YES	YES	YES	YES	
3.4	Supports	YES	YES	YES	YES	
3.5	Element	YES	YES	YES	YES	
3.6	Gaskets	YES	YES	YES	YES	
3.7	Fasteners	YES	YES	YES	YES	
3.8	Other parts/accessories	YES	YES	YES	YES	
4.	**Welding inspection:**					
4.1	Welding material verification	YES	YES	YES	YES	
4.2	Joint preparation/fit up	YES	YES	YES	YES	
4.3	Visual dimensional - weldments	YES	YES	YES	YES	
5.	**Assembly-visual/dimensional inspection**	YES	YES	YES	YES	
6.	**Nondestructive examination**	YES	YES	YES	YES	
7.	**Heat treatment/stress relieving**	YES	YES	YES	YES	

No.	Date	Revision	By	Apvd
0	3-3-97	FOR BID	MAA	

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
8.	**Cleaning**	YES	YES	YES	YES	

NOTES

	GENERAL INSTRUMENTATION SPECIFICATION INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.I.100I PAGE 1 OF 1

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

	INSPECTION OR TEST	S = Supplier inspection or test W = Company witnessed inspection or test D = Document results of inspection or test DC = Send documentation to Company S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.	Factory Test Inspection and Calibration.	YES	YES	YES	YES	
2.	Precommissioning Inspection Calibration and Test (Notes 1 and 2).	YES	YES	YES	YES	
3.	Instruments and Control System Commissioning (Note 1).	YES	YES	YES	YES	

NOTES

1. Inspection and testing requirements shall conform to referenced Company specification TEX.I.110 and this specification.
2. Instrument connection primary block valves shall be verified as leakproof during hydrostatic testing of the process piping.

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

	LOCAL SAFETY SHUTDOWN PANELS **INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)**	**TEX.I.210I** **PAGE 1 OF 1**

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

	INSPECTION OR TEST	S = Supplier inspection or test W = Company witnessed inspection or test D = Document results of inspection or test DC = Send documentation to Company S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.	Factory Test Inspection and Calibration.	YES	YES	YES	YES	
2.	Precommissioning Inspection Calibration and Test (Note 1).	YES	YES	YES	YES	
3.	Instruments and Control System Commissioning (Note 1).	YES	YES	YES	YES	

NOTES

1. Inspection and testing requirements shall conform to referenced Company specifications and this specification.

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

	CENTRIFUGAL PUMPS (API 610) INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.M.220I PAGE 1 OF 2

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: Pipe Line Pump Skid — Company Project Number: _____

Item Tag Number: _____ — Purchase Order Number: _____

Supplier: _____ — Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 3 days prior to inspection or test.						
1.	Hydrostatic	YES	YES	YES	YES	
2.	Performance	YES	YES	YES	YES	
3.	NPSH	YES	YES	YES	YES	
4.	Complete unit	YES	YES	YES	YES	
5.	Sound level	YES	YES	YES	YES	
6.	Auxiliary equipment	YES	YES	YES	YES	
7.	Dismantle and inspect after test	YES	YES	YES	YES	
8.	Cleanliness prior to final assembly	YES	YES	YES	YES	
9.	Pipeload test	YES	YES	YES	YES	
10.	Inspection of nozzle welds					
10.1	Magnetic particle	YES	YES	YES	YES	As Needed
10.2	Liquid penetrant	YES	YES	YES	YES	As Needed
10.3	Radiographic	YES	YES	YES	YES	As Needed
10.4	Ultrasonic	YES	YES	YES	YES	As Needed
		YES	YES	YES	YES	As Needed
11.	Inspection required for castings					
11.1	Magnetic particle	YES	YES	YES	YES	
11.2	Liquid penetrant	YES	YES	YES	YES	
11.3	Radiographic	YES	YES	YES	YES	
11.4	Ultrasonic	YES	YES	YES	YES	

No.	Date	Revision	By	Apvd
0	3-3-97	FOR BID	MAA	

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
12.	Charpy impact test(s)					
12.1						
12.2						
12.3						
13.	Hardness test(s)					
13.1						
13.2						
13.3						
14.	Surfactant hydrotest	YES	YES	YES	YES	
15.	Record final assembly running clearances	YES	YES	YES	YES	
16.	Residual unbalance check	YES	YES	YES	YES	
17.	Full pump curve operation vibration test	YES	YES	YES	YES	
18.	Test to verify compliance with 3.3.1.5	YES	YES	YES	YES	

NOTES

	VALVE SPECIFICATION INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.P.120I PAGE 1 OF 1

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

		S = Supplier inspection or test W = Company witnessed inspection or test D = Document results of inspection or test DC = Send documentation to Company				
	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.	**Valves with welded-on flanges**					
1.1	100% Radiography	YES	YES	YES	YES	
2.	**Manifold Valves**					
2.1	Hydrotest (Note 1)	YES	YES	YES	YES	
2.2	Pressure seat test to confirm seat integrity (Note 2)	YES	YES	YES	YES	
3.	**Ball Valves (Note 1)**					
3.1	Hydrotest	YES	YES	YES	YES	
3.2	Double block and bleed valve seat integrity pressure test (Both seats seal concurrently, while bleeding valve body cavity pressure) (Note 2)	YES	YES	YES	YES	
4.	**Check Valves**					
4.1	Hydrotest (Note 3)	YES	YES	YES	YES	

NOTES

1. Valves shall be hydrotested in the half-open position. Hydrotesting against closed valve seats greater than the valve's maximum allowable working pressure is prohibited.
2. Seat sealant injection is prohibited. Valves not properly seating shall be replaced. Each valve shall be marked with a unique number that will match Contractor's test documentation.
3. Valves shall be hydrotested by pressure testing through the flappers or pistons. Pressure testing against flappers or pistons shall be prohibited.

No.	Date	Revision	By	Apvd
0	7-23-97	FOR BID		

	FABRICATION OF PIPING INSPECTION AND TESTING REQUIREMENTS SHEET (ITRS)	TEX.P.130I PAGE 1 OF 2

Facility Name/Location: ANYALA DEVELOPMENT - NIGERIA

Item Name: _____ Company Project Number: _____

Item Tag Number: _____ Purchase Order Number: _____

Supplier: _____ Supplier Project Number: _____

1. Company denotes Company or designated representative.
2. Inspection and testing shall be performed in accordance with TEX.B.100.
3. Company reserves the right to witness all aspects of manufacturing, review and reject manufacturing equipment, testing equipment, test procedures, and test results, and reject product not meeting specification.
4. Company may perform additional testing, inspection, or both.
5. The submission of inspection and testing results is a condition of acceptance and payment.

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
Company shall be given written notice 7 days prior to inspection or test.						
1.	**Visual inspection of components.**					
2.	**Weld Inspection**					
2.1	Visual inspection	YES	YES	YES	YES	
2.2	Radiographic inspection	YES	YES	YES	YES	
2.3	Ultrasonic inspection	YES	YES	YES	YES	
2.4	Magnetic particle inspection					
2.5	Liquid penetrant inspection					
3.	**Testing**					
3.1	Hydrostatic test	YES	YES	YES		
3.2	Leak test	YES	YES	YES		
3.3	Other:					
4.	**Bondstrand Fiberglass Piping**					
4.1	Inspect for excessive adhesive buildup inside joints.	-	-	-	-	
4.2	Inspect for damage to flanges due to overtightening studs and nuts.	-	-	-	-	
4.3	Inspect for physical damage to pipe fittings from impact, heat, or abrasion.	-	-	-	-	
4.4	Inspect installation procedures.	-	-	-	-	
5.	**Hardness testing**					
5.1	Welds and heat affected zone	-	-	-	-	

No.	Date	Revision	By	Apvd

S = Supplier inspection or test
W = Company witnessed inspection or test
D = Document results of inspection or test
DC = Send documentation to Company

	INSPECTION OR TEST	S YES/NO	W YES/NO	D YES/NO	DC YES/NO	REMARKS
5.2	Other					

DRAWING NO.	REV.	TITLE
AA-A-400	B	Piping and Instrumentation Legend
AA-A-404	B	Mechanical Flow Diagram - Surge Vessel
AA-A-405	B	Mechanical Flow Diagram - Instrument/Utility Gas System
AA-A-408	B	Mechanical Flow Diagram - Oil Shipping Pumps
AA-A-409	B	Mechanical Flow Diagram - Pig Receivers, Departing Pipeline
AA-A-411	B	Mechanical Flow Diagram - Oil Shipping Pump (TYP. 2)
AA-A-001	B	Process Flow Diagram - Anyala “A”
AA-GA-002	B	Equipment Arrangement - Main & Cellar Deck

NUMBER	REV.	TITLE
TEX.B.300	0	Design and Fabrication of Skids for Equipment
TEX.B.400	0	Painting and Corrosion Protection
TEX.E.115	0	Electrical Facilities for Packaged Equipment
TEX.E.500	0	DC Supply Systems
TEX.H.400	0	Design and Fabrication of Fuel Gas Filter Package
TEX.I.100	0	Design, Materials, and Installation of Instrumentation
TEX.I.210	0	Design and Fabrication of Local Safety Shutdown Panels
TEX.M.220	0	Centrifugal Pumps (API 610)
TEX.P.100		Piping Design Specification
TEX.P.110		Piping Materials Specification
TEX.P.120	0	Valve Specification
TEX.P.130	0	Specification for Fabrication, Erection, Testing and Inspection of Piping

DESIGN AND FABRICATION OF SKIDS FOR EQUIPMENT

SPECIFICATION NO. TEX.B.300

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		

Approved by: Date:	Company Approval: Date:

Foreword

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1.	Inspection and Testing Requirements Sheet	YES[X] NO[ ]
2.	Documentation Requirements Sheet	YES[X] NO[ ]
3.	TEX.E.100, "General Electrical Specification"	YES[ ] NO[ ]
4.	TEX.I.100, "General Instrument Specification"	YES[ ] NO[ ]
5.	TEX.P.100, "Design, Fabrication, and Installation of Piping"	YES[ ] NO[ ]
6.	TEX.P.110, "Materials for Piping"	YES[ ] NO[ ]
7.	TEX.P.120, "Valves"	YES[ ] NO[ ]

PAGE

1. SCOPE

This specification defines minimum requirements for the design, materials, fabrication, testing, and inspection of skids for equipment.

2. REFERENCES

2.1 Company Specifications

This specification contains references to the following Company specifications:

1. TEX.B.100, "Inspection and Quality Control".
2. TEX.B.400, "Painting and Corrosion Protection".

2.2 Industry Codes and Specifications

This specification contains references to the following codes and specifications:

2.2.1 American Institute of Steel Construction (AISC)

AISC, "Manual of Steel Construction, Allowable Stress Design".

2.2.2 American National Standards Institute (ANSI)

ANSI A14.3, "Safety Requirements for Fixed Ladders".

2.2.3 American Petroleum Institute (API)

1. API RP 2A, "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms".
2. API RP 2X, "Recommended Practice for Ultrasonic Examination of Offshore Structural Fabrication and Guidelines for Qualification of Ultrasonic Technicians".
3. API Spec 2B, "Specification for Fabricated Structural Steel Pipe".
4. API Spec 5L, "Specification for Line Pipe".

2.2.4 American Society of Testing and Materials (ASTM)

ASTM A36, "Specification for Structural Steel".

ASTM A53, "Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless".

ASTM A500, "Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes".

ASTM A572, "Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality".

2.2.5 American Welding Society (AWS)

AWS D1.1, "Structural Welding Code".

3. PIPING AND ELECTRICAL

3.1 Piping

1. Piping and connections shall be taken to skid edge at locations approved by Company.
2. Piping shall not block access ways or create tripping hazards.
3. Piping and equipment supports shall be designed and fabricated with sufficient strength, rigidity, and quantity to support piping and eliminate vibration during load out, offshore transportation, and installation.
4. Piping supports and installation shall be made to allow piping to be removed without cutting main structural members.
5. Supports shall not be welded to piping.

3.2 Electrical

1. Unless otherwise specified, two diagonally opposite corners of the skid base shall be fitted with electrical grounding pads.
2. Pads shall be carbon steel and shall be drilled and tapped for a 1/2 inch bolt.

4. DESIGN

4.1 General

1. Skids shall be of all welded construction.

2. Skids shall have adequate strength and rigidity to transmit loads to the foundation and to enable the skid to be lifted and transported without damage to the equipment or skid.
3. Overall skid dimensions shall be no greater than those shown on drawings.
4. Overall skid structure, including padeyes, shall be designed in accordance with API RP 2A.
5. Operation, hydrotest, and dry weights of the skid package shall be shown on Approval Drawings, Certified Drawings, and As Built Drawings.

4.2 Support Conditions

Unless otherwise specified, skids shall be designed to be supported at the corners.

4.3 Area Loading

Unless otherwise specified, skids shall be designed to provide a uniform deck loading of less than 400 psf based on wet or operating weight.

4.4 Layout of Beams and Saddles

1. Spacing of longitudinal beams shall not exceed 6 feet.
2. Any skid base wider than 7 feet shall have a minimum of 4 longitudinal beams spaced approximately equal.
3. Skid beam and secondary beams shall be located such that the equipment load is uniformly distributed over the entire length of the skid.
4. Location of saddles and their loading effect on skids shall be provided to Company at an early stage of the design.

4.5 Access

1. Skids shall be provided with means of passage sufficient for personnel to escape from the area of a fire or other emergency and travel to a means of escape.
2. Access to operating equipment and valves shall be provided by means of stairs, walkways, and ladders with adequate handrails.

3. Access to vessels, valves, instruments, and controls shall be sufficient for operation and maintenance.

4. Sufficient access shall be provided to safety devices to permit testing in place.

5. Instruments, valve control platforms, etc., shall not extend outside the skid nor into designated access areas.

4.6 Deck Plate

1. Unless otherwise specified, the entire working area of each skid shall be uniformly covered with steel floor plate or equivalent decking not less than 1/4 inch (7mm) thick.

2. Decking shall be welded with a continuous bead around the edges of the plate and around each opening to prevent foreign matter from falling inside the skid members and to facilitate washdown and clean up.

4.7 Lifting

1. Pad-type lifting lugs shall be located to provide a lift which is level within 5° and such that the entire unit can be lifted using standard slings and a single point lift.

2. Unless otherwise approved by Company, spreader bars shall not be used. Spreader bars, if approved, shall be provided by supplier.

3. Lift procedure shall not endanger or require the removal of equipment mounted on the skid, or cause excessive strain or warping. If this is not practical, an alternate lifting arrangement, subject to Company approval, shall be devised.

4. Lifting arrangement, design, and drawings, including material takeoff, center of gravity calculation, sling, and shackle designation, shall be approved by Company prior to fabrication.

5. Primary structural members, padeyes, and members directly connected to padeyes shall be designed for a static load of 2 times the structural dead weight plus the equipment dry weight.

6. Padeyes and structural members framing directly into the lift points shall be designed for a lateral load of 5 percent of the static sling load.

7. Padeye pin holes shall be drilled.

4.8 Drip Pans

1. Drip pans, if specified, shall be designed to contain all spillage and/or leakage from the equipment or piping installed on the skid.

2. A threaded or flanged connection shall be installed at the low point of the drip pan for drainage into the deck sump system.

4.9 Details

1. Joints in grating shall be permitted only at points of support.

2. Handrail sockets shall be either fixed or removable type as approved by Company. Weep holes shall be provided where necessary.

3. Sharp corners and edges of beams and supports shall be rounded or ground smooth to eliminate safety hazards.

4. All points of contact between two or more steel surfaces shall be seal welded to prevent corrosion.

5. Any area or surface that is not fully accessible for blasting and coating in accordance with TEX.B.400 (paint spec) shall be "boxed in" and seal welded with plating or other structural material to prevent atmospheric contact with the inaccessible area or surface.

6. The requirements of the preceding two paragraphs shall also apply to all fabricated structural items associated with equipment on the skid. One example would be an enclosure house for engine or turbine driven equipment.

7. Horizontal webs and channels shall have weepholes to prevent trapping of water or fluids.

4.10 Ladders

Ladders shall conform to ANSI A14.3.

4.11 Design Review

Unless otherwise specified, design calculations and drawings shall be certified by a registered professional engineer with experience in skid design.

5. MATERIALS

5.1 General

1. Only new materials shall be used for the fabrication of skids. Material procured within one year of the start of the work shall be considered new.
2. Materials shall be free from rust and scale.
3. Materials shall not be damaged in any way.
4. Materials which do not meet this specification shall be removed and replaced at no additional cost to Company.

5.2 Structural Plate and Shapes

1. Unless otherwise specified, plate and shapes shall conform to ASTM A36.
2. High strength plates and shapes shall conform to ASTM A572 Grade 50.

5.3 Structural Pipe

Pipe used for structural fabrication shall meet the requirements of:

1. API Specification 5L Grade B.
2. ASTM A53 Grade B Type E (for non major structural applications to a maximum of 12 inches) or Type S for tubulars used as ladders, handrail, or handrail sockets.
3. ASTM A500 Grade B.

5.4 Steel Grating

1. Load bars shall be spaced at 1-3/16 inch on centers.
2. Crossbars shall be spaced 4 inches on centers.
3. Grating shall be serrated and galvanized.

5.5 Fiberglass Grating

Fiberglass grating shall be Fibergrate type MXFR or approved equal.

6. FABRICATION

6.1 Codes

1. Fabrication shall conform to AISC and API RP 2A.
2. Tubulars shall be manufactured in accordance with API Spec 2B.

6.2 Dimensional Checks

Dimensional checks shall be made on all interconnecting piping components for compliance with the dimensions as shown on contract drawings.

6.3 Splices

6.3.1 Structural Pipe

1. Pipes of the same diameter and wall thickness may be spliced.
2. The minimum distance between splices shall be 4 feet.
3. No more than 2 splices shall be made in any 10 foot length.
4. The longitudinal seams of fabricated pipe shall be spaced at least 90 degrees apart.

6.3.2 Beams

1. Beams with identical cross-sections may be spliced.
2. The minimum distance between splices shall be 4 feet.
3. No more than 2 splices shall be made in any 10 foot length.
4. Splices in cantilever beams shall not be made closer to the point of support than one half the cantilever length.
5. Splices shall not be located in the middle one fourth or in the end one eighth of any span.

6. Splices shall not be located on a support or within one eighth of a span from a support.

6.4 Tolerances

6.4.1 Straightness

1. Structural members shall be checked for straightness.
2. A string or wire shall be stretched between the endpoints of each member and a measurement shall be made at the point of maximum deviation from straightness.
3. The maximum allowable deviation in any 10 feet length shall be 1/8 inch.

6.4.2 Structural Pipe

1. The nominal outside diameter shall be ±1% based upon circumferential measurement, except that 1/4 inch shall be the maximum.
2. The difference between the major and minor outside diameters shall not exceed 1% except that 1/8 inch shall be the maximum.
3. The maximum weld reinforcement shall be 1/8 inch.
4. The wall thickness at any point shall be not more than 12.5% less than the nominal wall thickness.

6.4.3 Braces

1. Horizontal braces shall not deviate more than 1/2 inch vertically.
2. 1/2 inch of the dimensions on the Contract Drawings.

6.4.4 Skid Beams

1. Center to center spacing shall be within 3/8 inch of the dimensions on the Contract Drawings.
2. Maximum sweep shall be 3/4 inch in total length.

6.4.5 Handrail

Handrail shall be plumb.

6.4.6 Stairways

Stairways shall be within 1/2 inch horizontally of the dimensions on the Contract Drawings.

6.4.7 Landings

Landings shall be within 1/2 inch horizontally and vertically of the dimensions on the Contract Drawings.

6.5 Holes

1. Holes shall be drilled or punched prior to sandblasting and painting.
2. Punched holes shall not be permitted in materials greater than 7/16 inch thick.
3. Punched holes shall be reamed to a minimum of 3/64 inch greater than the punched hole diameter.
4. Holes through major members shall be reinforced using doubler plates to Company's satisfaction.

6.6 Welding

6.6.1 Code

Structural welding shall be performed in accordance with AWS D1.1 and this specification.

6.6.2 Processes

Structural welding shall be performed using low hydrogen electrodes.

6.6.3 Equipment

Defective equipment shall be repaired or replaced.

6.6.4 Electrodes

Electrodes shall be chosen to provide a weld as strong as the parent material.

6.6.5 Procedure Qualification

1. Welding procedures shall be subject to Company approval.
2. Contractor shall bear the costs for welding procedure qualification tests.

6.6.6 Welder Qualification

Each welder shall be tested and qualified in the procedures which he shall use.

6.6.7 Production Welding

The following general steps shall be performed in making each weld:

1. Surface Cleaning

Weld area shall be free from foreign material such as scale, slag, rust, grease, paint, etc.

2. Pre-Erection Painting

Unless a Company approved welding procedure is used for welding over pre-erection paint, the paint on surfaces adjacent to joints to be welded shall be thoroughly removed to expose clean steel for a distance of at least 6 inches (152 mm) on either side of the joint.

3. Edge Preparation

a. Edges shall be free from fins, tears, cracks, and other defects.

b. Rough edges shall be machined or ground to the required smoothness.

4. Fit-Up

a. The pieces to be joined shall be brought as close together as possible.

b. The gap shall not exceed 3/16 inch.

c. If the gap is larger than 1/16 inch, the leg of the weld shall be increased by the amount of the gap.

5. Post Welding Cleaning

Slag and flux deposits shall be removed from completed welds.

6.7 Painting

1. Skids shall be painted in accordance with TEX.B.400.
2. Top coat of paint on deck plate shall include non-skid aggregate. Paint system shall be as specified for "Plate Decks Including Heliports" in TEX.B.400.

3. Final top coat shall be applied after final assembly and testing.

7. PREPARATION FOR SHIPMENT

7.1 Equipment

1. Each equipment component shall be securely anchored to the skid.
2. Equipment extending beyond the skid edge shall be removed, tagged, and crated in waterproof boxes framed with 2 X 4's.
3. Boxes shall be securely attached to the skid for shipment.

7.2 Connections

1. Openings, flange faces, threaded connections, valve stems, or other components subject to mechanical damage and/or corrosion shall be adequately protected.
2. Protection shall consist of metal flange cover, sealing with waterproof tape, or enclosing with temporary metal housings.

7.3 Piping and Handrails

Piping and handrails removed for shipment shall be tagged and secured to the skid.

7.4 Shipped Loose Items

1. Items that require removal for shipment shall be installed in place to assure proper fitting.
2. Items may only be removed after witnessing by Company.
3. Each item shall be individually tagged and included in the packing list.

7.5 Materials

Materials subject to damage from the elements shall be protected for a minimum period of six (6) months by painting, greasing, installation of rust preventive oils, covering or protectors, etc., to protect externally and internally from damage due to humidity, temperature, and atmospheric conditions or environment.

PAINTING AND CORROSION PROTECTION

SPECIFICATION NO. TEX.B.400

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		
Approved by:		Company Approval:				

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1.	Data Sheet TB400S1	YES[X]	NO[ ]
2.	Data Sheet TB400S2	YES[X]	NO[ ]
3.	Inspection and Testing Requirements Sheet	YES[X]	NO[ ]
4.	Documentation Requirements Sheet	YES[X]	NO[ ]

PAGE

1. SCOPE

This specification defines minimum requirements for the selection, application, inspection and testing of exterior and interior surface coating systems for offshore facilities.

2. REFERENCES

2.1 Company Specifications

The following Company specifications supplement this specification:

1. TEX.B.100, “Inspection And Quality Control”.

2.2 Codes and Standards

Painting and corrosion protection shall be in accordance with the latest edition of the following Codes and Standards:

2.2.1 American National Standards Institute (ANSI)

ANSI Z55.1, "Gray Finishes for Industrial Apparatus and Equipment".

2.2.2 American Society for Testing and Materials (ASTM)

1. ASTM A 90, "Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles".
2. ASTM A 123, "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products".
3. ASTM A 143, "Recommended Practice for Safeguarding Against Embrittlement of Hot-Dipped Galvanized Structural Steel Products and Procedure for Detecting Embrittlement".
4. ASTM A 153, "Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware".
5. ASTM A 385, "Practice for Providing High-Quality Zinc Coatings (Hot-Dip)".
6. ASTM A 392, "Specification for Zinc-Coated

Steel Chain-Link Fence Fabric".

7. ASTM B 633, "Specification for Electro-deposited Coatings of Zinc on Iron and Steel".

2.2.3 National Association of Corrosion Engineers (NACE)

1. RP 0287-91, "Field Measurement of Surface Profiles using Replica Tape".

2.2.4 National Sanitation Foundation (NSF)

1. Standard 61, "Certification for Potable Water".

2.2.5 Steel Structures Painting Council (SSPC)

1. SSPC-PA 1, "Shop, Field, and Maintenance Painting".
2. SSPC-PA 2, "Measurement of Dry Film Thickness with Magnetic Gauges".
3. SSPC-SP 1, "Solvent Cleaning".
4. SSPC-SP 3, "Power Tool Cleaning".
5. SSPC-SP 5, "White Metal Blast Cleaning".
6. SSPC-SP 7, "Brush-off Blast Cleaning".

2.3 Manufacturer's Standards

Paint Manufacturer's Data Sheets, application instructions, and safety precautions shall be considered part of this specification.

3. GENERAL

3.1 Inspection and Quality Control

Inspection and quality control shall conform to TEX.B.100.

3.2 Surfaces Excluded from Abrasive Blasting and Painting

The following surfaces shall not be abrasive blasted or painted:

1. Copper and copper alloys.
2. Instrument tubing including fusible plugs and tubing used in the ESD system.

3. Fiberglass, plastic, or plastic-coated material not susceptible to ultraviolet deterioration.
4. Stainless steel instrument cases and process control panels.
5. Nameplates, machined surfaces, instrument glass, flange faces, control valve stems, and similar items.
6. Stainless steel process piping and vessels (unless specifically required).
7. Insulated stainless steel process piping and vessels.
8. Electrical conduit, breathers and drain fittings.

3.3 Manufactured Items

1. Manufactured items such as valves and level gauges shall be coated in accordance with this specification.
2. If manufacturer's paint system is not in accordance with this specification, Contractor shall blast and paint the item in accordance with this specification. This condition may be waived only by Company in writing.
3. Seals, sealing surfaces, packings and/or instruments shall be protected from damage caused by the blasting medium or infiltration of the blasting medium or coating into the interior of the component.
4. Equipment or instruments affected by blasting and coating operations shall be assembled and disassembled as required to protect the equipment.

3.4 Items Which May Be Adversely Affected by Coating Operations

Items which may be adversely affected by the blasting and coating operations and which cannot be disassembled or otherwise adequately protected shall be cleaned and prepared for painting by solvent washing followed by power tool cleaning in accordance with SSPC-SP 1 and SSPC-SP 3.

3.5 Surfaces in Contact

1. Surfaces of components in contact (bottom of skids, mounting surfaces of equipment, pipe supports, brackets, bolt holes, etc.) shall be painted.
2. Surfaces in contact shall receive a minimum of one coat of primer prior to assembly (unless instructed otherwise by Company).

3.6 Threads

1. Exposed threads on carbon steel piping shall be coated with Galvoweld or equal (zinc primer containing a minimum of 90 percent zinc by weight).
2. Application of this material shall take place after the final make-up of the fitting and prior to application of the piping paint system.

3.7 Environmental Criteria

1. Blasting shall be performed during dry weather.
2. Dry blast cleaning operations shall not be conducted on surfaces that are exposed to rain, water spray, or any other moisture.
3. Blasting shall not be permitted when metal surface temperatures are less than 5 Fahrenheit degrees (3 C degrees) above the dew point or when the relative humidity of the air is greater than 90 percent.
4. Surfaces shall not be coated in rain, wind, snow, fog, mist, dust, or in areas where injurious airborne elements exist.
5. Unless otherwise authorized by Company, coating shall be applied only if all the following conditions exist:
   a. Air temperature above 50 degrees F (10 deg. C).
   b. Surface temperature above 40 degrees F (4 deg. C).
   c. Surface temperature at least 5 F degrees (3 C degrees) above dew point.
   d. Relative humidity is below 90 percent.
   e. Any other conditions as recommended by coating manufacturer.

6. Before painting during cooler temperatures, Contractor shall consult with the paint manufacturer and obtain prior Company approval.
7. Painted surfaces upon which it rains prior to the paint being rainproof shall be reblasted and repainted.

3.8 Time Criteria

1. Blasting shall be performed during daylight hours.
2. Blast cleaned surfaces shall be coated with primer within four (4) hours, prior to sundown of the same day, and before any rusting occurs.
3. Coatings shall be applied only during daylight hours.

3.9 Post-Preparation

Nameplates, manufacturer's identification tags, instrument glass, finished flange faces, control valve stems, and similar items shall be cleaned, restored to their original condition, and reattached.

4. COATING SYSTEMS

1. The type, brand, number of coats, and color shall be as specified in Tables TB400T1 and Tables TB400T2 or TB400T3.
2. One manufacturer shall supply the products for all systems.
3. Selection of products shall be approved in writing by Company.
4. The lead content of inorganic zinc silicates shall not exceed 0.05%.
5. Organic coatings, excluding silicone and silicone acrylic, shall be lead and chromate free and VOC compliant.

5. PAINT STORAGE

5.1 Fire and Safety

Storage areas shall not constitute a potential fire hazard to the work.

5.2 Temperature

Paint, thinners, and associated materials shall be kept in fully enclosed, ventilated storage room(s) within the temperature limits and time restraints for storage specified in manufacturer's product data sheets.

5.3 Rejection of Improperly Stored Coating Materials

1. Coating materials which have jelled or otherwise deteriorated during storage shall not be used.
2. Rejected materials shall be disposed of in a manner not injurious to the environment (i.e., no product shall be poured on the ground or into any body of water).

6. BLASTER/PAINTER QUALIFICATION

6.1 General

Each blaster/painter shall be tested and only qualified blasters and painters shall be used.

6.2 Qualification Procedure

1. Each blaster/painter shall blast to a white metal finish and apply one coat of paint to a test stand provided by Contractor or to part of the complete fabrication.
2. The personnel being tested shall be subjectively rated by two Company representatives, a coating manufacturer's representative, and a contractor's representative.
3. To pass the test, the blaster/painter shall show proficiency and knowledge, and shall be graded in the following:
   a. Handling of the blast nozzle to blast different areas.
   b. Closeness of the finish to white metal.
   c. Setting up and mixing the products specified for the work.
   d. Application technique.
   e. Uniformity and millage of the applied product.
   f. Safety equipment.

g. Procedures for blasting and painting equipment.

h. Scaffolding.

7. SURFACE PREPARATION

7.1 Pre-Blast Preparation/Protection

7.1.1 Steel Surfaces

1. Welding flux in crevices shall be removed.
2. Burrs, weld splatter, slivers, mill scale, indentations, and other sharp surface projections shall be ground smooth prior to further surface preparation.
3. Grinding done after abrasive blasting shall be blast cleaned to obtain proper anchor pattern.
4. Bolt holes shall be drilled and reamed before blast cleaning.
5. Sharp edges shall be rounded to a minimum radius of 3/32 inch (2.5mm).

7.1.2 Electrical/Instrumentation

1. Local mounted instruments, gauges, nameplates, control valve stems, valve I.D. tags, vessel I.D. tags, SS tubing, controllers, tubing and conduit and cable trays, polished rods on pumps, code stamps, electrical fixtures, and aids to navigation shall be protected to prevent damage during blasting and painting.
2. Where practical, electrical cable shall be installed after blasting.
3. Nameplates which are attached in a manner that allows corrosion to occur behind the nameplate shall be removed prior to abrasive blasting and painting and reattached after painting is complete.

7.1.3 Mechanical, Piping, and Fittings

1. Flanges on finished piping shall be taped and sealed closed prior to blasting.
2. Non-mating flange surfaces shall be blasted

and coated in accordance with this specification. Gaskets and ring faces shall be protected from blasting.

3. Flanged valves and any other items which can not be effectively sand blasted and primed after assembly shall be blasted and primed separately prior to assembly. Mating surfaces and threads shall be carefully protected from blasting.

4. Machined and threaded surfaces shall be protected from damage caused by the blasting medium.

7.1.4 General Clean-Up

1. Before the start of abrasive blasting, oil and/or grease contaminations shall be removed in accordance with SSPC-SP 1.

2. Acid washes or other cleaning solutions or solvents shall not be used on metal surfaces after being abrasive blasted. This includes any inhibitive washes intended to prevent rusting.

3. Dirt, scale, or other surface contaminants shall be removed prior to the start of abrasive blasting.

7.2 Abrasive Blasting

7.2.1 General

1. Abrasive blasting shall be performed in an area away from painting operations and freshly coated surfaces.

2. Abrasive blasting shall be performed using OSHA approved equipment.

7.2.2 Blasting Equipment

1. Air compressors shall supply a continuous volume of air to each blast nozzle with adequate pressure (i.e., 100 psi at the nozzle) and volume to achieve the required surface profile.

2. Blast nozzles shall have "dead man" type controls.

3. Blast nozzles shall be of a size which minimizes overblast in touch-up situations.
4. Blast nozzle pressure shall be verified at the start of each shift using an approved nozzle pressure gauge.
5. The compressed air supply shall be provided with driers and oil mist extractors to keep the air supply dry and oil free.
6. The cleanliness of the compressed air shall be verified at the beginning of each shift by blowing air without abrasives or coating onto a clean white cloth. If oil or water appears on the cloth, all traps and separators shall be blown down until subsequent white cloth tests show no water or oil.
7. Accumulations of oil and water shall be removed from air receivers by daily purging (automatic and/or manual).
8. Air temperatures at the compressor discharge shall not exceed 150 degrees F (66 deg. C).

7.2.3 Abrasive

1. Unless specifically approved in advance by Company, the abrasive shall be mineral slag or a metal shot/grit mixture.
2. The maximum particle size shall be no larger than that passing a No. 16 wire mesh screen.
3. Abrasive material containing any oil, moisture, or impurities (particularly salt or organic material) or inclusions of any kind shall not be used.

7.2.4 Blasting Operations

The use of centrifugal wheels to propel the abrasive, or machine shot blasting, shall be acceptable only if the Contractor can demonstrate that an anchor pattern with the required surface profile is being produced.

7.2.5 Blast Cleaned Surface Requirements

1. Abrasive blasted surface profiles in accordance with SSPC-SP 5 shall be measured

using replica tape in accordance with NACE RP 0287-91. Surface profiles shall be as follows:

GROUP	SYSTEM(S)	SUFACE PROFILE (MILS)
A	1,2	1.5
B	1	1.5
C	1	1.5
D	1	1.5
E	1,2,3	1.5
F	1,2	1.5
G	1	3 TO 4

2. Galvanized and aluminum surfaces shall be degreased by steam cleaning prior to surface preparation in accordance with SSPC-SP7.
3. Abrasive blasted surfaces shall be rendered dust free by "blow-off" with compressed air or vacuum cleaning prior to the application of primer.
4. A minimum of six (6) inches (153mm) around the edges of abrasive blasted areas shall be left bare. If adjoining a coated surface, blasting shall continue a minimum of one (1) inch (26mm) into the coated surface

7.3 Surfaces Which Cannot Be Abrasive Blasted

1. Surfaces which cannot be abrasive blasted shall be degreased by steam cleaning prior to surface preparation in accordance with SSPC-SP 3.
2. Care shall be taken not to burnish the metal surface.
3. Rough edges shall be feathered.

8. COATING APPLICATION

8.1 General

1. Surfaces shall be coated in accordance with SSPC-PA 1 and Manufacturer's recommended coverage rates.

2. Paint exceeding its normal shelf life shall not be used.

3. Manufacturer's recommended pot life shall not be exceeded.

8.2 Protection of Flange, Machined, and Threaded Surfaces

8.2.1 Flange Surfaces

1. Gaskets and ring faces of non-mating flange surfaces shall be protected from paint overspray.

2. Mating surfaces and threads shall be carefully protected from paint overspray.

8.2.2 Machined and Threaded Surfaces

1. Machined and threaded surfaces on carbon steel materials shall be protected with a rust preventative compound or thick plastic protectors.

2. Machined and threaded surfaces shall be protected from damage that could be caused by paint overspray.

8.3 Paint Preparation

8.3.1 Mixing

1. Before use, coating ingredients in any container shall be thoroughly mixed by power-driven mixers to a smooth and uniform consistency for a minimum of 5 minutes. Hand mixing using paddles shall not be permitted. For two (2) component systems, the catalyst and the coating shall be thoroughly mixed after the catalyst has been added to the coating.

2. Coating material mixed in the original container shall not be used until all settled pigment is incorporated in the vehicle. This does not imply that part of the vehicle may not be poured off temporarily to simplify the mixing.

3. Coating material shall not be mixed or kept in suspension by use of a bubbling air stream.

4. Where a skin has formed in the container, the skin shall be cut loose and discarded. If such skins are sufficiently thick to have a practical effect on the composition and quality, the paint shall not be used.
5. Pigmented material shall be strained after mixing except where application equipment is provided with adequate strainers. Strainers shall be capable of passing the pigment and removing any skin.
6. Material which does not have a limited pot life, or does not deteriorate on standing, may be mixed any time before using. If settling has occurred, material shall not remain in spray pots or buckets overnight but shall be gathered into a closed container and remixed before use.

8.3.2 Thinning

1. Thinner shall not be added unless necessary for proper application.
2. Thinning shall not exceed the limitations established by manufacturer.
3. The thinner shall be as stated on the manufacturer's product specification sheets.
4. Thinner shall be supplied by the manufacturer of the coating materials in which it is used.
5. When use of thinner is permissible, it shall be added during the mixing process. Painters shall not add thinner after paint has been thinned to the proper consistency.
6. Thinning shall be done under supervision acquainted with the correct amount and type to be added.

8.4 General Application Techniques

1. Prior to the application of any coat of material, damage to previous coats shall be touched up.
2. Coating shall not be placed on edges prepared for field welds or within four inches of these edges.

3. Painting shall not be allowed over abrasive blasted areas less than four inches away from the unblasted area.

4. Each coat shall be uniformly applied as a continuous film of uniform thickness free of pores. Skips, sags, and drips shall be avoided. Holidays in the final coat at edges, corners, welds, and inaccessible areas shall be protected by hand brushing with an additional layer of finish coat.

5. Painters shall be equipped with wet mil gauges and each painter shall make frequent checks of wet film thickness.

6. Areas of organic coatings with a thin layer of coating or areas of organic coatings missed in the applications shall be recoated and permitted to dry before the next coat is applied, or in accordance with manufacturer's recommendation.

7. Each coat shall be in a proper state of cure or dryness before the application of the succeeding coat. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the undercoat, and after the manufacturer's minimum recommended drying time has elapsed.

8. Alternate coats shall be tinted sufficiently to produce enough contrast to indicate complete coverage of the surface. When the paint is the color of the steel, or when the tinting of the final coat is objectionable, the first coat to be applied shall be tinted. The tinting material shall not be detrimental to the service life of the paint.

9. Stripe painting shall be brush applied after the first coat (primer), using the intermediate coat on all welds, corners, and crevices to the following systems:

GROUP	SYSTEM(S)
A	1,2
B	1
E	1,2

10. Abrasive particles visible in the painted surface shall be reblasted as required to remove all particles.

8.5 Air Spray Equipment

8.5.1 General

1. Suitable regulators and gauges shall be provided for both the air supply to the pressure pot and the air supply to the pressure gun.
2. Air caps, nozzles, and needles shall be those recommended by the coating manufacturer for the material being sprayed.
3. The equipment shall be kept in satisfactory condition for proper paint application.
4. Lines and pots shall be clean before the addition of new material.

8.5.2 Traps or Separators

1. Traps or separators shall be installed between the air source and the spray equipment to remove oil and condensed water from the air.
2. Traps or separators shall be of adequate size and the drain valves shall be opened slightly to permit continuous draining of condensate during operations.
3. The air from the spray gun impinging against the surface shall show no condensed water or oil.

8.5.3 Agitation

Continuous mechanical agitation shall be used to keep ingredients properly mixed in the spray pots or containers.

8.5.4 Cleanliness

1. Spray equipment shall be kept sufficiently clean so that dirt, dried paint, and other foreign materials are not deposited in the paint film.
2. Solvents left in the equipment shall be completely removed before use to prevent

contamination of the coating materials.

3. Prior to use, equipment shall be purged with thinner compatible with product to be sprayed.

4. After filling the equipment with the coating material, the painter shall discharge product from the spray gun into a waste container until all noticeable traces of thinner have disappeared from the material being sprayed.

8.6 Brush Application

8.6.1 Equipment

1. Brushes shall be of a style and quality that complies with recommendations of the coating manufacturer.

2. Round or oval brushes are most suitable for rivets, bolts, irregular surfaces, and rough or pitted steel.

3. Wide, flat brushes are suitable for large flat areas, but they shall not have a width over five (5) inches (127mm).

4. Surfaces not accessible to spray or brushes may be painted by daubers or sheepskin mitts.

8.6.2 Application

1. Coatings shall be brushed on all areas which cannot be properly spray coated for any reason.

2. Brushing shall be done so that a smooth coat as nearly uniform in thickness as possible is obtained.

3. Paint shall be worked into all corners and crevices.

4. Runs or sags shall be brushed out.

5. Brush marks shall be minimized.

6. Successive coats of paint shall be applied by cross-hatching the previous coat.

8.7 Drying of Coated Surfaces

8.7.1 Forced Drying

Paint shall not be force dried under conditions which cause checking, wrinkling, blistering, formation of pores, or detrimentally affect the condition of the paint.

8.7.2 Drier Compounds/Accelerators

Drier compounds or accelerators shall not be added to a paint unless specifically called for in the manufacturer's specification for the paint.

8.8 Protection of Coated Surfaces

1. Wet paint shall be protected against contamination from dust or other foreign matter.
2. Paint shall be protected from rain, condensation, snow, and freezing to the fullest extent practical until hardened or cured as required by the product specification.
3. Surfaces already coated which have identification numbers, flow directions, or color coding shall be protected from paint and spray.

9. HOT-DIP GALVANIZING

9.1 Specifications

9.1.1 Miscellaneous Steel Products

1. Grating, ladders, handrails, stair treads, walkways, and helideck guards, and other items so specified on the Contract Drawings shall be prepared for hot-dipped galvanizing in accordance with ASTM A 385.
2. These items shall be galvanized in accordance with ASTM A 123, except that the weight of the zinc coating shall average not less than three (3) ounces of zinc per square foot of surface area (916 grams of zinc per square meter), and no individual specimen shall show less than 2.5 ounces of

zinc per square foot of surface area (764 grams of zinc per square meter) when analyzed using ASTM A 90.

3. Hot dipped galvanizing of bolts, nuts, and washers shall conform with ASTM A 153, and ASTM A 143.

9.1.2 Wire Mesh

Woven wire mesh shall be galvanized in accordance with ASTM A 392.

9.2 Procedures

9.2.1 Galvanized Connections

1. Items to be galvanized shall be galvanized after fabrication.
2. Where it is impossible to galvanize a completely fabricated unit, joints which must be welded after galvanizing shall have the welds metalized after assembly of the unit.

9.2.2 Painted Connections

1. Galvanized members which are to be permanently fixed to the structure by welding shall be attached after the supporting members are primed but before top coats are applied.
2. The heat-affected zone shall be cleaned of all welding flux, blasted, and primed with the Company approved coating system from TB400T1.

9.3 Repair

1. Galvanized surfaces that require welding, cutting, drilling, or other preparation and any galvanized surface that has been damaged shall be repaired with a Company approved coating repair system (zinc primer containing a minimum of 90 percent zinc by weight, i.e., Galvoweld or equal).
2. Before application of repair coating, surfaces shall be washed with fresh water.

3. Rust and surface contaminants shall be removed in accordance with SSPC-SP 3. The area shall then be cleaned by solvent washing.

4. Coating material shall be applied immediately after completion of surface preparation.

10. REPAIR OF DAMAGE TO SHOP PAINT

1. Where shop paint has been damaged in handling, damaged and loosely adhering paint shall be removed and the surface thoroughly cleaned by blasting wherever possible or by power tools if conditions do not permit blasting.

2. Edges of the breaks shall be feathered using sandpaper or emery cloth and the designated number of prime and finish coats applied.

3. Damage to the finish coating prior to delivery shall be reprimed and refinished.

11. ADDITIONAL PROTECTION OF FLANGED JOINTS

Flange faces that are exposed to the environment or that are not protected from the atmosphere by insulation material and aluminum jacketing and in service below 212 degrees F shall be protected against corrosion as follows:

1. Flanges at or below the sub-cellar deck shall be protected by flange protectors installed in accordance with manufacturer instructions.

2. Flanges above the sub-cellar deck shall be protected by application of an easily removable water proofing material between the flange faces and a semi-permanent weather resistant adhesive tape wrapped around the outer diameter of the flange.

12. OFFSHORE PAINTING AND REPAIR

1. The type, manufacturer, number of coats, color, and thickness of coatings shall be as specified in TB400T1.

2. The Installation Contractor shall touch up coatings that have been damaged during transport and installation.
3. Minor coating repairs made necessary as a result of normal installation procedures, i.e., removal of installation aids and sea-fastening, sling damage, etc., shall be performed in accordance with Section 10.
4. Installation Contractor shall paint structural and piping interface connection areas.
5. Surface preparation of the structural and piping interface connection areas shall be in accordance with Section 7 of this specification.

TB400T1
GENERIC SYSTEMS

SYS TEM	COMPONENTS	SURF PREP	COAT	GENERIC TYPE	DFT (MILS)
GROUP A: STRUCTURAL (Notes 1, 2, 4, 5)					
1	Structural steel above the splash zone.	SP 5	1 2 3	Inorganic Zinc Silicate (Self Cure) Polyamide Cured High Build Epoxy Aliphatic Urethane	3-4 4-6 2-3
2	Plate decks including heliports.	SP 5	1 2 3	Inorganic Zinc Silicate Primer (Self Cure) Polyamide Cured Epoxy Polyamide Cured High Build Epoxy with Alumina Oxide Aggregate	3-4 2-3 15-25
3	Galvanized and aluminum parts.	Degrease SP 7	1 2	Polyamide Cured Epoxy Aliphatic Urethane	2-3 2-3
GROUP B: PROCESS EQUIPMENT (Notes 1, 3, 4, 5)					
1	Exterior surfaces of vessels, manifolds, piping, pumps and other equipment or process skid units with surface temperatures not exceeding 200 F, except those specified as galvanized (Note 3).	SP 5	1 2 3	Inorganic Zinc Silicate (Self Cure) Polyamide Cured High-Build Epoxy Aliphatic Urethane	3-4 4-6 2-3
2	Galvanized and aluminum parts with surface temperatures not exceeding 200 F. (Coating is not required on galvanized parts unless specifically required by Company).	Degrease SP 7	1 2	Polyamide Cured Epoxy Aliphatic Urethane	2-3 2-3
3	Exterior surfaces of stainless steel and copper with surface temperatures not exceeding 200 F. (Not required unless specifically requested by Company).	Degrease SP 3	1 2	Polyamide Cured Epoxy Aliphatic Urethane	2-3 2-3
4	Exterior surfaces of equipment where abrasive blasting is not permitted, and with surface temperatures not exceeding 200 F, except those specified as galvanized.	Degrease SP 3	1 2 3	Universal Primer Polyamide Cured High-Build Epoxy Aliphatic Urethane	3-4 4-6 2-3
5	Exterior Surfaces of equipment where abrasive blasting is not permitted and with surface temperatures not exceeding 400 F, except those specified as galvanized.	Degrease SP 3	1 2	Surface Tolerant Surface Tolerant (Optional)	5-7 Total
GROUP C: SUBMERGED SERVICE (SUBSEA TEMPLATES, UNDERWATER MANIFOLDS, ETC) (Notes 1, 3, 4, 5)					
1	Totally submerged structural steel, piping, and equipment.	SP 5	1 2	Polyamide Cured, High-Build Epoxy Polyamide Cured, High-Build Epoxy	4-6 4-6
2	Totally submerged galvanized and aluminum parts. (Coating not required on galvanized items unless specifically requested by Company).	Degrease SP 7	1 2	Polyamide Cured High-Build Epoxy Polyamide Cured High-Build Epoxy	4-6 4-6
GROUP D: HIGH TEMPERATURE SERVICE (Notes 1, 3, 4, 5, 6, 7)					
1	Non-insulated exterior surfaces, 300 F to 700 F. (Note: All equipment surface temperatures must exceed 300 F in order to provide proper curing).	SP 5	1 2	Inorganic Zinc Silicate (Self Cure) Modified Silicone or Polysiloxane	2-3 Note 6 4-6
2	Insulated exterior surfaces of piping, vessels, etc. with surface temperature not exceeding 350 F, except austenitic stainless steel process piping.	SP 5	1 2	Epoxy Phenolic Primer Epoxy Phenolic Finish	4-6 4-6
3	Non-insulated exterior surfaces. 200 F to 500 F. (Note: Curing takes place at ambient temperatures).	SP 5	1 2	Inorganic Zinc Silicate (Self Cure) Silicone Acrylic or Polysiloxane	2-3 1.5-3 4-6
GROUP E: TANK LININGS (Notes 1, 4, 9)					
1	Interior surfaces of potable water storage tanks.	SP 5	1 2	Polyamide Cured High-Build Epoxy Polyamide Cured High-Build Epoxy	4-6 4-6
2	Interior surfaces of glycol and diesel fuel storage tanks.	SP 5	1 2	Polyamide Cured High-Build Epoxy Polyamide Cured High-Build Epoxy	4-6 4-6
GROUP F: OFFSHORE TOUCH-UP (Notes 4, 5, 8)					
1	Offshore touch-up painting above the splash zone.	SP 5	1 2 3	Zinc Rich Epoxy Polyamide Primer Polyamide Cured High-Build Epoxy Aliphatic Urethane	3-5 4-6 2-3

GROUP G: SPLASH ZONE (Note 2)

TB400T1
GENERIC SYSTEMS

SYS TEM	COMPONENTS	SURF PREP	COAT	GENERIC TYPE	DFT (MILS)
1	Splash zone excluding risers	SP 5	1	Epoxy Cladding	3/16"
			2	Polyamide Cured High Build Epoxy	(100-120)
					4-6

Table TB400T1 (continued)

NOTES

1. The color of each coat shall contrast with the color of the previous coat.

2. Final topcoat shall be International Orange unless noted otherwise.

3. Final topcoat shall be Light Grey. Color shall be ANSI Z55.1, Color Chips for No. 70 Grey.

4. Drying and curing times shall conform to Manufacturer's instructions.

5. Other products may be submitted to Company for approval.

6. Generally 1.5 mils. Check Manufacturer's product tables.

7. The initial startup operation of equipment protected with Group D, System 1 shall be carried out at a controlled rate of increase in temperature not to exceed 100 F per hour in order to provide a final cure and to avoid damage to the paint.

8. Final topcoat shall match the color of the system being touched-up.

9. Group E System 1 shall be NSF certified. Final topcoat shall be WHITE unless noted otherwise.

TB400T2

PAINT MANUFACTURERS AND PRODUCTS FOR USE IN AREAS WITH NO VOC RESTRICTIONS

SYSTEM	COAT	MANUFACTURER					
		AMERON	CARBOLINE	COOK-SW	HEMPEL	INTERNATIONAL PC	SIGMA
GROUP A: STRUCTURAL							
1	1	Dimetcote 9	Carbo-Zinc 11 (Low Level)	Zinc Clad II	Galvosil 1570	Interzinc 22	7551 Tornusil MC
	2	Amercoat 383 HS	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	5483 Sigmacover PR/Int
	3	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
2	1	Dimetcote 9	Carbo-Zinc 11 (Low Level)	Zinc Clad II	Galvosil 1570	Interzinc 22	7551 Tornusil MC
	2	Amercoat 182	893	Corolon HS Epoxy 920-W-350	Hempadur 4523	Intertuf KHA300	7420 Sigmarite Sealer
	3	Amerlock 400GF w/ 888 (Non-skid Agregate)	1210 w/ Non-Skid Aggregate	Corolon HS Epoxy w/ Non-Skid Aggregate	Hempadur 4526 w/ Non-Skid Aggregate	Intergard 7745/EGK Series	5453 Non-Skid Epoxy w/ aggregate
3	1	Amercoat 182	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
GROUP B: PROCESS EQUIPMENT							
1	1	Dimetcote 9	Carbo-Zinc 11 (Low Level)	Zinc Clad II	Galvosil 1570	Interzinc 22	7551 Tornusil MC
	2	Amercoat 383 HS	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
2	1	Amercoat 182	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
3	1	Amercoat 182	893	Macropoxy Black 920-B-355	Hempadur 4523	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
4	1	Amerlock 400	Carbomastic 90	Macropoxy 920-W-354	Hempadur 4515	Interprime CPA098	7427 Sigmacover CM MIO
	2	Amercoat 383 HS	893	Recoatable Epoxy PR	Hempadur 4515	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
5	1	Amerlock 400 AL	Carbomastic #15 LO	Macropoxy Alum	Hempadur 4515	Interbond HTA 002	7427 Sigmacover CM MIO
	2					Interbond HTA 002	

TB400T2

PAINT MANUFACTURERS AND PRODUCTS FOR USE IN AREAS WITH NO VOC RESTRICTIONS

SYSTEM	COAT	MANUFACTURER					
		AMERON	CARBOLINE	COOK-SW	HEMPEL	INTERNATIONAL PC	SIGMA
GROUP C: SUBMERGED SERVICE (SUBSEA TEMPLATES, UNDERWATER MANIFOLDS, ETC)							
1	1	Amercoat 385P	890	Shellcote II	Hempadur 4563	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 385	890	Shellcote II	Hempadur 4563	Intertuf KHA302	7433 Sigmaguard EHB
2	1	Amercoat 385P	890	Shellcote II	Hempadur 4563	Intertuf KHA300	7433 Sigmaguard EHB
	2	Amercoat 385	890	Shellcote II	Hempadur 4563	Intertuf KHA302	7433 Sigmaguard EHB
GROUP D: HIGH TEMPERATURE SERVICE							
1	1	Dimetcote 9	Carbo-Zinc 11 (Low Level)	Zinc Clad II	Galvosil 1570	Interzinc 22	7551 Tornusil MC
	2	Amercoat 878	4674	Silicon Aluminum 100-A-518	Silicone Alum 5690	Interbond 50	7563 Sigmatherm Siloxan
2	1	Amercoat 90 HS	Thermaline 400	Phenicon 920-W-A11	Hempadur 1599	Interline THA/TL Series	7409 Phenguard Primer
	2	Amercoat 90 HS	Thermaline 400	Phenicon 920-W-A11	Hempadur 1599	Interline THA/TL Series	7436 Phenguard Finish
3	1	Dimetcote 9	Carbo-Zinc 11 (Low Level)	Zinc Clad II	Galvosil 1570	Interzinc 22	7551 Tornusil MC
	2	Amercoat 891	1248	Silicone Acrylic 881-A-001	Silicone Acrylic 5694	Interbond 50	7563 Sigmatherm Siloxan
GROUP E: TANK LININGS							
1	1	Amercoat 395	891	Potable Water Epoxy B62W7	Hempadur 3553	Magna-Line 7537/THA 200	5476-3160 Sigmaguard HSV
	2	Amercoat 395	891	Potable Water Epoxy B62W7	Hempadur 3553	Magna-Line 7536/THA 200	5476-7000 Sigmaguard HBV
2	1	Amercoat 395	187 Primer	Shelcote II 920-W-355	Hempadur 3553	Interline THA855/THB	7433 Sigmaguard EHB
	2	Amercoat 395	187 Finish	Shelcote II 920-W-355	Hempadur 3553	Interline THA852/THB	7433 Sigmaguard EHB
GROUP F: OFFSHORE TOUCH UP							
1	1	Amercoat 68A	858	Zinc Clad IV B69A8	Hempadur Zinc 1536	Interzinc EPA075	7402 Sigmacover
	2	Amercoat 383HS	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 GL	134	Acrothane II BRS 975-W-502	Hempathane 5521	Interthane PC/PQ	5523 Sigmadur HS
GROUP G: SPLASH ZONE							

TB400T2

PAINT MANUFACTURERS AND PRODUCTS FOR USE IN AREAS WITH NO VOC RESTRICTIONS

SYSTEM	COAT	MANUFACTURER					
		AMERON	CARBOLINE	COOK-SW	HEMPEL	INTERNATIONAL PC	SIGMA
1	1	Tideguard 171 A	C-Gard 1207	-	Hempadur Spray Guard 3549	Interzone 6000	7490 Sigmacover
	2	Amercoat 383 HS	890	-	Hempadur 4523	Intertuf KHA 300	7456 Sigmacover CM

TB400T3
PAINT MANUFACTURERS AND PRODUCTS FOR USE IN AREAS WITH VOC RESTRICTIONS
(* INDICATES NON VOC)

SYSTEM	COAT	MANUFACTURER					
		AMERON	CARBOLINE	COOK-SW	HEMPEL	INTERNATIONAL PC	SIGMA
GROUP A: STRUCTURAL							
1	1	Dimetcote 21-9	Carbo-Zinc 11 HS (Low Level)	Zinc Clad XI	Galvosil 1562	Interzinc TQ4374H	7550 Silguard
	2	Amercoat 385	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
2	1	Dimetcote 21-9	Carbo-Zinc 11 HS (Low Level)	Zinc Clad XI	Galvosil 1562	Interzinc TQ4374H	7550 Silguard SC
	2	Amercoat 385	893	Corolon HS Epoxy 920-W-350	Hempadur 4523	Intertuf KHA300	7420 Sigmarite Sealer
	3	Amerlock 400GF w/ 888 Agregate	1210 w/ Non-Skid Aggregate	Corolon HS Epoxy w/ Non-Skid Aggregate	Hempadur 4526 w/ 9783 Aggregate	Intergard 7754/EKG Series	5453 Non-Skid Epoxy w/707 Aggregate
3	1	Amercoat 385P	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
GROUP B: PROCESS EQUIPMENT							
1	1	Dimetcote 21-9	Carbo-Zinc 11 HS (Low Level)	Zinc Clad XI	Galvosil 1562	Interzinc TQ4374H	7550 Silguard SC
	2	Amercoat 385	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
2	1	Amercoat 385P	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
3	1	Amercoat 385P	893	Macropoxy Black 920-W-502	Hempadur 4523	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
4	1	Amercoat 385P	Carbomastic 90	Macropoxy 920-W-354	Hempadur 4515	Intertuf KHA300	7427 Sigmacover CM MIO
	2	Amercoat 385	893	Recoatable Epoxy PR	Hempadur 4515	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
5	1	Amerlock 400 AL	Carbomastic #15 LO	Macropoxy Alum	Hempadur 4515	Interbond HTA 002 *	7427 Sigmacover CM MIO
	2					Interbond HTA 002 *	

TB400T3
PAINT MANUFACTURERS AND PRODUCTS FOR USE IN AREAS WITH VOC RESTRICTIONS
(* INDICATES NON VOC)

SYSTEM	COAT	MANUFACTURER					
		AMERON	CARBOLINE	COOK-SW	HEMPEL	INTERNATIONAL PC	SIGMA
GROUP C: SUBMERGED SERVICE (SUBSEA TEMPLATES, UNDERWATER MANIFOLDS, ETC)							
1	1	Amercoat 385P	890	Shelcote II	Hempadur 4563	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 385	890	Shelcote II	Hempadur 4563	Intertuf KHA302	7433 Sigmaguard EHB
2	1	Amercoat 385P	893	Shelcote II	Hempadur 4563	Intertuf KHA300	7413 Sigmacover PR
	2	Amercoat 385	890	Shelcote II	Hempadur 4563	Intertuf KHA302	7433 Sigmaguard EHB
GROUP D: HIGH TEMPERATURE SERVICE							
1	1	Dimetcote 21-9	Carbozinc 11 HS (Low Level)	Zinc Clad XI	Galvosil 1562	Interzinc TQ4374H	7550 Silguard SC
	2	Amercoat 738	4674 *	Silicone Aluminum 100-A-518 *	Silicone 5690 *	Interbond HTA 230 *	7563 Sigmatherm Siloxan *
2	1	Amercoat 738	Thermoline 400	Phenicon HS 920-W-A11	Hempadur 1550	Interline THA 800/TL Series	7409 Phenguard Primer
	2	Amercoat 738	Thermoline 400	Phenicon HS 920-W-A11	Hempadur 1550	Interline THA 800/TL Series	7436 Phenguard Finish
3	1	Dimetcote 21-9	Carbo-Zinc 11 HS (Low Level)	Zinc Clad XI	Galvosil 1562	Interzinc TQ4374H	7550 Silguard SC
	2	Amercoat 738	1248 *	Silicone Acrylic 881-A-001 *	Silicone Acrylic 5694 *	Interbond HA2778H *	7563 Sigmatherm Siloxan *
GROUP E: TANK LININGS							
1	1	Amercoat 395	891	Potable Water Epoxy B62W7	Hempadur 3553	Magna-Line 7536/THA 200	5476-3160 Sigmaguard HSV
	2	Amercoat 395	891	Potable Water Epoxy B62W7	Hempadur 3553	Magna-Line 7530/THA 200	5476-7000 Sigmaguard HSV
2	1	Amercoat 395	187 Primer	Shelcote II	Hempadur 3553	Interline THA855/TH Series	7433 Sigmaguard EHB
	2	Amercoat 395	187 Finish	Shelcote II	Hempadur 3553	Interline THA852/TH Series	7433 Sigmaguard EHB
GROUP F: OFFSHORE TOUCH-UP							
1	1	Amercoat 68 HS	858	Zinc Clad IV B69A8	Hempadur 4515	Zinc Lock 308	7402 Sigmacover
	2	Amercoat 385	893	Recoatable Epoxy PR	Hempadur 4523	Intertuf KHA300	5483 Sigmacover PR/INT
	3	Amercoat 450 HS	Carbothane D134 HS	Acrothane II BRS 975-W-502	Hempathane 5590	Hythane Ultra 8700	5523 Sigmadur HS
GROUP G: SPLASH ZONE							
1	1	Tideguard 171 A	C-Guard 1207	-	Spray Guard 3549	Interzone 6000	7490 Sigmacover

TB400T3
PAINT MANUFACTURERS AND PRODUCTS FOR USE IN AREAS WITH VOC RESTRICTIONS
(* INDICATES NON VOC)

SYSTEM	COAT	MANUFACTURER					
		AMERON	CARBOLINE	COOK-SW	HEMPEL	INTERNATIONAL PC	SIGMA
	2	Amercoat 385	890	-	Hempadur 4523	Intertuf KHA 300	7456 Sigmacover CM

ELECTRICAL FACILITIES FOR PACKAGED EQUIPMENT

SPECIFICATION NO. TEX. E.115

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		

Approved by:	Company Approval:

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Documentation Requirements Sheet YES[X] NO[ ]

TABLE OF CONTENTS

1. SCOPE

This specification defines minimum requirements for design, materials, fabrication, and testing of electrical facilities for packaged equipment to be installed on an offshore platform.

2. REFERENCES

2.1 Company Specifications

The following Company specifications supplement this specification:

1. TEX.E.100, "Design, Materials, and Installation of Electrical Facilities".
2. TEX.E.110, "Check and Commissioning of Electrical Equipment and Facilities".
3. TEX.E.200, "Design and Manufacture of Induction Motors 150 HP and Less".
4. TEX.E.2??, "Design and Manufacture of Large Induction Motors 200 HP and Above".
5. TEX.E.2??, "Design and Manufacture of Synchronous Motors".
6. TEX.E.600, "600 Volt Power and Control Cable".
7. TEX.E.605, "Instrument Cabling".
8. TEX.E.610, "Medium Voltage Power Cable".
9. TEX.E.6??, "Thermocouple Extension Wire and Cable".

2.2 Codes and Standards

The design and installation of the electrical facilities shall be in accordance with the latest edition of the following Codes and Standards:

2.2.1 American Petroleum Institute (API)

1. API RP 14F, "Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms".
2. API RP 500B, "Recommended Practice for Classification of Areas for Electrical Installations at Drilling Rigs and

Production Facilities on Land and on Marine Fixed and Mobile Platforms".

2.2.2 Insulated Cable Engineers Association (ICEA)

ICEA S-6 8-516, "Ethylene-propylene-rubber-insulated Wire and Cable for Transmission and Distribution of Electrical Energy".

2.2.3 National Fire Protection Association (NFPA)

NFPA 70, "National Electrical Code (NEC)".

2.2.4 Other

Installations not under the jurisdiction of the U.S. shall conform to applicable requirements of the nation in which the project is located, provided requirements are equal to those of the U.S. In each case, the more rigid requirements shall take precedence.

In case of conflict between this specification and the Codes and Standards above, the most stringent requirement shall govern.

3. DESIGN REQUIREMENTS

3.1 Area Classification

1. Hazardous areas shall be defined in accordance with the NEC, Article 500.
2. Hazardous area locations shall conform to API RP 500.
3. Area classification shall be as shown in contract drawings.

3.2 Utilization Voltages

1. Unless otherwise specified, over current protected power feeders and motor feeders shall be supplied by Company.
2. Number and type of feeders required shall be determined by Vendor's package.
3. Utilization voltages shall be as follows:

Voltage	Current	Application
4160 V, 3 phase 3 wire, wye,	40A to 420A	Motors 200 HP to 3000 HP

low resistance grounding		
480 V, 3 phase 3 wire, wye, solid grounding	15A to 600A	Motors 1/2 HP - 200 HP, heaters, and total package power
120 V, 1 phase 2 wire, grounding neutral	15A, 20A, 30A	Motors less than 1/2HP, lighting, heaters, instrument controls, and other single phase loads

4. If control voltages other than those listed are required, mechanical equipment shall have means for transformation. (This could apply for local control interlocking requirement.)

3.3 Control and Alarm Circuits

1. Control and alarm circuits shall fail safe. That is, open circuiting of one wire, short circuiting of one wire, or failure of a component shall not cause machinery to start up.
2. Failures shall shut down equipment, render equipment inoperative, or sound an alarm.
3. Controls shall have suitable circuit protection such that any one electrical fault does not affect more than one unit or system. Protection can be from circuit breaker or fuse.
4. A disconnecting means shall be provided to permit servicing of individual systems or control components.
5. Contacts, such as relays and contactors, on 120 V and 480 V services shall be rated 600 V.
6. If specified, contacts on 120 V service shall be rated 250 V.
7. 600 V class control relays shall be heavy duty (10 A contact rating on 600 V noninductive load). Each relay shall have at least one spare NO and one spare NC contact for future use.
8. 300 V class control relays shall be heavy duty (10 A contact rating on 300 V noninductive load). Each

relay shall have at least one spare NO and one spare NC contact for future use.

9. Contacts in low energy circuits shall be gold plated or gold flashed. Contacts shall be suitable for dry circuit applications.

10. Contacts on equipment in outdoor service (NEMA 4X enclosures) shall be hermetically sealed type.

4. FABRICATION

4.1 General

1. Electrical devices, enclosures, and equipment shall be securely mounted, adequately supported, completely wired, and tested in accordance with this specification and other specifications in this package.

2. Electrical device, enclosures, and equipment shall agree with Vendor drawings and lists of material.

3. Switches, control stations, and indicating lamps shall be grouped together, arranged in a logical manner, and aligned with surrounding members to present a finished installation. Equipment shall be installed such that there is no interference with normal operation or maintenance.

4. If space heaters are provided and required for preservation of equipment during storage, electrical connection points shall be accessible without removing shipment packing.

5. Enclosures shall have breathers and drains as required to prevent accumulation of moisture. Low points of conduit runs have drains.

6. Surfaces of electrical apparatus which are scratched or marred during shipment or installation shall be touched up.

7. Materials used for touch up shall match equipment manufacturer's coating specification.

8. Prior to painting, exposed raceways, fittings, boxes, supports, etc., shall be cleaned by removing oil, grease, dirt, etc.

9. Metal clad power, control, and instrument cable shall be used for interconnection of electrical equipment and devices within the package.

4.2 Electrical Equipment and Material

4.2.1 General

1. Except for materially specifically designated as being furnished by Company, all materials shall be furnished.
2. Material shall be new and in good condition. Manufacturer's names and catalog numbers listed on drawings or specifications indicates required material. Unless approved in writing, substitution shall not be made. Substitution, if approved, shall not delay completion of project by specified date.
3. Equipment shall be currently manufactured or stock items. Discontinued models or parts shall not be used.
4. To fullest extent possible, electrical materials and equipment shall be approved by Underwriters Laboratories (UL) for the service in which they are used. Materials and equipment shall bear UL label or listing. Materials and equipment not available with a UL label or listing shall be assembled from approved components and shall be built in accordance with published standards of UL or other internationally recognized testing laboratory.
5. Explosionproof enclosures shall have neoprene or equal O-ring gasket on flange cover.
6. Equipment shall be installed in accordance with the NEC for electrical area classifications.
7. Electrical devices, enclosures, and equipment shall be securely mounted, adequately supported, and completely tested in accordance with ANSI, IEEE, NEMA, and UL.
8. Cable and equipment installation shall allow for equipment translation due to platform deflections and thermal expansion and contraction.

9. Major electrical material and equipment shall be checked to ensure that they conform to appropriate general specification and/or equipment data sheets and are marked with appropriate tag number before they are installed.
10. Electrical material and equipment shall be aligned and square with surrounding structural members.
11. Additional structural framing shall be installed around base of switchgear, motor control centers, and power transformer areas to provide extra support for equipment.
12. Access space to electrical equipment shall conform to the NEC.
13. Electrical material and equipment shall be installed such that access is easy for operation, service, and maintenance of equipment, piping, and valves.
14. Distribution panelboards, junction boxes, etc., shall be mounted on steel framework welded to structural steel for accessibility.
15. Spare and replacement parts shall be regularly available for equipment supplied.
16. Special equipment shall be avoided.
17. Interchangeability of parts and commonality of manufacture shall be selected to reduce spare parts inventory.

4.2.2 Junction Boxes Without Arcing Devices

1. Junction boxes without arcing devices located in non-classified or Class 1, Division 2, areas shall be type NEMA 4X.
2. Such boxes may be constructed of any of the following materials:
   a. Cast copper free aluminum.
   b. 316 stainless steel.
   c. Fiberglass reinforced epoxy.

3. Junction boxes in Class 1, Division 1, areas shall be NEMA 7-4X construction, cast copper free aluminum.

4.2.3 Junction Boxes with Arcing Devices

1. Junction boxes with arcing devices located in non-classified or Class 1, Division 2, areas shall be NEMA 7-4X construction and certified explosionproof.
2. If arcing devices are hermetically sealed, enclosure may be:
   a. Fiberglass reinforced epoxy of NEMA 4X construction.
   b. 316 stainless steel of NEMA 4X construction.

4.2.4 Equipment Used Outdoors

1. Outdoor enclosures shall have combination breather drain.
2. Aluminum parts shall not be used outdoors unless made of copper free aluminum.
3. Pushbuttons and selector switches used outdoors shall have hermetically sealed contacts (Allen Bradley Bulletin 800 R or equal).

4.3 Metal Clad Cable

1. Metal clad power, control, and instrument cable shall conform to TEX.E.600, TEX.E.605, TEX.E.610, or TEX.E.??? (Thermocouple Extension Wire and Cable).
2. Metal clad cable shall be installed in all area classifications in accordance with API RP 14F.
3. Conduit fittings, such as tees, junction boxes, cable terminators, and seals, associated with installation of metal clad cable shall be PVC copper free aluminum (0.4% maximum copper UL Approved) Plasti-Bond "Red" by Robroy Industries, OCAL "Blue" by Occidental Coating Company, or approved equal. PVC coating shall be 40 mils.
4. MC type CLX cable shall be fitted with Thomas and Betts Spin-on cable glands complete with internal grounding ring and bushing.

5. Cable glands installed outdoors shall have corrosion resistant neoprene boots fitted over each cable gland.

4.4 Conduit Systems

Wire in conduit, if used in lieu of metal clad cable, shall conform to the following:

1. Conduit and conduit fittings shall be rigid copper free aluminum (0.4% copper) PVC coated, UL approved. Conduit shall be Plasti-Bond "Red" by Robroy Industries, OCAL "Blue" by Occidental Coating Company, or approved equal. PVC coating shall be 40 mils. Conduit shall be at least 3/4 inch. Conduit shall be installed in accordance with this specification.

2. Liquid-tight flexible metallic conduit with PVC jacket shall be used for instrument connections and at motor conduit boxes. Terminations of flexible metallic conduit shall be made with PVC coated liquid-tight type connectors which have integral insulated threads and positive ground connections. Bonding jumpers shall be installed as required. Flexible conduit shall have a maximum length of 24 inches.

3. Conduits shall be installed plumb and level, with runs parallel to one another and parallel or perpendicular to structural makeup.

4. Conduit which has been crushed, deformed, or damaged in any way shall not be installed. The end of each section of conduit shall be reamed to remove burrs before assembly.

5. Outdoor conduit runs shall have suitable drain at low point and breather at high point.

6. Rigid metal conduit threads shall be tapered and factory cut or field cut with dies designed specifically for type of conduit being threaded.

7. Threaded conduit joints shall be made up wrench tight with proper tools. Hand tight assembly shall not acceptable. Crouse-Hinds compound or equal shall be applied to conduit threads before makeup. Thread compounds shall be conductive to maintain continuity of grounding system through metallic conduit.

8. After makeup, exposed threads shall be cleaned of thread compound.
9. Rigid metal conduit connections to couplings, fitting boxes, or devices shall be threaded with at least five full threads of engagement. Connections to sheet metal enclosures (indoors only) may be made with threaded conduit hubs.
10. Conduit-to-conduit and conduit-to-box connections shall be made with approved nonindent type couplings and connectors.
11. Bends in 3/4 inch rigid conduit may be made with proper bending tools. Bends in 1 inch and larger rigid conduit shall be made with hydraulic or mechanical benders designed specifically for type of conduit being bent. I.D. of conduit shall not be reduced effectively in the bend. Centerline radius of a field bend shall not be less than six times nominal conduit diameter. Field bends in 3 inch and larger conduit shall be limited to a maximum of 30°.
12. Conduit support materials shall be compatible with type of conduit used and atmospheric conditions. Conduit shall not be supported directly on equipment. Conduit shall be supported a minimum of 6 inches above skid deck or other horizontal surface.
13. Conduit shall be sized in accordance with NEC requirements, assuming that type THW wire will be used.
14. Conduits shall have a properly sized green insulated wire to maintain ground continuity in case of conduit corrosion.

4.5 Wire and Cable

1. Wiring shall be installed and connections made to items of equipment within confines of equipment skid.
2. Only wiring between packaged unit skid and devices which are located remote from skid shall be provided by Company.
3. Electrical circuits shall be installed in accordance with the drawings.

4. Wiring shall be sized in accordance with NEC, except:
   a. Single conductor insulated power wires No. 12 AWG minimum, stranded copper, type THW or THWN/THHN, 600 V, installed in conduit or in CLX cable.
   b. Single conductor control and alarm circuit conductors shall not be smaller than No. 14 AWG in metal clad or conduit.
   c. Control, instrumentation, communication, and signal circuits may use multiconductor insulated cables without metallic armor UL listed, type TC, stranded copper, 600 V, installed in conduit, should metal clad cable not be available. Multiconductor cable conductors shall be not smaller than No. 16 AWG.
5. Wire and cable shall be continuous without splices from origin to termination.
6. Wire or cable which has damaged insulation or jacket shall not be installed.
7. Dedicated conduit systems and adequate separation shall be provided for segregation of each of the different types of wiring systems listed below:
   a. AC power wiring.
   b. AC control wiring.
   c. DC power wiring.
   d. AC instrument wiring for alarm and shutdown.
   e. DC electronic signal wiring (4-20 mA).
   f. Thermocouple or RTD wiring.
   g. Intrinsically safe wire.
   h. Other specialized wiring systems (e.g., pulsed signal).
8. Lighting, heating, and convenience outlets shall not be connected to alarm and control circuits.
9. If shielded instrumentation and thermocouple extension wire is provided by Vendor, shields and drain wires shall be terminated on separate

terminals adjacent to signal terminals. Shield and drain wire terminals shall not be grounded.

10. Conductors for power, lighting, alarm, and control shall be color coded per ICEA S-68-516, Method 1 or 3.

11. Wiring connections required by Company shall have a central terminal strip (600 V, nylon, tubular clamp type). Terminal blocks shall be in a terminal box or a control cabinet located on packaged unit. Only one side of terminal block shall be used by Vendor and shall be intended to interface with Company. The remaining side shall be left clear for Company use. No more than two wires per terminal shall be used. Terminals shall be labeled with a white plastic strip suitable for such purpose.

12. Terminal boxes shall contain a minimum of 20% spare terminals and conduit space.

13. Terminal blocks and wire numbers on each terminal block shall be clearly marked. Wire numbers shall be installed on each end of every wire by use of permanently printed white heat-shrink tubing. Wire identification shall agree with identification shown on Vendor's wiring diagrams.

14. If equipment must be furnished or shipped in different sections (or skids), each section of package system shall have a terminal box. ACT-OG **(???)** shall install any wiring required between different section terminal boxes.

15. Conductors on equipment without terminal blocks shall be terminated with lug-type connectors. Connectors for wires No. 4 AWG and larger shall be made with copper compression type connectors. Control wiring shall be terminated with proper type compression lugs.

16. Insulating tape shall be Scotch No. 33 or equal.

17. Wire in conduit shall conform to TEX.E.600, TEX.E.605, TEX.E.610, and TEX.E.??? (Thermocouple Extension Wire and Cable).

4.6 Control Panels

1. Packaged unit shall have controls necessary for satisfactory operation.

2. Controls, if required, shall be mounted in a control cabinet.
3. Controls shall include control relays, timers, pushbutton, selector switches, indicating lights, and control power transformers.
4. Class I, Division 2, equipment shall have hermetically sealed contacts mounted in a NEMA 4X enclosure.
5. Class I, Division 1, instruments and devices shall be UL listed as explosionproof or mounted in a NEMA 7 enclosure. Purged enclosures shall not be acceptable.
6. Control panels shall have light emitting diode (LED) indicating lights (Stahl or approved equal).
7. Electrical devices within control panel shall be prewired. Terminal blocks shall be included within panel for wiring to externally located devices.
8. Control panel shall be mounted on packaged unit skid.
9. Wiring between cabinet and skid mounted devices shall be installed by Vendor.
10. If control panel cannot be physically mounted on packaged unit skid, skid mounted devices shall be wired to a skid terminal box. Wiring between skid terminal box and control panel shall be installed by Company.
11. Control panel shall have a bypass switch for each shutdown function.
12. Control panels shall have an SPDT for the following functions:
    a. a.Unit malfunction.
    b. b.Shutdown function.
    c. c.Common bypass on shutdowns.
13. Electrical equipment enclosures shall be located to provide working clearance and access per NEC.

4.7 Grounding

1. Grounding conductors shall be soft drawn copper wire.

2. Exposed grounding conductors shall be rigidly supported and protected from mechanical injury. Grounding conductors shall be bare or covered with green insulation.

3. If nonmetallic enclosures are installed in metallic conduit system, grounding fittings shall be installed on conduit. An appropriately sized ground wire shall connect metal conduits together to maintain ground continuity in metallic conduit system.

4. If flexible conduit larger than 1-1/4 inches is installed, an appropriately sized ground wire with required grounding fittings shall be installed to ground conduit system to device.

4.8 Lighting

1. Light fixtures and associated mounting hardware installed in hazardous areas shall be UL approved for those areas and hazardous atmospheres involved and shall be installed in accordance with applicable sections of the NEC.

2. Fixtures in Class I, Division 2, areas and non-hazardous areas shall be vapor tight (enclosed and gasketed).

3. Fixtures in Class I, Division 1, areas shall be factory sealed.

4. Indoor applications shall have fluorescent fixtures.

5. Lighting system illumination levels shall generally conform to IES recommendations using a 0.75 maintenance factor in all lighting calculations.

6. Minimum illumination levels shall be:

   a. Walkways, Stairs, and Aisles — 5 footcandles

   b. Control Rooms — 50 footcandles

   c. Work Shops — 50 footcandles

   d. Indoor General Areas — 20 footcandles

7. Lighting fixtures shall be easily accessible for relamping and maintenance.

8. Light fixtures shall be located such that piping or other obstructions cause the least interference with lighting patterns.

9. Indoor lighting shall be controlled by individual wall-mounted switches conveniently located in each area or room near exit. Areas or rooms with two or more exits shall have three way switches.

10. Circuit breakers in panels shall not be used as switches.

4.9 Low Voltage Switches

1. Switches in Class I, Division 1, areas shall be explosionproof, hermetically sealed devices, UL listed for area, in accordance with construction drawings.

2. Switches in Class I, Division 2, areas or non-hazardous areas shall have hermetically sealed contacts. Switches shall be mounted in a reinforced glass polyester enclosure (Allen Bradley Rosite) or approved equal in accordance with construction drawings.

3. Low voltage switches shall not require conduit seal fitting.

4. Low voltage switches shall be installed in accordance with applicable sections of the NEC.

4.10 Convenience Outlets

1. A sufficient number of convenience receptacles, intended for portable tools or lighting, shall be provided such that any equipment may be reached using a 50 foot (15.25 meter) long extension cord.

2. Convenience outlets shall be 20 ampere, duplex, 120 volt, single-phase, 60 Hertz.

3. Nameplates which clearly indicate voltage, phase, frequency, ampere rating, and power supply circuit shall be installed at each receptacle.

4. Indoor non-hazardous areas shall have convenience receptacles which are NEMA Type 5-20 specification grade.

5. Class I, Group D, Divisions 1 and 2, areas shall have Crouse-Hinds Ark-Gard factory sealed explosionproof delayed action two-wire, three-pole grounded receptacles.

6. Plugs shall be Crouse-Hinds Type Ark-Gard 2. Explosionproof plugs shall fit explosionproof and conventional receptacles.
7. Receptacles used in the following locations shall be protected by a ground fault interrupter (GFI) type branch circuit breaker in lighting panel:
   a. Lavatories.
   b. Washrooms.
   c. Change rooms.
   d. Tool or maintenance shops.
   e. Areas with moist or wet ground where electrical equipment or portable electric tools may be used.
8. Receptacles shall be installed in accordance with applicable sections of the NEC.

4.11 Panelboards

1. Panelboards shall be dead-front safety-type.
2. Panelboards shall have size and number of single-, double-, or triple-pole branches as required.
3. Panelboards shall be suitable for location and shall have a hinged door complete with a combination catch and lock provision.
4. Busses mounted inside panelboards shall be tinned solid copper at joints, including full sized neutral (where applicable) and ground.
5. Panelboards shall contain a ground bus with suitable connectors.
6. Panelboards shall be installed in accordance with manufacturer's instructions and Contractor's final certified drawings.
7. Panelboards shall have typewritten circuit directory correctly listing all branch circuits. Directory shall be mounted in a moistureproof holder inside panel door.
8. Panelboards fed by a lighting transformer shall have their neutrals directly connected to transformer neutral. Neutral wire and power (phase) wires shall be of equal ampacity.

9. Panelboards shall be Westinghouse, General Electric, Square D, or approved equal. Panelboards shall be of same manufacturer as motor control centers.

4.12 Individual Circuit Breakers for Feeder and Branch Circuits

1. Individual circuit breakers for feeder and branch circuits shall be molded case, thermal magnetic-type, bolted frame, manually operated, trip free from handle, and common trip-type.
2. Circuit breakers shall be mounted in an enclosure suitable for area classification.
3. Molded case breakers shall have a minimum interrupting rating (UL and NEMA) of:
   a. 22,000 symmetrical RMS amperes at 480 volts.
   b. 10,000 amperes symmetrical RMS at 120/240 volts.
4. Main panelboard breakers shall be capable of interrupting maximum available short circuit current.
5. Two- and three-pole molded case breakers shall operate on common trip principle that an overload on any pole shall trip all poles.
6. Two single-pole breakers with handle tie or bail or equivalent construction shall not be substituted for a double-pole breaker.

4.13 Transformers - Indoor Dry Type

1. Transformers shall be dry-type, with 392° F (200°C) insulation, compound filled, in a weatherproof enclosure suitable for location installed.
2. Transformers which feed sensitive electrical or electronic components shall be shielded isolation-type.
3. Transformers shall be three-phase, rated 480 volts primary, 208Y/120 volts secondary, 60 Hertz, 302°F (150°C) rise over 104°F (40°C) ambient.
4. Transformation shall be within 1% of rated secondary voltage and equipped with six ±2-1/2% taps (two above and four below rated voltage).

5. Transformer neutral shall be solidly grounded to structural steel.

4.14 Motors

1. Unless otherwise specified, motors 1/2 horsepower through 250 horsepower shall be 480 V, 60 Hz, 3 phase TEFC, severe duty, induction motors.
2. Motors less than 1/2 horsepower shall be 120 V, 60 Hz, single phase, explosionproof.
3. Motors 300 horsepower or larger shall be 4160 V, 60 Hz, 3 phase as specified elsewhere.
4. Motors shall conform to TEX.E.200, TEX.E.??? (Large Induction Motors 200 HP and Above), and TEX.E.??? (Synchronous Motors).
5. Motor starters shall be remotely mounted and supplied by others.
6. Electric motors in hazardous or outdoor areas shall have cast iron frame and endplates (aluminum not acceptable).

4.15 Nameplates

1. Electrical equipment and devices, including pushbuttons, selector switches, and indicating lights, shall have engraved bakelite nameplates and/or stainless steel tags.
2. Bakelite nameplates shall be 1/8 inch thick and white with engraved black lettering at least 1/4 inch high.
3. Bakelite nameplates shall be attached with stainless steel screws.

DC SUPPLY SYSTEMS

SPECIFICATION NO. TEX.E.500

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		
Approved by:		Company Approval:				

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1.	Data Sheets	YES[X]	NO[ ]
2.	Inspection and Testing Requirements Sheet	YES[X]	NO[ ]
3.	Documentation Requirements Sheet	YES[X]	NO[ ]

TABLE OF CONTENTS

1. SCOPE

1. This specification defines minimum requirements for the design, materials, fabrication, testing, and inspection of direct current (DC) electrical supply systems suitable for installation on offshore platforms.
2. DC electrical supply systems include rechargeable batteries, battery chargers, and accessories.

2. REFERENCES

2.1 Company Specifications

This specification contains references to the following Company specifications:

1. TEX.E.400, "Design and Construction of 480 Volt Switchgear/Motor Control Centers".
2. TEX.E.510, "Design and Fabrication of Uninterruptible Power Supplies (UPS).
3. TEX.M.500, "Turbine Generator Packages".

2.2 Industry Codes and Specifications

This specification contains references to the following industry codes and specifications:

2.2.1 American National Standards Institute (ANSI)

1. ANSI C18.1, "Specifications for Dry Cells and Batteries".
2. ANSI C18.1a, "Specification for Dry Cells and Batteries (Supplement)".
3. ANSI C80.5, "Specification for Sealed Rechargeable Nickel-Cadmium Cylindrical Bare Cells".

2.2.2 Institute of Electrical and Electronic Engineers (IEEE)

1. IEEE Standard 450, "Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations".

2. IEEE Standard 485, "Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations".

2.2.3 National Electrical Manufacturers Association (NEMA)

1. NEMA Standard PE 5, "Utility Type Battery Chargers".
2. NEMA Standard PE 7, "Communication Type Battery Chargers".

2.2.4 National Fire Protection Association (NFPA)

NFPA 70, "National Electrical Code (NEC)".

3. CHARACTERISTICS

3.1 Performance

3.1.1 Batteries

1. Batteries shall be capable of supplying electrical power independently of outside power sources.
2. Power shall be available in the event of complete failure of all locally generated and offsite power.

3.1.2 Battery Chargers

1. Battery chargers shall be able to keep batteries fully charged while supplying the load and to restore batteries from a fully discharged state to a 90% charged state in a maximum of 10 hours, thereby making DC power available for emergencies.
2. When dual chargers are specified, chargers shall be provided with load-sharing circuitry.
3. Provision shall be made for gradual load balancing and paralleling to avoid sudden changes in charging power when a charger is being placed on line parallel with an already loaded charger.
4. Each charger shall provide half the load within ±2%. In case one charger fails, the remaining unit shall be capable of maintaining the full load.

5. Chargers shall be sized to provide the specified equipment load and the load of an automatically regulated, floating charge.
6. Chargers shall have both an automatic and a manually selected equalize charge level for battery recharging after a prolonged discharge.
7. Chargers shall be capable of supplying the rated continuous-output current specified on the data sheets.
8. Minimum battery charger conversion efficiency at 50% load or greater shall be 75% for a single-phase input and 85% for a three-phase input.

3.2 Environmental Conditions

Power supply system components shall be suitable for operation in the environmental conditions specified on the data sheets with the following additional requirements.

1. Batteries shall be suitable for operation in naturally ventilated, indoor locations with salt-laden, corrosive atmospheres.
2. Battery chargers, unless otherwise specified, shall be suitable for indoor, air-conditioned environments but shall be capable of operation under full load conditions if air-conditioning fails.

4. DESIGN AND FABRICATION

4.1 Battery Design

1. Batteries shall comply with ANSI C18.1 or C80.5, and NFPA 70.
2. Lead-acid batteries shall be sized in accordance with IEEE standard 485.
3. Sealed lead-acid batteries shall be sized to maintain their specified duty cycle requirements at the specified ambient conditions.
4. Sealed lead-acid batteries shall have at least 95% of their rated capacity charge upon delivery to the job site.

4.2 Battery Components

4.2.1 Cells

1. Nickel-cadmium cells shall have vented, pocket-plate construction.
2. Cell containers shall be made of either stainless steel or heat- and impact-resistant plastic material.
3. Stainless steel cells shall be mounted in fire-retardant wood trays.
4. Plastic containers shall be either transparent or translucent with the electrolyte level clearly marked on the side of each container.
5. Cells shall be designed with sediment space of sufficient size and volume for the specified service life.
6. Sealed lead-acid batteries shall be designed with the "oxygen recombination" principle to achieve non-watering criteria.
7. Sealed cells shall be provided with a pressure-release vent.
8. Stackable modular steel tray construction shall be provided for sealed batteries, unless otherwise specified.

4.2.2 Joints

Joints between the cover and the container and all cover openings (other than vents) shall be gas-tight and sealed against electrolyte creepage.

4.2.3 Caps

Vent caps shall be equipped with a flame arrestor.

4.2.4 Connectors and Posts

1. Connectors and hardware for nickel-cadmium cells shall be nickel-plated.
2. Lead-acid cell terminal post and inter-cell connectors shall be sized to carry the required current at the specified ambient

temperature without excessive heating or voltage drop.

3. Copper inserts (when used in posts and connectors) shall be completely embedded to prevent contact with the electrolyte.

4. Copper strips used for inter-cell and inter-row connectors shall be protected with a uniform, homogeneous, lead or lead-alloy coating.

5. Lead or lead-alloy coating shall be bonded to the copper strips and shall be free of blisters and pinholes.

6. Connector bolts, nuts, and washers shall be either lead-plated brass or Type 316 stainless steel.

4.2.5 Tags

Cell shall be permanently and legibly marked with the following information:

1. Name of manufacturer.

2. Manufacturer's type designation relating to the number of plates.

3. Ampere-hour capacity.

4. Number of hours on which rating is based.

5. Date of manufacture.

4.3 Battery Racks

1. Battery racks, when required, shall be constructed of acid resisting enameled steel.

2. Battery racks shall be large enough to provide space for mounting all the cells required for the specified DC system.

4.4 Battery Chargers

4.4.1 General

1. Battery chargers shall be of solid-state type, fully automatic, and shall comply with the requirements of NEMA PE 7 for communications type or NEMA PE 5 for utility type.

2. When chargers are furnished as part of packaged DC power supply systems, chargers shall be compatible with the inverter supplied with the package.

3. Battery chargers shall be compensated for ambient temperature.

4.4.2 Enclosures

1. Chargers, unless otherwise specified, shall be NEMA Type 1 and shall be ventilated.

2. Charger enclosures shall be of the minimum size practicable.

3. Wall-mounted cubicles may be supplied for small battery.

4. Charger enclosures shall be arranged for front operation and maintenance.

5. Removable side panels may be provided in addition to front access, but rear access to enclosures shall not be required.

6. Panel doors shall have locks.

4.4.3 Cooling

1. Chargers shall not have cooling fans unless approved in advance in writing by the Company.

2. If cooling fans are approved, the fans shall be enclosed with safety screens for personnel protection.

4.4.4 Operation

1. Battery chargers shall be designed for a maximum output voltage ripple of 2% root mean square (RMS) when connected to a battery with an ampere-hour capacity equal to or greater than four times the ampere capacity of the charger.

2. The rectifier-charger shall be of the current-limiting type set not higher than 105%.

3. Chargers shall be current limited in both the float and equalize positions in order to protect the equipment from a short circuit on the load side.

4. The rectifier-charger shall have a minimum power factor (PF) of 0.8 under the following operating conditions.
   a. ±15% of rated input voltage.
   b. ±5% of rated frequency.
   c. Full rectifier output.
5. The rectifier-charger shall have a minimum power factor of 0.75 under the following conditions.
   a. Full inverter load (coupled inverter).
   b. Battery on float charge.
   c. Nominal line voltage.
6. A walk-in circuit shall be provided to limit in-rush current to 110% of rectifier-charger full-load current.
7. The RMS sum of all harmonics in the input waveform shall not exceed 10% of the RMS value of the fundamental harmonic with the system operating at rated voltage and current.

4.4.5 Voltage Regulation

1. Charger output shall be within ±1% of the nominal output voltage from no-load to full-load if the alternating current (AC) input voltage varies no more than ±10%.
2. Charger output voltage shall vary no more than ±10% as a result of a transient 4,000-volt peak lasting 100 microseconds with a 40-ohm source impedence, the batteries, and the full load connected.

4.4.6 Controls

1. Chargers shall have all required float and equalizer controls,and indicating lights.
2. Chargers shall have an automatic charging control circuit to switch the rectifier output automatically from float charging to equalize charging if the charger is in current limit for more than 10 seconds.

3. The equalize charging time shall be controlled by a timer that has an adjustable setting.

4. Battery chargers shall have the following panel-mounted controls.

   a. Float voltage adjustment potentiometer.

   b. Equalize voltage adjustment potentiometer.

4.4.7 Indicators and Alarms

1. Battery chargers shall have the manufacturer's standard indicating and alarm devices, which shall include, but not be limited to, those specified on the data sheets.

2. Alarms shall have local indication on the battery charger.

3. Indicator lamps on the charger panel shall be operated at no more than 75% of the rated voltage of the lamp.

4. An alarm shall be provided to signal loss of ventilation when cooling fans are used. The alarm shall be activated by a sail switch upstream of the cooling fans. The sail switch shall be mounted inside the charger enclosure.

5. Alarm contacts shall be rated for 0.5 amps at 120 volts DC for connection to a remote annunciator. Isolated alarm contacts of the type that open to actuate the alarms shall be provided.

4.4.8 Wiring

1. Battery charger and associated wiring shall be stranded copper conductor with moisture, heat, and flame resistant insulation type THHN.

2. Minimum conductor size shall be No. 18 American Wire Gauge (AWG) for electronic boards and No. 12 AWG for power wiring.

3. Wire terminations shall be made with compression type insulated terminals.

4. Bundles of wires shall be routed neatly in vertical or horizontal planes.
5. Individual wires and bundles shall be secured with plastic wire ties, cable lacing, or enclosed plastic wireways.
6. Plastic wiring materials shall be flame retardant.
7. External connections shall be brought to easily accessible terminal blocks complete with marking strips.
8. Wires shall be identified with heat-shrink wire markers at the terminal strips or connection points.
9. All exposed wire ends and control modules shall be fungus proof or glyptol dipped to prevent corrosion.

4.4.9 Grounding

1. A copper main-ground bus bar shall be provided in the bottom of the battery charger enclosure.
2. The ground bar shall have an adequate cross-sectional area and mechanical strength to withstand the maximum short circuit of the system.
3. A split-bolt connector, or equal, shall be provided for connecting the charger ground bus to the main platform ground system by means of a grounding cable.

4.5 Accessories

Each battery shall be supplied with accessories suitable for the battery type specified, which shall include, but not be limited to, those specified on the data sheets.

4.6 Identification and Marking

4.6.1 General

Corrosion-resistant, stainless steel nameplates shall be fastened with stainless steel screws or rivets to each identifiable piece of equipment.

4.6.2 Battery Chargers

1. Each battery charger shall have an embossed, stainless steel rating plate containing the following information:
   a. Purchase order number.
   b. Maximum input rating [kilovoltamperes(KVA), amps, volts, and hertz].
   c. Maximum output rating [kilowatts (KW),amps, and volts].
   d. Float charge (volts).
   e. Equalize charge (volts).
   f. Weight of unit (pounds).
   g. Year manufactured.
2. Major internal components of the charger (such as printed circuit boards, assemblies, meters, and relays) shall be identified with three-ply, phenolic labels laminated white/black/white.
3. Labels shall be engraved through the first (white) layer to expose the inscription in white letters.
4. Labels shall identify the charger components in accordance with schematic/connection diagrams.
5. Labels shall be attached with stainless steel screws.

5. PREPARATION FOR SHIPPING AND STORAGE

1. Batteries, electrolyte, charger, and rack shall be packaged separately for shipping and storage.
2. Unless otherwise specified, wet electrolyte batteries shall be shipped dry with standard vent plugs installed.
3. Two charges of electrolyte for onsite charging shall be shipped in separate containers.

6. BATTERY DISPOSAL

1. Disposal of batteries at the end of their service life shall be provided by Vendor in accordance with E.P.A. regulations.
2. Transportation of batteries to disposal facility shall be the responsibility of Company.

DESIGN AND FABRICATION OF FUEL GAS FILTER PACKAGE

SPECIFICATION NO. TEX.H.400

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		

Approved by:	Company Approval:

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Data Sheet TEX.H.400S1 YES[X] NO[ ]

2. Inspection and Testing Requirements Sheet (ITRS) TEX.H.400I YES[X] NO[ ]

3. Documentation Requirements Sheet (DRS) TEX.H.400R YES[X] NO[ ]

TABLE OF CONTENTS

1. SCOPE

This specification defines minimum technical requirements for design, materials, fabrication, testing and inspection, and documentation of a fuel gas filter separator package for offshore platforms.

2. REFERENCES

2.1 Company Specifications

This specification contains references to the following Company specifications:

1. TEX.B.400, "Painting and Corrosion Protection".
2. TEX.H.100, "Design and Fabrication of Unfired Pressure Vessels".

2.2 Codes and Standards

This specification contains references to the latest edition of the following codes and standards:

2.2.1 American National Standards Institute (ANSI)

ANSI B16.5, "Steel Pipe Flanges".

2.2.2 American Society of Mechanical Engineers (ASME)

Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels", Division 1.

3. GENERAL

1. Fuel gas filter separator design shall incorporate two stages:
   a. First stage shall contain replaceable resin impregnated molded fiberglass elements.
   b. Second stage shall contain vane type mist eliminators.
2. Vessels shall be pressure rated and stamped based on the actual metal thickness of the material used.
3. All bolting shall be chromate dipped and cadmium plated.

4. VESSEL

1. Fuel gas filter separator shall be an ASME code stamped vertical vessel.
2. Vessel shall comply with TEX.H.100.
3. Vessel shall remove 99% of all solid particles and 1 micron and larger liquid droplets from the gas stream.
4. Carry-over of free liquid in the exit gas of the filter separator shall be less than 0.01 gal/MMSCFD.

5. INTERNALS

Fuel gas filter package shall be equipped with the following features:

1. A high efficiency fiberglass coalescer section as primary filter.
2. A quick opening head for removal of the fiberglass coalescer elements.
3. A 304L stainless steel vane type mist eliminator as secondary filter.

6. GASKETS

1. All gaskets, except the quick opening head gasket, shall be 1/16 inch flat ring Flexitallic© in accordance with ANSI B16.5.
2. Gaskets used during hydrostatic testing shall be of the same type as required with final assembly.

7. INSTRUMENTATION

Control and instrumentation shall be provided by Company.

8. PAINTING

1. All surface preparation, protection, and coating shall be in accordance with TEX.B.400.
2. Corrosion resistant materials, such as stainless steel, shall not be painted.

3. All internal surfaces shall be protected with an approved rust preventive.

9. NAMEPLATE

Fuel gas filter package shall have a nameplate of stainless steel or Monel permanently attached with pins of the same material.

10. INSPECTION, TESTING AND SHIPPING

1. Vessels shall be tested per Section UG-99C of ASME Code, Section VIII, Division 1.
2. Immediately upon completion of tests and inspections, liquids used for testing shall be completely drained.
3. All items shall be thoroughly dry when packed for shipment.

11. SPARE PARTS AND SPECIAL TOOLS

1. Start-up spares shall be provided if required.
2. A priced list of recommended spare parts for two years operation shall be provided.
3. Spreader bar or frame, if required for a single point lift of filter/separator skid, shall be provided.
4. Special installation and maintenance tools necessary to dismantle, service, and assemble the filter separator or other associated equipment shall be provided.

DESIGN, MATERIALS, AND INSTALLATION OF INSTRUMENTATION

SPECIFICATION NO. TEX.I.100

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		

Approved by:	Company Approval:

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Inspection and Testing Requirements Sheet YES[X] NO[ ]

2. Documentation Requirements Sheet YES[X] NO[ ]

TABLE OF CONTENTS

1. SCOPE

This specification defines minimum requirements for the design, materials, and installation of instrumentation and safety systems for skid-mounted equipment, vessels, or other items that incorporate instrumentation or control functions.

2. REFERENCES

2.1 Company Specifications

This specification includes references to the following Company specifications:

1. TEX.B.100, "Inspection and Quality Control".
2. TEX.B.400, "Painting and Corrosion Protection".
3. TEX.E.100, "Design, Materials, and Installation of Electrical Systems".
4. TEX.F.100, "Emergency Shutdown (ESD) and Fusible Plug Loops".
5. TEX.H.100, "Design and Fabrication of Pressure Vessels."
6. TEX.I.110, "Checkout and Commissioning of Instrumentation".
7. TEX.I.210, "Local Safety Shutdown Panels".
8. TEX.I.220, "Well Control and Shutdown Panels".
9. TEX.I.500, "Programmable Logic Controller (PLC) Systems".
10. TEX.P.100, "Design, Fabrication, and Installation of Piping".
11. TEX.P.110, "Materials for Piping".
12. TEX.P.120, "Valve Specification".

2.2 Codes and Standards

This specification includes references to the latest edition of the following codes and standards:

2.2.1 American Gas Association (AGA)

AGA Report No. 3, "Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids".

2.2.2 American National Standards Institute (ANSI)

1. ANSI/FCI 70-2-1991, "Quality Control Standard for Control Valve Seat Leakage".
2. ANSI MC96.1, "Temperature Measurement Thermocouples".

2.2.3 American Petroleum Institute (API)

1. API RP 14A, "Specification for Subsurface Safety Valves Equipment".
2. API RP 14C, "Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms".
3. API RP 14D, "Specification for Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service".
4. API RP 14F, "Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms".
5. API RP 500B, "Recommended Practice for Classification of Locations for Electrical Installations at Drilling Rigs and Production Facilities on Land and on Marine Fixed and Mobile Platforms".
6. API RP 500C, "Classification of Locations for Electrical Installations at Pipeline Transportation Facilities".
7. API RP 520, "Recommended Practice for Sizing, Selection, and Installation of the Pressure-Relieving Systems in Refineries, Part I - Design, Part II - Installation".
8. API RP 526, "Flanged Steel Safety-Relief Valves".
9. API RP 527, "Commercial Seat Tightness of Safety Relief Valves with Metal-to-Metal Seats".
10. API RP 550, "Manual on Installation of Refinery Instruments and Control Systems, Part I and II".

11. API RP 2000, "Venting Atmospheric and Low-Pressure Storage Tanks (Nonrefrigerated and Refrigerated)".

2.2.4 American Society of Mechanical Engineers (ASME)

Boiler and Pressure Vessel Code, Section VIII, "Rules for Construction of Pressure Vessels, Division I".

2.2.5 American Society for Testing and Materials

ASTM A269, "Seamless or Welded Austenitic Stainless Steel Tubing for General Purpose".

2.2.6 Instrument Society of America (ISA)

1. ISA RP12.6, "Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations".
2. ISA RP75.06, "Control Valve Manifold Designs".

2.2.7 National Association of Corrosion Engineers (NACE)

NACE MR-01-75, "Sulfide Stress Cracking Resistant Metallic Material for Oilfield Equipment".

2.2.8 National Electrical Manufacturers Association (NEMA)

NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".

2.2.9 National Fire Protection Association (NFPA)

1. NFPA 70, "National Electrical Code (NEC)".
2. NFPA 496, "Purged and Pressurized Enclosures for Electrical Equipment".

2.2.10 US Department of the Interior (USDI)

USDI, Minerals Management Service (MMS), Outer Continental Shelf (OCS), Gulf of Mexico, Order No. 5, "Production Safety Systems".

2.3 Other References

Miller, Richard W.

"Flow Measurement Engineering Handbook", McGraw Hill, 2nd. Edition, 1989.

3. DESIGN

3.1 Instrumentation System

3.1.1 General

1. All proposed instrumentation shall be submitted to the Company for approval.
2. Instruments shall be pneumatic type, electronic type, or a combination of the two.
3. Units of measure shall conform to Table 1.
4. Normal operating range of an instrument shall be between 35% and 75% of its calibrated range.
5. A gauge indicating the controlled measurement value shall be located at or adjacent to each blind controller, pilot, or transmitter. Minimum diameter of pressure gauge for this service shall be 2-1/2 inches.
6. Safety instrumentation shall be designed such that an abnormal condition causes a loss in signal pressure or electrical power. Loss of the input signal to a safety instrument shall cause the instrument to respond in the manner described in the design drawings, specifications, and safe charts.
7. Instruments exposed to sour process streams shall conform to NACE Specification MR-01-75.
8. Safety devices and instrumentation shall be capable of being reset without replacement of any element. Fusible plugs shall only be allowed in fire protection loops. Use of rupture disks is prohibited.
9. Master shutdown valves (SDV) and surface safety valves (SSV) shall be operated pneumatically. Downhole subsurface safety valves (SSSV) shall be operated hydraulically.

10. Major process and utility systems shall each have a dedicated local safety shutdown panel.

11. Each vessel, tank, boiler, exchanger, pump, etc., including piping and other equipment, that may be subjected to pressures beyond the range of the allowable working pressure shall be protected with pressure safety and relief valves.

12. Pressure vessels under the scope of ASME Boiler and Pressure Vessel Code, Section VIII, shall have protective devices in accordance with paragraph 4G-125 through 4G-134 and Appendices "J" and "M".

3.1.2 Instrument Numbering and Tagging

1. Each instrument shall have a unique tag number consisting of standard ISA instrument identification lettering (e.g., PI, TIC, LG, PCV, etc.), followed by the associated vessel or sequential tag number.

2. Each instrument shall be identified by either:

   a. Stamping the tag number on the manufacturer's nameplate.

   b. Stamping the tag number on an 18 gage stainless steel tag and attaching the tag to the instrument with a 16 gage stainless steel wire. Size of tag shall be 1 inch by 2 inches.

3. Tag number shall be the number assigned to the instrument on the Piping and Instrumentation Diagram (P & ID) sheets.

4. Tag numbers on vessel connected instrumentation such as relief valves and level gauges shall include the vessel identification number.

3.1.3 Central Control Room

1. If a central control room is required, it shall be designed to allow the monitoring of all process and utility systems.

2. If electrical control signals between field devices and the central control room are required to be intrinsically safe, design shall conform to ISA RP12.6.

3. Central control room shall be located in a nonhazardous area if possible and shall be pressurized in accordance with NFPA 496.

4. Process fluids shall not be piped into the control room.

3.1.4 Local Shutdown Devices and Shutdown System

1. Each process component shall be protected with safety devices in accordance with API RP 14C.

2. Level switches, pressure switches, etc., shall be pneumatic and independent of all other process control devices.

3. Safety system shall be pressurized during normal operation. If a safety device detects an abnormal condition, it shall block its air supply and bleed its output, depressurizing a local panel-mounted indicating relay. This signal shall shut down the processing component (unit shutdown) through local panel logic.

4. Shutdown logic components shall require manual reset action at the local panel.

5. Local panel shall provide an electrical (dry contact) alarm signal to the control room for unit shutdown alarm and input to the master shutdown system. Local panel shall receive electrical signals from both the master shutdown system and the manual ESD system for remote shutdown of the processing unit.

6. Local panel shutdown devices shall have a bypass for testing and maintenance purposes. Each bypass shall have an auxiliary contact to be wired into a common "bypass/trouble" alarm circuit.

7. Emergency and master shutdown signals shall not be bypassed.

8. Local panels shall remain "locked out" after detection of a shutdown until manually placed back into service.

9. Local shutdown panels shall conform to TEX.I.210.

3.1.5 Wellhead Control Panels

1. Wellhead control panels shall be designed to operate in a similar manner as the local panels and shall conform to TEX.I.220.

2. Each wellhead control panel shall have a redundant pneumatic-over-hydraulic system for control of the hydraulically operated downhole subsurface safety valves (SSSV).

3. Wellhead control panels shall conform to the requirements of the total "Production Safety System" per MMS Order No. 5.

3.1.6 Pneumatic Instrumentation

1. Pneumatic instrumentation shall operate on dry, filtered compressed air. Use of an alternate pneumatic supply is prohibited unless approved by Company in writing.

2. Pneumatic shutdown instruments shall be block-and-bleed-type. Use of continuous bleed components for this service is prohibited.

3. Normal pneumatic signals shall be 3-15 PSIG.

4. Pneumatic signals for process equipment that requires higher pressure may be 6-30 PSIG.

5. Each locally mounted pneumatic instrument shall have a filter-regulator. Filter regulators shall be of the same type and model if practical. Each user shall have a 0-30 or 0-60 PSIG supply gauge located at the instrument.

6. Instrument air supply to control panels shall have dryer-type regulators mounted inside the panel. Dryer-regulator drains shall be piped to the outside of the panel with 316 stainless steel tubing.

7. Locally mounted controllers shall have proportional-plus-reset control functions.
8. Instrument air supply pressures shall be as follows:
   a. Minimum pressure: 75 PSIG.
   b. Normal pressure: 100 PSIG.
   c. Maximum pressure: 150 PSIG.
9. Pneumatic alarm logic signal range shall be 30-50 PSIG.

3.1.7 Electrical Instrumentation

1. Electrical instruments, switches, etc., shall be certified by UL, FM, or other national/international agency approved by the Company.
2. Electrical switch contact shall be single-pole, double-throw (SPDT), hermetically sealed.
3. Switch contacts for non-inductive loads shall be rated a minimum of 10 amps at 120 volts AC, 60 Hz, or a minimum of 5 amps at 28 volts DC.
4. Normal electronic signals shall be 4-20 milliamps powered by 24 volt DC supply.
5. Transmission circuits shall be two-wire wherever possible.
6. Electro-pneumatic converters, valve positioners, transmitters, and other electrical or electronic instruments and devices located in areas electrically classified as hazardous shall have NEMA 7 enclosures.
7. Intrinsically safe circuits (loop) used for electronic instrumentation shall be certified by FM or other national/international agency approved by the Company.
8. Devices in intrinsically safe circuits may be housed in NEMA 4X enclosures.
9. The following electronic instrumentation shall operate on a 24 volt DC supply:

a. Control and shutdown logic circuits.

b. Critical instruments.

c. Fire and gas detection systems.

10. Level gauge illumination and analytical instruments shall operate on 110 volts AC.

11. Alarm logic instruments shall have double-pole, double-throw (DPDT) dry contact switches. Contacts shall open to initiate alarm.

12. Electrical enclosures shall conform to NEMA Standard 250.

3.1.8 Recording Instrumentation

1. Locally mounted circular chart recording instruments shall have standard 7-day, hand-wound chart drives with 24-hour or 7-day hubs.

2. Panel-mounted recording instruments in nonhazardous locations shall have synchronous electric chart drives.

3. Circular chart recording instruments shall have a removable felt pen inking system. Ink colors shall be assigned as follows:

a. Pressure: violet.

b. Temperature: green.

c. Differential pressure (flow): red.

3.2 Materials

3.2.1 General

1. Pipe and pipe fittings shall conform to TEX.P.110.

2. Tubing shall conform to ASTM A269.

3. Tubing shall be 316 stainless steel that is either cold drawn seamless or welded and drawn.

4. Except as noted, minimum tubing size shall be 1/4 inch with a wall thickness of 0.035 inches.

5. Tubing shall be "stick" type.

6. Use of coiled tubing is prohibited.
7. Tube fittings shall be 316 stainless steel of double ferrule design, manufactured by either Swagelok, Gyrolok, or Parker. Fittings for a project shall be supplied by a single manufacturer.
8. Valves shall conform to TEX.P.110 and TEX.P.120.

3.2.2 Pneumatic Signal Tubing

1. Use of prebundled tubing for pneumatic signals shall be approved by Company.
2. Tube bundles shall be polyethylene tubes with an outer PVC sheath and thermal protection. Manufacturer and model of tube bundles shall be approved by the Company.

3.2.3 Sense Line Tubing

1. Minimum size of sense line tubing shall be 3/8 inch with a wall thickness of 0.049 inches.
2. Wall thickness shall meet the process pressures' safety requirements.
3. Sense line tubing shall be a minimum of 1/2-inch diameter if process conditions may foul or clog 3/8-inch diameter tubing.

3.2.4 Valves

1. Primary block valves shall conform to TEX.P.100, TEX.P.110, and TEX.P.120.
2. Pressure instrument secondary block and bleed valves shall be Anderson Greenwood MSVS-44.
3. Pressure instrument test valves shall be Anderson Greenwood H1 VS 44Q with plug or Whitey equivalent.
4. Differential pressure instrument manifold valves shall be Anderson Greenwood M6AVH3-4 or Whitey equivalent.
5. Subsurface safety valves (SSSV's) shall conform to API RP 14A.

6. Wellhead surface safety valves (SSV's) and underwater safety valves shall conform to API RP 14D.

3.2.5 Fusible Plug Loops

1. Fusible plug loops shall conform to TEX.F.100.
2. Fusible plug loops shall be stainless steel tubing with Swagelok fusible plugs. Tubing shall be 3/8-inch with a wall thickness of 0.049 inches.
3. The fusible plugs shall have the following melting points:
   a. For nonheated equipment: 160°F (71°C).
   b. For heated equipment: 212°F (100°C).
   c. For perimeter of heated equipment (e.g., compressor building walls): 160°F (71°C).

3.2.6 Instrument Wiring

1. Field instruments shall be individually wired to their corresponding receiver instrument or system. Common wires shall not serve multiple instrument circuits.
2. Field contacts shall not be connected by looping through several separate instruments. Each contact shall have a twisted pair of wires connected between the field switch and the terminal strip at the control panel or terminal box.
3. Twisted single pair cable shall have stranded conductors with a minimum gage of #16 AWG.
4. Multicore cable shall have stranded conductors with a minimum gage of #16 AWG.
5. Twisted single pair cable and multicore cable shall have:
   a. Soft copper, Class B, 7-strand conductors.
   b. XHHW insulation with a minimum rating of 105°C, 300 volts.

c. Individual pair and overall shielding.

d. Corrugated aluminum CLX sheath armoring.

e. Overall XHHW or PVC sheathing.

6. Instrument and thermocouple cable shall conform to TEX.E.600.

7. Cables and terminal blocks shall be flame retardant type.

8. MC-type CLX cable shall be fitted with Thomas and Betts Spin-On cable glands complete with an internal grounding ring and bushing.

9. Cable glands installed outdoors shall have corrosion resistant neoprene boots fitted over each cable gland.

10. Thermocouple extension cables shall have twisted pair solid conductors in accordance with ANSI MC96.1.

3.3 Components

Instrument connections to vessels, tanks, or process piping, shall conform to the minimum sizes shown in this section, to the sizes shown in Table 2, to the sketches attached to TEX.P.100 which show typical instrument installation details, and to P & IDs.

3.3.1 Thermowells

1. Temperature instrument thermowells shall be drilled from 316 stainless steel bar stock and shall be separable from the sensor.

2. Temperature instrument thermowells shall have:

a. A 3/4-inch NPT process connection.

b. A 1/2-inch National Straight Pipe Mechanical (NSPM) instrument connection.

c. A bore dimension that is compatible with the sensor diameter (O.D.).

d. Stepped shank or tapered construction.

3. Thermowells to be installed in insulated lines or vessels shall have a lagging

extension of sufficient length to place the instrument connection outside the insulation.

4. Thermowells to be installed in process lines shall be checked for their natural vibration frequency limit.

5. Test thermowells shall have a bore of 0.260 inches.

6. Test thermowells shall have a threaded stainless steel plug attached to the thermowell by a stainless steel chain.

3.3.2 Bimetal Temperature Indicators

1. Bimetal temperature indicators shall be Ashcroft.

2. Indicators shall have the following:

   a. 5-inch dial face.

   b. Every-angle stem construction.

   c. Liquid-filled case.

   d. Stainless steel construction.

   e. 0.250-inch diameter stem.

   f. External zero adjustment.

   g. Hermetically sealed construction.

   h. Shatterproof glass lens.

3. Bimetal temperature indicators shall have matching thermowells, preferably supplied with the bimetal temperature indicator.

3.3.3 Filled System Temperature Instruments

1. General

   a. Filled thermal systems for direct-connected process temperature instruments shall be the liquid-filled, fully ambient temperature-compensated type.

   b. Remote bulb type temperature indicators shall be used in place of bimetallic type where required to provide indicator readability.

2. Sensors

   a. Sensor capillary tubing and bulb shall be stainless steel.

   b. Maximum length of capillary tubing shall be 10 feet if connected to a transmitter and 20 feet if connected to an indicator, switch, recorder and/or controller.

3. Pneumatic Temperature Transmitters

   a. Pneumatic temperature transmitters shall be blind force-balanced type with a 3-15 PSIG output signal.

   b. Transmitters shall have a filter regulator, a 0-30 PSIG air supply gauge, and a control signal output gauge.

4. Electronic Temperature Transmitters

   a. Electronic temperature transmitters shall have an output of 4-20 milliamps.

   b. Primary measuring elements for the transmitter input shall be hermetically sealed platinum resistance temperature detectors (RTD's).

   c. RTD's shall have a base resistance of 100 ohms at 32°F.

   d. If platinum RTD's are not applicable, primary measuring elements shall be thermocouple sensors. Use and selection of thermocouple assembly types shall be approved by Company.

5. Process Temperature Controllers

   a. Process temperature controllers shall have proportional-plus-reset control action.

   b. Process temperature controllers shall include rate control function if a long time lag in measurement response is anticipated.

6. Temperature Switches

Pneumatic and electrical temperature switches shall be adjustable and shall be the filled system type.

3.3.4 Pressure Instruments

1. General

   a. Pressure actuated instruments subject to over-pressures that could damage or change the calibration of the instrument shall have over-range protection.

   b. Pressure instruments with internal components that are incompatible with the process fluid or gas being measured shall have a diaphragm seal constructed of a material compatible with the process fluid or gas.

2. Pressure Gauges

   a. Process and utility pressure gauges shall have the following:

      i. 4-1/2 inch dial face.

      ii. Liquid-filled construction.

      iii. Corrosion resistant case.

      iv. 316 stainless steel Bourdon tube and 1/2-inch socket.

      v. Blowout back.

      vi. Shatterproof glass lens.

      vii. Calibrated range of approximately two times normal operating pressure.

   b. Panel pressure gauges shall have the following:

      i. 2-1/2 inch dial face.

      ii. Glycerin-filled construction.

      iii. Pressure relief construction.

      iv. 316 stainless steel Bourdon tube and 1/2-inch socket.

      v. Shatterproof glass lens.

vi. Calibrated range of 0-100% or a scale range equal to the transmitter input range.

vii. Case shall be 316 stainless steel.

c. Externally mounted accessory pressure gauges shall have the following:

i. 1/4-inch socket and Bourdon tube of material suitable for offshore service.

ii. 1-inch (nominal) dial face.

iii. Stainless steel or corrosion resistant case.

3. Pressure Transmitters

a. Pneumatic pressure transmitters shall be force-balance type with an output signal of 3-15 PSIG.

b. Electronic pressure transmitters shall be capacitance, resonant, or strain gauge type with an output signal of 4-20 milliamps.

4. Pressure Switches

a. Pressure switches shall have adjustable set points.

b. Minimum proof pressure shall be 150% of maximum system design pressure.

3.3.5 Level Instruments

1. General

a. Displacers shall be solid plastic or 300 series stainless steel.

b. Displacer material shall be suitable for the process liquid in which the displacer is installed.

c. Pneumatic level instruments shall have input, output, and supply pressure gauges.

d. Capacitance type level instruments may be used for interface level measurement with Company approval.

e. External cage type, float operated pneumatic or electric switches shall be used for alarms, shutdowns, pump actions, etc., and to initiate intermittent liquid draining services.

f. Switches shall have 1-inch NPT female connections on the upper side and lower bottom.

g. Unless otherwise specified, float operated switches shall be vibration resistant with dual magnet switch activators.

2. Local Level Controllers and Transmitters

a. Local level controllers and transmitters shall be external float cage, displacement type with 2-inch side-flanged connections unless otherwise specified.

b. Controllers and transmitters may be internal float displacement type or capacitance type with Company approval.

c. Controllers and transmitters shall be differential pressure type in the following services:

i. If liquids to be measured surge and boil in normal operation.

ii. If level range to be covered exceeds 72 inches.

3. Level Gauges

a. Level gauges shall cover the operating level range of the vessel, the span of all level controllers, and the high and low alarm and shutdown level switch operating points.

b. Gas-liquid interfaces shall have reflex gauge glasses.

c. Level gauges measuring opaque or low viscosity liquids or liquid to liquid interfaces shall have backlit transparent or thru-vision gauge glasses.

d. Use of tubular gauge glass assemblies is prohibited.

e. Single gauge glass shall have a minimum visible length of 11-7/8 inches.

f. Minimum pressure rating for reflex gauges shall be 1850 PSI at 100°F.

g. Minimum pressure rating for transparent gauges shall be 675 psi at 100°F.

h. Single gauge column shall have a maximum of 4 sections.

i. If more than one gauge column is required, columns shall overlap a minimum of 1 inch of visible length.

j. Gauge assemblies shall have a special coating for offshore (salt-laden) service.

k. Gauge glasses and gauge columns shall have offset type gauge cocks. Gauge cocks shall be of the same manufacture as the gauge glass.

l. Gauge glass and displacer/float-type level instruments shall have 1/2 inch drain and vent connections. 1/2 inch ball valves shall be "short" nippled to these connections with Schedule 160 nipples.

3.3.6 Flow Instruments

1. All flow measurement applications shall conform to industry standard practices as reviewed by R.W. Miller's "Flow Measurement Engineering Handbook".

2. Flow measurement instruments shall be differential pressure measurement type using an orifice plate flow element. Flow measurements for specific applications may be made with other types of meters with Company approval.

3. Orifice plates shall be 316 stainless steel, sharp edge, concentric plates installed in orifice flanges with "flange tap" connections.

4. Measurement shall be based upon maximum flow producing a differential range of 100 inches of water column across the flange taps. Alternate ranges shall be approved by Company.
5. Meter run design details and tolerances shall conform to AGA Report No. 3 using flange taps and upstream and downstream meter runs lengths based upon a Beta ratio of 0.75.
6. Orifice plate dimensions and tolerances shall conform to AGA Report No. 3.
7. Plate bore shall be to the nearest 1/8 inch that provides approximate midscale range output for initial design conditions.
8. Plate bore for critical flow control conditions shall be the actual calculated bore.
9. Maximum Beta ratio shall be 0.70 for initial or planned peak flow rates. Minimum Beta ratio shall be 0.25.
10. Except as noted, lines for process service shall have "senior" type orifice fittings for flow measurement. Lines in non-process services may have "junior" type orifice fittings or orifice flange sets with Company approval.
11. Static pressure shall be sensed on the downstream side of the orifice plate.
12. Static pressure tap shall be connected to the low pressure side of the meter manifold valve.
13. Orifice meter measurement instruments shall have 316 stainless steel five-valve manifolds.
14. Local flow controllers shall have:
    a. Proportional and reset control functions.
    b. Auto-manual bypass assembly.
    c. Scale markings from 0-10, square root.

15. Pneumatic flow (differential pressure) transmitters shall be force balance type with an output signal of 3-15 PSIG.

16. Electronic flow (differential pressure) transmitters shall be capacitance, resonant, or strain gauge type with an output signal of 4-20 milliamps. Electronic flow transmitters shall have an integral square root extractor.

17. Flanged positive displacement meters, turbine meters, or electromagnetic meters may be used for high accuracy flow measurement applications.

18. Variable area flow meters may be used for low flow rates, or where absolute accuracy is not required.

3.3.7 Control Valves and Regulators

1. Body material and end connections on control valves and regulators shall conform to the applicable piping class of TEX.P.110.

2. Valves 1 inch and larger shall be flanged or bolted between flanges.

3. Internal valve trim shall be:

   a. 316 stainless steel for normal service.

   b. Suitably hardfaced in high pressure drop or erosive conditions.

   c. Of appropriate metallurgy for process fluids identified as a corrosive service stream.

4. Noise level of control valve shall be a maximum of 85 decibels as measured at 10 feet.

5. Valve positioners with a bypass switch and stainless steel cased pressure gauges shall be provided for the following:

   a. All control valves, except for balanced-pressure type in temperature service.

b. Butterfly and V-ball valves in throttling control applications.

c. Control valves operating with high pressure drops or in flashing services where instability of valve operation is anticipated.

d. Valves in "split-range" services (e.g., valves that are to be stroked less than the total control signal from the controller.)

e. Fan cooler louver operators.

6. Pilot operated control valves or regulators shall be used where close regulation is required but where set point changes are not normally required.

7. Pilot operated control valves or regulators that are accessible from a platform shall have the pilot assembly supplied and mounted on the valve by the manufacturer. If valve is not accessible, pilot assembly shall be supplied separately for remote mounting and shall be properly identified.

8. Control valves shall be sized to handle the design flow rates and the normal flow rates at 40-70% of capacity. Snap-acting control valves shall be sized to handle 3 times the design and normal flow rates at 80-100% capacity.

9. Control valve packing shall be selected to meet the process requirements.

10. Process control valves shall be Class IV shutoff in accordance with ANSI/FCI-70.2-1991 unless other shutoff class is approved by Company in writing for specific applications.

11. Control valve actuators shall be diaphragm operated, spring-return-type.

12. Actuators shall be sized for a maximum pressure drop equal to the maximum expected differential pressure across the valve.

13. Actuator spring return action shall provide the required fail-safe position.

3.3.8 Shutdown Valves

1. Shutdown valve body material, rating, and trim shall conform to TEX.P.110 for the applicable piping class.
2. Shutdown valves shall have quick exhaust vents to speed closing action.
3. Actuators shall be pneumatically operated, spring return type. Actuators may be hydraulically operated type in special applications with written Company approval.
4. Pneumatically operated actuators for valves that are 2 inches and larger shall be heavy-duty Scotch Yoke Piston type.
5. Hydraulically operated actuators shall be piston or rotary type.
6. Hydraulic shutdown valve actuators located in process lines shall have accumulators that are sized for a minimum of three complete strokes of the operated valve upon loss of control or power to the hydraulic system pump.
7. Actuators shall be sized for a maximum pressure drop equal to the maximum upstream pressure for the ANSI rating of the piping, with downstream pressure assumed as zero.
8. Actuator spring return action shall provide the required fail-safe position.

3.3.9 Pressure Relieving Devices

1. Safety-relief valves with metal-to-metal seats shall conform to API RP 527.
2. Flanged steel safety-relief valves shall conform to API RP 526 and API RP 527.
3. Safety relief valve sizing shall consider operational over-pressure, blocked discharge by any valve in the discharge piping that may be inadvertently closed, and fire conditions. Relief valve sizing requirements arising from operational

difficulties shall be in accordance with, but not limited to, Table 2 of API RP 520. Relieving capacity for fire conditions shall be determined in accordance with Sections 5 and 6 of API RP 520.

4. Safety relief devices for venting and breathing of low pressure storage tanks shall be sized in accordance with Sections 1 through 3 of API RP 2000.

5. Body material of relief and safety valves shall conform with the applicable piping specifications for the service.

6. Relief valve nozzles shall be stainless steel.

7. Applications with variable backpressure conditions shall have pilot operated or balanced type relief valves.

8. Process vessels shall have pilot operated safety valves with non-flow pilots, test connections, and backflow preventors.

9. Pilot discharge shall be piped to the downstream port of the relief valve.

10. Spring chamber or adjustment screw chamber shall be isolated from the discharge port.

11. Applications requiring secondary relieving devices shall have two safety relief valves in parallel that are set to relieve at the same pressure.

3.3.10 Annunciators

1. Annunciator functions, if combined with sequential and loop control functions in a control panel, may be performed by a programmable logic controller (PLC). PLC shall conform to TEX.I.500. Manufacturer and model of PLC shall be approved by Company.

2. All annunciator components except the alarm horn shall be integrally mounted in a protective enclosure.

3. Field connections shall be made on screw-type terminal strips at the rear of the annunciator assembly.
4. Annunciator shall have a minimum of 25% spare terminals and future display alarm points.
5. Annunciator power supply shall be sized to drive all active and future alarm points.
6. Field contacts shall be closed under normal conditions (fail-safe) and open in alarm condition.
7. Annunciator field contacts shall be dry and ungrounded.
8. Annunciator shall operate correctly with a single unintentional ground occurring anywhere in the field wiring.
9. Contact sensing voltage shall be supplied by the annunciator.
10. Each annunciator point shall have an auxiliary contact that repeats the field contact action.
11. The sequence for all alarm points shall be first-out with manual reset as follows:

CONDITION	VISUAL ALARM	AUDIBLE ALARM
Normal	Off	Off
Abnormal		
a. Initial	Flashing	On
b. All Subsequent	Flashing	On
Acknowledge (Normal/Abnormal)		
a. Initial	Slow-flashing	Off
b. All Subsequent	On	Off
Reset (Normal)	Off	Off
Lamp Test	On	Off

12. Annunciator display shall consist of translucent backlit windows. Color of the windows shall be as follows:

White	Status
Amber	Alarm
Red	Shutdown

13. Each annunciator window shall have a minimum of 2 lamps.
14. Legend shall be engraved on windows in black lettering.
15. Spare display windows shall be prewired to terminal strip by manufacturer and equipped with a blank nameplate and a sequence logic card.
16. Acknowledge, reset, and lamp test push buttons shall be integrally mounted in the lower right hand corner of the annunciator display windows.
17. Annunciator housing or panel shall have an externally mounted, audible horn. Manufacturer, model, and type of horn shall be approved by Company.

3.3.11 Local Panels Construction

1. Local panels shall:
   a. Be freestanding and rigid.
   b. Be a minimum 12 gage 316 stainless steel welded enclosure.
   c. Have lifting eyes.
   d. Have a 316 stainless steel support frame or base.
   e. Have no sharp corners.
2. Doors shall be:
   a. Full panel height.
   b. Attached with three-point hinges and three-point closure latches.
   c. Have hold-open rods.
   d. Be easily removable.
3. Panel mounted electrical devices and enclosures shall be suitable for the area classification in which they are installed.
4. Materials, instruments, hardware, etc., used in the panels shall be stainless steel.

5. Panels shall be complete and ready for installation in the field, and shall require no further work other than to be connected to field instruments, valves, electrical terminations, etc.

6. Name tags shall be three-ply phenolic (white-black-white) or stainless steel, with a minimum letter height of 1/4 inch. Name tags shall be attached to equipment with stainless steel screws or to internal panel items with #16 AWG stainless steel wire.

4. INSTALLATION

4.1 General

Materials and design for process connections and piping shall conform to TEX.P.100 and TEX.P.110.

4.1.1 Location

1. Locally Mounted Instruments

   a. Locally mounted instruments shall be located and oriented such that they are visible from areas used during normal operations.

   b. Instruments shall be located such that they are accessible for repair or adjustment from ground level, permanent ladder, or platform.

   c. Except for devices that are close coupled to the point of measurement, e.g., thermometers and pressure gauges, instruments shall be mounted approximately 5 feet above the platform or floor of an accessible position.

   d. Instruments used as a basis for manual control shall be visible from the related controlling device.

2. Instrument Devices

   a. Instrument devices, e.g., transmitters and temperature switches, shall be located as close to their sensing points as possible.

b. Instrument devices shall be supported such that no undue weight or strain is placed on connecting piping.

4.1.2 Mounting

1. Direct connected process instruments shall not be mounted on lines that have excessive vibration.
2. Instruments shall not be supported by process piping, utility piping, instrument piping, or electrical conduit except for direct connected process instruments.
3. Instruments shall be supported by pedestals, pipe stands, subpanels, yoke mounts, mounting plates welded to structures, or by similar support arrangements.
4. Instrument supports shall not be attached to process piping or vessels.
5. Instruments shall not be mounted on handrails.
6. Local instrument mounting plates and support stands shall be hot-dip galvanized in accordance with TEX.B.400.

4.1.3 Skid Terminations

Instrument and control leads entering or exiting prefabricated skids, modules, or packages shall terminate at a central location near the skid edge using junction boxes, bulkheads, or panel plates. Location of junction boxes, bulkheads, and panel plates shall be noted on contractor's drawings and submitted to Company for approval.

4.1.4 Protection

1. Field instruments shall be suitable for offshore installation.
2. Instruments and sense lines containing process fluids shall have insulation, heat tracing, and/or seals where process fluids may vaporize or freeze due to exposure to ambient temperatures.

4.2 Individual Instruments

4.2.1 Temperature Instruments

1. Temperature instrument sensors shall not be installed directly into the process media.
2. Thermowell connections on vessels or pipe shall be 3/4 inch NPT. Nozzle connections shall have screwed reducing flanges.
3. Thermowell insertion length shall be such that the temperature sensor is in the middle one-third of the pipe or is fully covered by the thoroughly mixed fluid in a vessel (i.e., not in a stratified or stagnant location).
4. High temperature grease shall be applied between probe and thermowell for maximum heat transfer.

4.2.2 Pressure Instruments

1. Pressure instrument connections on vessels and piping shall conform to the vessel or pipe specifications.
2. Pressure instrument connections shall have a 3/4 inch primary block valve (minimum).
3. Pressure instrument sense lines shall have a bleed valve installed to allow the sensing line to be depressurized when the block valve is closed.
4. Remotely located instruments shall have a 316 stainless steel secondary block valve with bleed valve. Block valve with bleed valve shall be located within 18 inches of the instrument.
5. Pressure actuated instruments, pilots, gauges, etc., in pulsating services, (e.g., reciprocating pump and compressor suction and discharge), shall be installed with pulsation dampeners.
6. Pressure gauges shall be mounted as close to their sensing points as possible.
7. If process temperature (exhaust gasses, heat medium, etc.) is greater than 250°F,

pressure gauge shall be mounted 3-15 feet away from heat source. If this is impractical, a 316 stainless steel stram siphon ("pigtail nipple") shall be installed between the block valve and the pressure gauge.

8. Pressure instruments shall have a quick-type test port connection to allow testing of pressure instruments without requiring process shutdown or disconnection of equipment. Test ports shall be located adjacent to the pressure instrument or in an easily accessible location if access to the pressure instrument is limited.

9. Differential pressure instruments shall have five-valve manifolds constructed of 316 stainless steel unless other types are approved by the Company.

4.2.3 Level Instruments

1. General

   a. Level gauges shall be mounted such that they are easily viewed.

   b. Vessels that require level transmitters or controllers and level switches shall have two level bridles. Level transmitters or controllers shall be mounted on one bridle and level switches shall be mounted on the other.

   c. Level bridles shall have isolation block valves, vent and drain valves, and valves for calibration and testing of level instruments.

   d. Level gauge and gauge column connections shall conform to the vessel specifications.

   e. Each gauge and gauge column connection shall have a 3/4-inch block valve in addition to the gauge cocks. Block valves shall be "short-nippled" to the vessel or bridle with Schedule 160 nipples.

f. Level instrument connections shall be piped from the vessel shell independent of liquid or gas inlet or outlet connections.

g. Float operated traps and drains may be used for draining nonvolatile liquids with specific gravities greater than 0.7.

h. Use of float operated traps and drains for interface dual gravity service is prohibited.

2. Drain Valves on Level Bridles in Sour Hydrocarbon Service

a. Drain valves on level bridles in sour hydrocarbon service shall be connected to the closed drain system via bridle drain headers. Bridle drain headers shall consist of 1-inch piping.

b. Drain valves from the individual bridle mounted instruments shall be connected to the bridle drain header with 1/2-inch stainless steel tubing.

c. A 1-inch block valve shall be installed where the bridle drain header connects to the closed drain system.

d. Bridle drain headers on skidded equipment shall terminate with a drain valve located at the skid edge.

3. Drain Valves in Other Than Sour Hydrocarbon Service

a. Drain valves on level instruments and bridles in other than sour hydrocarbon service shall be connected to a drain system if indicated in P&ID drawings or other contract documents.

b. Drain lines, including bridle drain header, may be 1/2-inch stainless steel tubing.

4. Vent Valves in Sour Hydrocarbon Service

a. Vent valves on level instruments and bridles in sour hydrocarbon service

shall be connected to the vent header system in the same manner as outlined in Section 4.2.3.2 for drain header connections.

b. Vent lines, including bridle vent header, may be 1/2-inch stainless steel tubing.

4.2.4 Flow Instruments

1. Orifice meter runs shall be installed in horizontal piping.
2. Orifice flange taps for gas service shall be on top of the horizontal run.
3. Orifice flange taps for liquid service shall be on the horizontal centerline.
4. Instruments in gas service shall be mounted above the orifice taps.
5. Instruments in liquid service shall be mounted below the orifice taps.
6. Vertical meter runs shall be approved by the Company.
7. Each orifice fitting connection shall have a primary, full port, 1/2-inch block valve installed to permit cleaning the orifice connections by rodding.
8. Final configuration of orifice fitting installation shall not require the operator to stand directly over the orifice fitting to change orifice plates.
9. Maximum length of sense lines for direct connected locally mounted instruments shall be 20 feet.
10. Liquid or sealed sense lines shall have 3/4-inch vent valves at the high points and 3/4-inch drain valves at the low points.
11. Unsealed sense lines shall have 3/4-inch drain valves at low points.

4.2.5 Control Valves

1. Control valves shall be installed upstream of isolating valves, a bypass valve, and a bleed valve in accordance with ISA RP75.06.

2. Control valves shall be installed in horizontal lines with the diaphragm operators above the valves. Alternate configurations shall be approved by the Company.

3. Control valves in process service with trim sizes of 1/2 inch or less shall have a strainer located upstream of the valves if the controlled liquid can cause a stoppage.

4. Signal pressure to each valve shall be observable from an access way. Where the positioner gauges cannot be seen from an access way, a secondary receiver gauge, in addition to the locally mounted positioner gauge, shall be added for ease of viewing.

4.2.6 Pressure Relieving Devices

1. General

   a. Inlet piping to pressure safety relief valves shall be as short as practical.

   b. Minimum line size of relief valve inlet and valve discharge shall be the nominal size of the corresponding valve connections.

   c. Discharge piping shall be independently supported.

   d. Each safety relief valve discharging into an open stack shall have a drain port located on the valve body.

2. Isolation Valves

   a. Isolation valves shall be installed on the inlet and discharge piping of each safety relief valve.

   b. Isolation valves shall be full port and have locking devices.

   c. A 1/2-inch test port with valve shall be installed between the inlet isolation valve and the safety relief valve inlet.

d. Unions or flanges shall be installed to facilitate removal of safety relief valves.

4.3 Electrical Instrumentation

4.3.1 General

1. Electrical installation shall conform to TEX.E.100 and API RP 14F.
2. Area classification for electrical installations shall conform to API RP 500B and API RP 500C.
3. Electrical signal wiring from electronic transmitters to receiver and from receiver to final control elements shall be continuously shielded. Shields shall be grounded at the same point, generally at the control instrument (panel) end.
4. Multipair cables shall have overall shielding and individual pair shielding.
5. Shield and drain wire at the electronic field device end shall be insulated by heat shrink tubing.
6. The shield/drain wires shall be insulated by heat shrink tubing in junction boxes and control panels.
7. Shielded pairs of conductors for similar type signals (those operating at the same voltage level) may be installed in the same conduit or shielded cables. Signals with different voltage levels shall not be run in the same conduit or shielded cable.
8. Instrument and control cables shall be installed in cable trays that contain no pipe, tubing, or power cables.
9. Field wiring splices shall be made only in junction boxes with locking-fork-type lugs and screw connectors.
10. Minimum separation of field instrument signal wiring from power wiring shall conform to API RP 550, Part 1 Section VII.

11. All wires and cable, including shield drain wires, shall be terminated at properly sized Wiedmuller terminal strips or Company approved equal.
12. Wiring in cable raceways and cable trays shall have no intermediate splices.
13. Wires shall have slip-on or heat shrinkable wire markers on both ends. Markers shall be identified with the wire number specified on the drawings. Adhesive-backed wire markers are prohibited.
14. Intrinsically safe circuits shall be installed in accordance with ISA RP12.6.

4.3.2 Intrinsically Safe Circuit Cables

1. Intrinsically safe circuit cables shall be physically separated from non-intrinsically safe circuit cables by installing them in two separate trays or in one tray with a separator between the cables.
2. Intrinsically safe circuits and non-intrinsically safe circuits shall have separate junction boxes and equipment cabinets.
3. Outer jacket of intrinsically safe circuit cables shall be bright blue. Paint, or other thin coating applied after the manufacture of the cable to achieve the bright blue color is prohibited.
4. Conduits with intrinsically safe cables shall have bright blue color bands at each end.
5. Terminals for intrinsically safe circuit cables shall be bright blue and marked "IS circuits".

4.4 Piping and Vessel Connections, Valves

1. Instrument process connection ratings shall conform to TEX.P.100 and TEX.H.1OO.
2. Instrument connections to vessels, tanks, or process piping shall conform to Table 2.
3. Valves shall conform to TEX.P.120.

4.5 Piping and Tubing

4.5.1 General

1. Instrument tubing, capillaries, and piping shall be plumb and level.
2. Sensing lines that require a slope shall be continuously sloped at a minimum rate of 1 in 12. Direction of slope shall be downward from the process for liquid service and upward from the process for gas service.
3. Tubing or sense lines shall not be secured directly to machinery, pipe, or structural members without Company approval.
4. Drip pots and drain valves shall be installed at low points where slope on connection lines cannot be obtained.
5. Teflon tape and an anti-galling lubricant such as Lubon shall be applied to stainless steel-to-stainless steel tubing and piping connections. SWAK brand of lubricant is prohibited.
6. Bushings and all-thread nipples are prohibited.
7. Piping and tubing shall be blown clean with clean dry air before it is connected.
8. Open ends of process drains and vents shall be closed with suitable caps or plugs. Plugs shall be bar stock with hex heads.
9. Ends of installed piping and tubing that are not connected shall be closed with caps or plugs manufactured for this purpose.
10. Installation of fusible plug loop tubing and detectors shall conform to API RP 14C.
11. Small atmospheric vents, e.g., on venting instruments and pilot valves, shall have 316 stainless steel bug screens. Minimum size of screens shall be equal to the size of the vent piping or tubing, or 1/4 inch, whichever is greater.

4.5.2 Instrument Air Supply System

1. Installation of piping for air supply system shall be neat, functional, and run in either the horizontal or vertical plane.

2. Instrument air headers and branch lines shall be sized as follows:

NUMBER OF INSTRUMENTS	PIPE SIZE
1 - 14	3/4 inch
15 - 23	1 inch
24 - 56	1-1/2 inch
57 - up	2 inch

3. Take-offs for branch lines shall be from the top of the main header. Needle valves equal in size to the branch line shall be installed at the header take-off.

4. Maximum distance from individual instruments to connection on branch line or supply header shall be 60 inches.

5. A needle valve shall be installed between the supply source and the instrument/regulator.

6. Needle valve shall be connected to the instrument/regulator with 1/4-inch stainless steel tubing.

7. All low points in the air supply system shall have a 3/4 inch ball valve for drain and blowdown service.

4.5.3 Instrument Piping

1. Pipe threads shall be cut with sharp thread-cutting tools and with cutting oil applied during the thread cutting operation.

2. Threads shall be brushed and cleaned and Teflon tape shall be applied to the male threads prior to make-up of threaded joints.

4.5.4 Instrument Tubing

1. Unless otherwise noted in design documents, instrument tubing shall be sized as follows:

SIZE
1/4 inch O.D. x 0.035 inch W.T.

3/8 inch O.D. x 0.049 inch W.T.
1/2 inch O.D. x 0.065 inch W.T.

2. Tubing shall be bent as required to minimize the use of ells and fittings wherever possible.
3. Tubing shall be bent with the correct size tubing bender.
4. Tubing shall be cut with tubing cutters.
5. Cut tubing shall be reamed before connection to a fitting.
6. Tubing runs shall be installed with maximum lengths of tubing.
7. Tubing shall be tagged with a unique identification code at both ends of runs longer than 10 feet and on both sides of any module penetration.
8. Tubing shall be installed such that couplings can be tightened without distorting the tubing runs.
9. Tubing bends shall be installed in all tubing runs to allow for thermal expansion and contraction.
10. Tubing used for vent connections shall have no low points.
11. Tubing used for drain connections shall have no high points.
12. Tubing runs shall be installed in traceable flat bundles.
13. Tubing bundles with three or more tubing runs shall be placed in tubing trays for support.
14. Tubing trays shall be heavy-duty fiberglass Robroy brand or Company approved equal.
15. Splicing plates, tubing clamps, banding, and miscellaneous mounting hardware for tubing and tray installation shall be 316 stainless steel.
16. Tubing bundles shall be firmly attached to the tray at maximum intervals of 24 inches.

17. Tubing not installed in tubing trays shall be supported and protected from vibrations and physical damage.

18. Tubing runs shall be supported and fixed at the following maximum linear distances:

SIZE	MAX. DISTANCE BETWEEN SUPPORTS
3/8 inch OD and less	Continuous
1/2 inch to 3/4 inch	6 feet
3/4 inch to 1 inch	9 feet

19. Tubing shall not place stress or mechanical strain upon an instrument.

20. Two laps of Teflon tape shall be applied to the male thread of tubing to pipe connections and screwed pipe joints. Tape shall not be over the end of the male fitting.

21. Cut ends shall be reamed to remove burrs.

4.5.5 Tubing Bundles

1. Use of multitube bundles shall require Company approval.

2. Each tube in multitube bundles shall be clearly identified with a stainless steel tag at each end to indicate the tube's service and route.

3. Multitube bundles, shall be interconnected in NEMA 4X junction boxes or control panels.

4. Multitube bundles entering junction boxes or control panels shall be weatherproofed with properly sized bundle-type bulkhead fittings.

5. Multitube bundles shall be installed in tubing tray.

6. If tubing bundles crossing structural splice lines require field joints:

   a. Tubing shall be cut at each terminating end to prevent damage during installation.

   b. Ends shall have unions.

c. The splice piece shall be cut to length and secured to the bundle on one of the main runs.

d. All tubing ends shall be plugged or capped.

7. Opposite ends of tubing bundles shall not terminate in areas having different electrical classifications.

5. CLEANING

5.1 Line Blow Down

Piping and tubing for instrument air/gas shall be disconnected upstream of all filter-regulators and blown down to remove water, slag, and mill scale prior to placing the lines in service.

5.2 Line Flush

1. Process sensing lines shall be disconnected and flushed with water.
2. After flushing, process sensing lines shall be blown dry with air, then reconnected to the instrument manifold. After reconnection, all manifold valves shall be checked for tight shut-off.
3. Pipes connected to close coupled instruments (e.g., pipe-mounted d/p cells) shall be disconnected only at the instrument and checked for tight shut off up to the initial isolation valve(s).
4. Installed instruments shall be positively isolated from the process line during flushing.
5. Instruments with manifolds shall have their bypass valve open during flushing.

6. PROTECTION

1. All instruments, tubing, piping, fittings, etc., shall be protected from physical damage, contamination by dirt, sand, or other foreign material, during construction, transport, storage, and installation.
2. All instruments shall be covered with polyethylene bags to ensure adequate protection during

installation. Polyethylene bags shall be kept in place at all times except during work on the device they protect, until they are removed for start-up.

3. Threaded joints, covers, hardware, etc. shall be treated with Kopr-Shield anti-seizing compound or Company approved equal.

4. Control valve stem, shutdown valve stem, and exposed manual valve stems shall be greased and then protected against corrosion, dirt, sandblasting, and painting overspray to ensure their proper operation at startup and commissioning.

7. PREPARATION FOR MARINE TRANSPORT

1. Instruments shall be protected from physical damage and weather damage (including wind) during marine transport.

2. Instruments shall be braced or secured with wire or rope to prevent damage from vibration.

3. Movable parts, e.g., level instrument floats, sailswitch arms, shall be secured with shipping bolts or by other means supplied by manufacturer.

8. CHECKOUT AND COMMISSIONING

Instrumentation checkout, testing, calibration, and commissioning shall conform to TEX.I.110.

TABLE 1

UNITS OF MEASURE

The following units of measure shall be used for instrumentation:

Length:	Inches or feet (IN. or FT)
Mass:	Pound (LB)
Temperature:	Degrees Fahrenheit (°F)
Pressure:	Pounds per square inch gauge (PSIG)
Differential pressure:	Pounds per square inch gauge (PSIG) or inches of water column (IN. H_2O or IN. WC)
Flow rate of liquid:	Gallons per minute or barrels per day (GAL/MIN or BBL/D)
Totalized flow of liquid:	Barrels (BBL)
Flow rate of gas:	Standard cubic feet per hour or million standard cubic feet per day (SCFH or MMSCFD)
Totalized flow of gas:	Standard cubic feet or million standard cubic feet (SCF or MMSCF)
Level:	Percent (%)
Viscosity:	Centipoise or Saybolt seconds universal (cP or SSU)
Mass rate of flow:	Pounds per hour (LB/HR)

TABLE 2

MINIMUM SIZE OF INSTRUMENT CONNECTIONS TO VESSELS, TANKS, OR PROCESS PIPING

	ON VESSELS		ON PIPING	
	Nozzle Size	Isolation Valve	Nozzle Size	Isolation Valve
1. Pressure Instruments	3/4"	3/4"	3/4"	3/4"
2. Temperature Instruments	3/4"			
3. External Displacer Type Level Transmitter/ Controllers	2"	2"		
4. Level Gauges	1"	3/4"		
5. Dp Transmitters	1-1/2"	3/4"	3/4"	3/4"
6. External Type Float/Displacer Level Switch	1-1/2"	1"		
7. Internal Type Float/Displacer Level Instrument	4"			
8. Instrument Bridle with Two Instruments	2"			
9. Instrument Bridle with More Than 2 Instruments	3"			

NOTE: Above are minimum requirements. In some instances, particularly sour service, larger connection sizes are required. Refer to sketches showing typical instrument installation details which are attached to TEX.P.100 for specific requirements. Also refer to P&IDs.

DESIGN AND FABRICATION OF LOCAL SAFETY SHUTDOWN PANELS

SPECIFICATION NO. TEX.I.210

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		

Approved by:	Company Approval:

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Data Sheet YES[ ] NO[X]

2. Inspection and Testing Requirements Sheet YES[X] NO[ ]

3. Documentation Requirements Sheet YES[X] NO[ ]

TABLE OF CONTENTS

1. SCOPE

This specification defines minimum requirements for the design, materials, fabrication, testing, and inspection of local safety shutdown panels to be installed on an offshore platform.

2. REFERENCES

2.1 Company Specifications

This specification contains references to the following Company specifications:

1. TEX.I.100, "Design, Materials, and Installation of Instrumentation".
2. TEX.I.200, "Master Safety Shutdown Panels".
3. TEX.I.220, "Wellhead Control and Shutdown Panels".

2.2 Industry Codes and Specifications

This specification contains references to the following industry codes and specifications:

2.2.1 American Petroleum Institute (API)

API RP 14C, "Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms".

2.2.2 American Society for Testing and Materials (ASTM)

ASTM A269, "Seamless or Welded Austenitic Stainless Steel Tubing for General Purpose".

2.2.3 Instrument Society of America (ISA)

ISA RP12.6, "Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations".

2.2.4 National Electrical Manufacturers Association (NEMA)

NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".

2.2.5 National Fire Protection Association (NFPA)

1. NFPA 70, "National Electrical Code (NEC)".

2. NFPA 496, "Purged and Pressurized Enclosures for Electrical Equipment".

2.2.6 United States Department of the Interior (USDI)

USDI, Minerals Management Service (MMS), Outer Con-tinental Shelf (OCS), Gulf of Mexico, Order No. 5, "Production Safety Systems".

3. SYSTEMS

1. All local safety shutdown panel designs shall be sub-mitted to Company for approval and shall meet all requirements of API RP14C and OCS Order No. 5.
2. Instruments and shutdown logic shall be pneumatic type. Electric to pneumatic interfaces shall be permitted where required.
3. Units of measure shall conform to Table 1.
4. Local safety shutdown panel logic and functionality shall conform with the following parameters:
   a. Safety instrumentation shall be designed such that an abnormal condition causes a loss in signal pressure or electrical power.
   b. Loss of the input signal to a safety instrument shall cause the instrument to respond in the manner described in the design drawings, specifications, and safe charts.
5. Safety devices and instrumentation shall be capable of being reset without replacement of any element.
6. Master shutdown valves (SDV) and surface safety valves (SSV) shall be operated pneumatically. Downhole subsurface safety valves (SSSV) shall be operated hydraulically. SSVs and SSSVs shall normally be controlled from a wellhead control and shutdown panel.
7. Major processes and utility systems shall each have a dedicated local safety shutdown panel.
8. Local safety shutdown panels shall:
   a. Provide a visual indication of an abnormal condition.
   b. Cause the loss of a "normal operations" signal to the platform master safety shutdown panel.

c. Cause and indicate shutdowns of assigned shutdown valves.

d. Receive and relay shutdown signals from the master safety shutdown panel.

9. Local safety shutdown panels shall incorporate a "first-out alarm" design.

10. Shutdown logic components in the local safety shutdown panel shall require manual reset action at the local panel and then only after the cause has been corrected.

11. The safety system shall be pressurized during normal operation. When a safety device detects an abnormal condition, it shall block its air supply and bleed its output, depressurizing a local panel-mounted indicating relay. This signal shall shut down the processing com-ponent (unit shutdown) through the local safety shutdown panel logic.

12. In addition to the "normal operations" signal to the master safety panel, the local safety shutdown panel shall provide an electrical (dry contact) alarm signal to the control room and/or to the master panel for unit shutdown alarm when required.

13. Local safety shutdown panels shall receive pneumatic or electrical signals from both the master shutdown system and the manual emergency shutdown system (ESD) for remote shutdown of the processing unit.

14. Local safety shutdown panel devices shall have a bypass for testing and maintenance. Each bypass shall have an auxiliary contact wired into a common "bypass/trouble" alarm circuit when required by overall control system design.

15. Emergency and master panel shutdown signals shall not be bypassed.

16. Local safety shutdown panels shall remain "locked out" after detection of a shutdown until manually placed back into service.

4. FUNCTIONAL REQUIREMENTS

1. Local safety shutdown panels shall indicate the loss of pneumatic signal from the end device and

relay signal loss to the master panel. Panel shall continue to indicate the upset and block the signal to themaster panel in the event the upset should right itself and the end device signal return. After the panel is manually reset, the panel will then clear and supply signal pressure to the master panel.

2. Each shutdown grouping shall supply a signal to the master panel corresponding to the condition of that piece of equipment. Each signal shall have its own bypass. Bulk-head connections shall also be arranged according to the grouping wherever possible.

5. COMPONENTS

1. It shall not be necessary to remove any components or tubing in order to gain access to or remove any other components.
2. Tubing shall meet the following requirements:
   a. Tubing runs within the panels shall be in the horizontal or vertical plane only, carefully grouped for accessibility and ease of tracing lines, and clamped for rigidity.
   b. All tubing shall be numbered using Brady or equal labels.
   c. Properly sized tube cutters and benders shall be used for all cuts and bends.
   d. Tubing shall conform to ASTM A269.
   e. Tubing shall be 316 stainless steel that is either cold drawn seamless or welded and drawn.
   f. Except as noted, minimum tubing size shall be 1/4 inch with a wall thickness of 0.035 inches.
   g. Tubing shall be "stick" type. Use of coiled tubing is prohibited.
   h. Tube fittings shall be 316 stainless steel Swage-lok, Gyrolok, or Parker C.P.I. type. Fittings for a project shall be supplied by a single manufacturer.
   i. Plastic tubing is prohibited.

3. Each panel shall have pressure gauges to indicate air supply pressure, signal supply pressure and output signal pressures, each properly labeled. "Signal pressure gauges" shall be connected so that they indicate the signal supplied to the master panel by each group of instruments. The manual bypass shall have no effect on this gauge, but shall have its own indication by either valve handle position or other means.

4. Panel pneumatic supply shall be provided through two complete 100 percent capacity parallel, redundant internally mounted supply paths. Each shall consist of a filter regulator with automatic drain, check valve, and isolation block valves.

5. Electrical instruments and components and their installation shall be suitable for the area classification in which they are installed, meet NEC requirements, meet the applicable requirements of specification TEX.I.100, NFPA 496 when purged, and the following:

   a. Wiring shall terminate in a common junction box on a terminal strip with one side dedicated for field connections. Junction box shall meet the require-ments of NEMA Standard 250.

   b. Minimum spacing of two inches between junction box wall and terminal strips and four inches between terminal strips shall be provided.

   c. Twenty-five percent spare terminal space shall be provided.

   d. All wires shall be tagged at every termination with permanent shrink-on type wire markers.

   e. Intrinsically safe circuits shall conform to ISA RP12.6 where required.

6. INSTRUMENTS

1. Pressure gauges shall be flush mounted 2-1/2 inch dial face, all stainless, glycerine filled McDaniel, U.S. Gauge P1545L, or Company approved equal.

2. Pressure regulator shall be automatic drain Fisher 67FR, Norgren, or Company approved equal.

3. First-out indicator shall be type BWB "C-2A" relay.
4. Three-way block and bleed relay, pressure maintained, spring return control valve with manual override "pull to open", "push to close" with indicator shall be type BWB "EHBI" relay.
5. Three-way block and bleed relay shall be same as No. 4 without bypass pin type BWB "EHI" relay.
6. Three-way manual bypass valve with indicator shall be type BWB "D-3" valve.
7. Three-way automatic reset valves, when required, shall be type BWB "P" relay valves.
8. Three-way solenoid valves, 316 SS explosion proof, quick-exhaust type, with 24 VDC continuously energized coil shall be Skinner Mfg., Inc. or Company approved equal.
9. Pressure switches, stainless steel external parts, hermetically sealed DPDT switch, 24 VDC shall be Static O-ring or Company approved equal.
10. Two-way block valves shall be Whitey SS-44 FL or Company approved equal.
11. Three-way block and bleed valves shall be panel mount Whitey SS-44XF4 or Company approved equal.

7. CONSTRUCTION

1. Local safety shutdown panels shall be weatherproof and equivalent to NEMA 4X enclosure design, and shall:
   a. Be freestanding and rigid.
   b. Be a minimum 12 gauge 316 stainless steel welded enclosure with a Number 3 or 4 polished exterior surface finish and polished mill finish interior surface.
   c. Have lifting eyes, each designed to carry the weight of the completed panel.
   d. Have a 316 stainless steel support frame and/or base capable of being welded to the deck without welding on the panel walls.
   e. Have no sharp corners.
   f. Be raintight.

g. Not have cut-outs made with flame producing devices. All cut-out dimensions shall be verified prior to making any cut-outs.

2. Panel access shall be through rear doors that shall be:

   a. Full panel height.

   b. Attached with three-point hinges and three-point closure latches.

   c. Have hold-open rods.

   d. Be easily removable.

   e. Gasketed with the perimeter of the door opening constructed with a rain gutter at least 1/2 inch deep and 1/2 inch wide.

   f. No more than 36 inches in width in the full open position.

3. Materials, components, hardware, etc., used in the panels shall be stainless steel. Instruments shall be of stain-less steel construction wherever possible.

4. Panels shall be complete and ready for installation in the field, and shall require no further work other than to be connected to field instruments, valves, electrical terminations, etc., and pneumatic supply.

5. Panels shall have laminated schematic drawings secured to the panel door interior. Laminated schematic content and construction shall be approved by Company.

6. Name tags shall be three-ply phenolic (white-black-white) or stainless steel, with a minimum letter height of 3/16 inch. Name tags shall be attached to equipment with stainless steel screws or to internal panel items with #16 AWG stainless steel wire. Panel mounted items shall have front of panel and rear (internal) name tags.

7. All pneumatic and hydraulic lines shall enter the panels through stainless steel bulkhead connections located at the bottom or side of the panels and shall be identified on both sides of the bulkhead plate. Ten percent spare bulkhead fittings shall be provided.

8. Each local safety shutdown panel enclosure shall have a 3/4 inch vent at the top with a threaded "gooseneck" outlet. All instruments and valves which vent shall have their vent ports piped to a common vent header that terminates in a second "gooseneck" outlet at the top of the enclosure.

TABLE 1

Units of Measure

The following units of measure shall be used for instrumentation:

Length:	Inches or feet (IN. or FT.)
Mass:	Pound (LB.)
Temperature:	Degrees Fahrenheit (°F)
Pressure:	Pounds per square inch gauge (PSIG)
Differential pressure:	Pounds per square inch gauge or inches of water column (IN. H_2O or IN. WC)
Flow rate of liquid:	Gallons per minute or barrels per day (GAL/MIN or BBL/D)
Totalized flow of liquid:	Barrels (BBL)
Flow rate of gas:	Standard cubic feet per hour or million standard cubic feet per day (SCFH or MMSCFD)
Totalized flow of gas:	Standard cubic feet or million standard cubic feet (SCF or MMSCF)
Level:	Percent (%)
Viscosity:	Centipose or Saybolt seconds universal (cP or SSU)
Mass rate of flow:	Pounds per hour (LB/HR)

CENTRIFUGAL PUMPS (API 610)

SPECIFICATION NO. TEX.M.220

FEB. 97

REV	**DATE**	**DESCRIPTION**	**ORIG**	**APPROVALS**		
Approved by: **Date:**			**Company Approval:** **Date:**			

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1.	Data Sheet	YES[X]	NO[ ]
2.	Pump Seals Data Sheet	YES[X]	NO[ ]
3.	Inspection and Testing Requirements Sheet	YES[X]	NO[ ]
4.	Documentation Requirements Sheet	YES[X]	NO[ ]

TABLE OF CONTENTS

SCOPE

This specification defines minimum technical requirements for centrifugal pumps.

INTRODUCTION

1. Technical requirements for centrifugal pumps are based on API 610, Eighth Edition, August 1995.
2. This specification contains requirements supplementary to those of API 610.
3. Supplementary requirements are identified as additions, deletions, and replacements.
4. Paragraph numbers in this specification are the same as API 610.
5. Requirements of API 610 which are not revised remain applicable.

COMPANY REFERENCES

This following Company documents apply to this specification:

1. TEX.B.400, "Painting and Corrosion Protection".
2. TEX.M.100, "Acceptance Criteria for Equipment Noise".

SECTION 2 - BASIC DESIGN

2.1 General

2.1.9 REPLACE WITH

Suction specific speed shall be maximum of 11,000 if calculated at best efficiency point with NPSHR based on 3% head drop.

2.1.11 ADD

Head capacity curves shall rise continuously to shutoff. Head rise for parallel operation shall be minimum of 10%.

2.1.14 DECISION

Equipment shall conform to TEX.M.100.

2.1.15 ADD

Pumps, with heads greater than 1300 feet per stage, radial clearance between volute tongue, and maximum

allowable impeller blade tip radius shall be minimum of 10%.

2.1.24 ADD

If mating faces cannot be fully machined, complete details shall be provided.

2.1.26 ADD

Pump and driver skid shall be supported on test stand in configuration similar to field installation support.

2.1.27 DECISION

Supplier shall comment on Company’s piping and foundation drawings for multistage pumps.

2.1.27d REPLACE WITH

Initial alignment of pump and drive train shall be performed by Supplier with assistance provided by Purchaser.

2.2 Pressure Casings

2.2.7 ADD

Supplier’s bid shall state if split halves are crowned to achieve seal.

2.2.12 ADD

Jackscrew end that mates with relieved flange face shall be unthreaded and rounded.

2.2.13.2 ADD

Each tapped hole shall be chamfered to minimum of 1/16 inch.

2.3 Nozzles and Pressure Casing Connections

2.3.3.2 ADD

Connections in corrosive service sized 1 1/2 inches and less shall be socket welded.

2.3.3.10 REPLACE WITH

Pumps shall have casing vent and drain connections.

2.5 Rotors

2.5.1 ADD

Impellers with minimum specific speed of less than 1000 shall be avoided.

2.5.2 DECISION

Collets shall be prohibited on vertical pumps.

2.5.2 ADD

Impellers for multistage pumps shall be individually secured to prevent axial movement in either direction along shaft.

2.6 Wear Rings and Running Clearances

2.6.2 ADD

Wear ring and throttle bushing materials of 316L stainless steel with stellite overlay shall be preferred.

2.6.3 ADD

1. Radial locking devices shall not be permitted.
2. Tack welds attaching renewable wear rings shall each be minimum 1 inch long and have 3 inch gap between tack welds.

2.7 Mechanical Shaft Seals

2.7.3.11 REPLACE SECOND SENTENCE WITH

Register fit surface shall be concentric to shaft and shall have maximum total indicated runout of 0.002 inch (Appendix K).

2.7.3.17 REPLACE FIRST SENTENCE WITH

If Supplier recommends cooling or heating jackets on seal chambers, jackets shall be included.

2.7.3.19 REPLACE SECOND SENTENCE WITH

Mechanical seal piping and appurtenances shall be provided. Seal piping arrangement designated ″Plan 31″ shall be preferred.

2.7.3.20 DELETE IN FIRST SENTENCE

"and when specified for"

2.8 Dynamics

ADD

2.8.1.2 Pumps shall not operate within 10% of predictable critical speed with internal clearances in either design or twice design condition.

2.8.2.1 REPLACE WITH

Torsional and transient torsional vibration analysis of complete coupled train shall be performed by Supplier.

2.8.3 Vibration

2.8.3.1 ADD AS FIRST SENTENCE

Supplier shall demonstrate that pump can operate at capacity from rated flow to quoted minimum continuous stable flow without exceeding vibration limits.

2.9 Bearing and Bearing Housings

2.9.1 Bearings

ADD

2.9.1.6 Thrust collars shall be replaceable and positively locked to shaft to prevent fretting.

2.9.2.9 REPLACE WITH

If Supplier recommends oil heaters, Supplier shall provide them.

2.10 Lubrication

2.10.1 ADD

RTDs installed in thermowells shall be supplied in bearing oil drain lines.

2.10.3 REPLACE WITH

Pure oil or purge oil mist lubrication shall be provided as appropriate to application.

ADD

2.10.4

1. Lube oil coolers shall be fin fan type with carbon steel tubes and aluminum fins with coating and electric motor driven fan.
2. Fin fan coolers shall be designed for quick installation and removal.
3. Shell and tube cooler may be used if cooling water is available.

4. For shell and tube designs, oil side operating pressure shall be higher than water side operating pressure.

2.11 Materials

2.11.1 General

ADD

2.11.2.1 Acceptable criteria for visual inspection shall conform to ASTM A802/A802M.

SECTION 3 - ACCESSORIES

3.1 Drivers

3.1.4 ADD

Motor power ratings, including service factor, shall be sufficient to drive pump throughout its head capacity curve with maximum impeller without causing overload.

3.2 Couplings and Guards

3.2.2 REPLACE FIRST AND SECOND SENTENCES WITH

1. Flexible spacer couplings of forged steel laminated disc type shall be used.
2. Discs shall be constructed of stainless steel or suitable corrosion resistant alloy material.
3. Other types of flexible spacer couplings shall be considered for special applications.

3.3 Baseplates

3.3.1 ADD

1. Drip pan baseplate drain pan shall be continuous 3/16 inch minimum thickness.
2. Penetrations through drip pan shall be seal welded and have collars.
3. Grating shall be placed on open areas of skid not covered by equipment.
4. Grating shall be carbon steel fitted, cut, banded, and hot dipped galvanized.
5. Drip pan shall not be used for grating support.
6. Grating shall extend to edge of skid.

3.3.3 ADD

Mounting pads for all multistage centrifugal components shall be 316L stainless steel.

3.3.4 ADD

1. For gear driven horizontal centrifugal pumps, gear shall be fixed directly to gear pedestal.
2. Driver and pump shall be shimmed approximately 1/4 inch (±0.05 inch) to align to gear.
3. A set of shims at least 1/4 inch per shim location shall be supplied.

3.3.14 ADD

Longitudinal and transverse 316 stainless steel alignment positioning screws shall be supplied.

3.3.15 ADD

Vertical and leveling screws shall be 316 stainless steel.

ADD

3.3.21 Centerline supported pumps with operating temperatures above 450°F (or at lower temperatures if required by Supplier) shall have pedestal cooling.

3.4 Instrumentation

3.4.1 Temperature Gages

3.4.2.2 REPLACE WITH

Liquid filled gages shall furnished in all locations.

3.4.3 Vibration, Position, And Temperature Detectors

3.4.3.1 REPLACE WITH

1. For equipment with hydrodynamic bearings, provision shall be made for mounting two radial vibration probes in each bearing housing, two axial position probes at thrust end of each machine, and a one event per revolution probe in each machine.
2. Detectors shall be provided by pump Supplier.
3. Detectors and their mounting and calibration shall conform to API Standard 670.

3.4.3.2 REPLACE WITH

1. Hydrodynamic thrust and radial bearings shall be fitted with bearing metal temperature detectors.
2. Detectors and their mounting and calibration shall conform to API Standard 670.

3.4.3.3 REPLACE WITH

Monitors with connecting cables to vibration, axial position, and/or temperature detectors shall be supplied and/or installed and calibrated in accordance with API Standard 670.

3.5 Piping and Appurtenances

3.5.2 Auxiliary Process Fluid Piping

3.5.2.10.l ADD

Threaded connections shall not be permitted 1 1/2 inches and smaller in corrosive service.

3.5.4 Water Cooling Piping

3.5.4.4 DECISION

Sight flow indicators shall be provided at each outlet line.

SECTION 4 - INSPECTION, TESTING, AND PREPARATION FOR SHIPMENT

4.1 General

4.1.4 REPLACE WITH

Inspection and testing requirements shall conform to Inspection and Testing Requirements Sheet (ITRS).

4.1.6 REPLACE WITH

Inspector’s Checklist (Appendix N of API 610) shall be initialed and dated in all blanks by Supplier and purchaser representative.

4.3 Testing

4.3.1 General

4.3.1.2 DELETE

"When specified,"

4.3.3 Performance Test

4.3.3.2.1 ADD

For variable speed applications, 4 sets of 5 data points shall be taken, 1 set at maximum speed, 1 set at rated speed, 1 set at minimum speed, and 1 set at a speed that is midway between rated speed and minimum speed.

4.3.3.3.1 ADD

In place of fabricator’s shop probes, contract vibration probes shall be used.

4.3.3.4.3 ADD

For multistage split case pumps, hydrodynamic bearings shall be removed, inspected by Purchaser or his representative, and reassembled after performance test is completed. In addition, pump rotor shall be exposed for inspection.

4.3.4 Optional Tests

4.3.4.2 REPLACE FIRST SENTENCE WITH

Supplier of complete pump skid shall have an option to supply complete unit test. Option shall include total cost and schedule impact for each test to be performed.

4.3.4.4 Auxiliary Equipment Test

REPLACE FIRST SENTENCE WITH

If required, auxiliary equipment test shall be performed at Supplier’s shop. These tests shall be performed prior to compete unit test.

4.4 Preparation for Shipment

4.4.3.3 ADD

Supplier of complete skid shall be responsible for blasting and coating components in accordance with TEX.B.400.

SECTION 5 - SPECIFIC PUMP TYPES

5.2 Between Bearing Pumps (Types BB1-BB5)

5.2.6.2 ADD

7. Ground Clips

5.2.6.3 REPLACE WITH

1. If minimum ambient site temperature is less than manufacturer's required startup temperature, lube oil heater shall be supplied.
2. Lube oil heater shall be thermostatically controlled electric immersion heater with sheath of AISI Standard Type 300 stainless steel and shall be supplied for heating charge capacity of oil before startup.
3. Heating device shall have sufficient capacity to heat oil in reservoir from specified minimum site ambient temperature to manufacturer's required startup temperature within 4 hours.
4. Watt density shall not exceed 15 watts per square inch (2.33 watts per square centimeter).

5.2.6.6 DELETE

"When specified,"

5.3 Vertically Suspended Pumps

5.3.2.3 REPLACE WITH

Vertical pumps pump shaft shall be limited to maximum lengths of 10 feet per section.

SECTION 6 - SUPPLIER'S DATA

6.1 General

6.1.1 REPLACE WITH

Data requirements shall conform to Documentation Requirements Sheet.

6.2 Proposals

6.2.3.l REPLACE WITH

A list of similar machines installed with similar conditions with date of installations.

6.3 Contract Data

6.3.4 REPLACE WITH

1. Progress reports shall be submitted twice monthly.
2. Reports shall include status of engineering, delivery date of purchased items, and of fabrication status in accordance with Documentation Requirements Sheet.

APPENDIX A- REFERENCED PUBLICATIONS AND INTERNATIONAL STANDARDS

ASTM ADD

A802/A802M, "Steel Castings, Surface Acceptance Standards, Visual Examination".

PIPING DESIGN SPECIFICATION

SPECIFICATION NO. TEX.P.100

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		
Approved by:		Company Approval:				

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1.	Inspection and Testing Requirements Sheet	YES[ ]	NO[X]
2.	Documentation Requirements Sheet	YES[X]	NO[ ]

TABLE OF CONTENTS

P100F2	Pressure Controllers (Sweet and Sour Service)
P100F3	Pressure Indicators (Sweet and Sour Service)
P100F4	Spring Operated Pressure Relief Valves (Sweet and Sour Service)
P100F5	Purge Connection (Sour Service), Pilot Operated Pressure Relief Valves (Sweet and Sour Service)
P100F6	Pressure Differential Indicators and Controllers (Sweet and Sour Service)
P100F7	Level Switches (Sweet and Sour Service)
P100F8	Level Controllers (Sweet and Sour Service)
P100F9	Level Gauges (Sweet and Sour Service)
P100F10	Temperature Indicators (Sweet Service)
P100F11	Temperature Indicators (Sweet and Sour Service)
P100F12	Chemical Injection (Sweet and Sour Service)
P100F13	Vents and Drains (Sweet Service)
P100F14	Vents and Drains (Sweet and Sour Service)

1. SCOPE

This specification defines minimum requirements for the design of piping to be installed on offshore platforms.

Piping for special fire protection systems, such as Halon, CO_2, dry chemical, and foam concentrate are excluded from this specification.

The term "Vendor" shall mean either the "Company's Vendor" or the "Contractor's Vendor".

2. REFERENCES

2.1 Company Specifications

The following Company specifications supplement this specification:

1. TEX.P.110, "Piping Materials Specification".
2. TEX.P.120, "Valve Specification".
3. TEX.P.130, "Specification for Fabrication, Erection, Testing, and Inspection of Piping".
4. TEX.G.140, "Painting and Corrosion Protection Specification".
5. TEX.M.110, "Thermal Insulation Specification".
6. TEX.I.100, "General Instrument Specification".
7. TEX.I.120, "Local Safety Shutdown Panel Specification".
8. TEX.G.110, "Skid Mounted Process Equipment Specification".
9. TEX.S.400, "Offshore Structures Fabrication Specification".

2.2 Codes and Standards

The design of piping systems shall be in accordance with the latest edition of the following Codes and Standards:

2.2.1 American Iron and Steel Institute (AISI)

2.2.2 American National Standards Institute (ANSI)

1. ANSI/ASME B1.2, "Gages and Gaging for Unified Screw Threads".
2. ANSI/ASME B16.5, "Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys".
3. ANSI/ASME B16.9, "Factory-Made Wrought Steel Buttwelding Fittings".
4. ANSI B16.11, "Forged Steel Fittings, Socket-Welding and Threaded".
5. ANSI/ASME B16.25, "Buttwelding Ends".
6. ANSI/ASME B31.3, "Chemical plant and Petroleum Refinery Piping".
7. ANSI/ASME B31.4, "Liquid Petroleum Transportation Piping Systems".
8. ANSI/ASME B31.8, "Gas Transmission and Distribution Piping Systems".

2.2.3 American Petroleum Institute (API)

1. API RP 14E, "Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems".
2. API Standard 1104, "Welding Pipelines and Related Facilities".

2.2.4 American Society of Mechanical Engineers (ASME)

"ASME Boiler and Pressure Vessel Code".

2.2.5 American Society for Testing and Materials (ASTM)

1. ASTM A 105, "Specification for Carbon Steel, for Piping Components".
2. ASTM A 106, "Specification for Seamless Carbon Steel Pipe for High-Temperature Service".
3. ASTM A 193, "Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service".
4. ASTM A 194, "Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service".

5. ASTM A 234, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures".
6. ASTM A 283, "Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars".
7. ASTM A 285, "Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength".
8. ASTM A 333, "Specification for Seamless and Welded Steel pipe for Low-Temperature Service".
9. ASTM A 516, "Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service".

2.2.6 American Water Works Association (AWWA)

2.2.7 National Association of Corrosion Engineers (NACE)

NACE MR0175, "Sulfide Stress Cracking Resistant Metallic Material for Oilfield Equipment".

2.2.8 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

2.2.9 National Fire Protection Association (NFPA)

1. NFPA 13, "Installation of Sprinkler Systems".
2. NFPA 15, "Water Spray Fixed Systems for Fire Protection".
3. NFPA 24, "Installation of Private Service Mains".

2.2.10 Occupational Safety and Health Administration (OSHA)

U.S. Code of Federal Regulations, Title 29, Part 1910, Occupational Safety and Health Act (OSHA) Standards.

2.2.11 US Department of the Interior (USDI)

USDI, Minerals Management Service (MMS), Outer Continental Shelf (OCS) Orders Gulf of Mexico.

2.2.12 US Environmental Protection Agency (EPA)

2.2.13 Federal, State, and Local Laws and Regulations

In case of conflict between this specification and the Codes and Standards above, the most stringent requirement shall govern.

3. GENERAL

3.1 Design and Layout

3.1.1 Materials, Sizes, and Fittings

1. All pipe, fittings, and valves shall conform to the specifications for the service specified, as defined in TEX.P.110 and TEX.P.120.
2. Pipe sizes 1-1/4, 3-1/2, 5, and 7 inches shall not be used except with specific written approval of the Company.
3. When pipe sizes 1-1/4, 3-1/2, 5, and 7 inches are a part of purchased equipment, the connecting piping shall be increased or decreased to a standard size.
4. In general, no piping smaller than 3/4 inch shall be used.
5. All taps onto piping shall be no smaller than 3/4 inch and no less than 3000 pound rating.
6. Weldolets, sockolets, elbolets, etc. shall not be installed on forged steel fittings on hydrocarbon piping, except for drains and instrument points. Exceptions to this rule may be permitted provided prior approval is obtained from Company.

3.1.2 Layout

1. Piping shall be run either platform north/south or platform east/west.
2. Diagonal runs shall not be used without Company permission.
3. Uninsulated lines shall be located so that bottom (B.O.P.) or top (T.O.P) of pipes are at the same elevation.

4. Lines running Platform North or Platform South shall be a minimum of two (2) foot different in elevation from lines running Platform East or Platform West.
5. Insulated lines shall have the same bottom (B.O.P.) or top (T.O.P.) of pipes as adjacent uninsulated lines, whichever is the reference.
6. Piping shall be designed to permit the most efficient and economical layout of equipment.
7. Arrangements shall provide for servicing or removal of instruments, pump casings and rods, exchanger bundles, compressor pistons, and other integral equipment parts.
8. Arrangements shall provide access to manholes and access openings.

3.1.3 Clearance and Accessibility

1. Accessibility
   a. Valves and instruments shall have maximum accessibility.
   b. Control valves, relief valves, and lubricated valves shall be located where they can be serviced conveniently.
   c. Provision shall be made for operating frequently used valves from platforms, ladders, or from the deck.
   d. The use of chainwheels and extension stems shall be kept to a minimum (chains shall clear operating level by 3 foot 6 inch).
   e. Gauge glasses, thermometers, and pressure gauges shall be arranged so that they are visible from the deck.
   f. Drain and vent valves shall be located as conveniently as possible at or near operating levels.
2. Overhead or Stumbling Hazards

a. Piping systems shall be arranged to prevent interference with equipment maintenance and to prevent overhead or stumbling hazards in designated access or walkway areas.

b. Where interference with equipment removal cannot be avoided, removable spool pieces shall be provided.

3. Minimum Clearances

The following minimum clearances shall be observed. (Dimensions are to the bottom of pipe or bottom of insulation):

a. Operating area (overhead): 7 foot 6 inches.

b. Lines at grade or deck elevation: eight (8) inches.

c. Meter runs: 2 foot 6 inches between pipe and deck where practical.

4. Pipe Stiles

Lines crossing walk areas, other than overhead lines, shall be provided with a pipe stile fabricated in accordance with TEX.S.400.

5. Clearances

a. Clearance shall be provided between lines to permit access for removal and/or repair.

b. A minimum of two (2) inches shall be provided between a pipe and the largest flange or fitting of an adjacent pipe.

c. Insulation thickness and movement due to thermal expansion or contraction shall be considered when determining pipe spacing and bottom elevation.

3.2 Thermal Expansion And Contraction Design

3.2.1 General

1. Piping shall be designed so that adequate provision is made for thermal expansion and contraction in accordance with ANSI/ASME B31.3.

2. Piping six (6) inches and larger operating at 150 degrees F. and above shall be analyzed by precise calculations such as the Kellogg method or computer programs.

3. Piping systems shall be designed so that forces on equipment due to static or operating loads, including those produced by expansion, shall not exceed the allowable forces or cause misalignments greater than permitted by the equipment manufacturers.

3.2.2 Expansion Joints

1. Slip joint or bellows-type expansion joints, or creased or corrugated pipe shall not be used to provide flexibility, except on gas engine exhaust piping and other special applications as specified.

2. Excessive stress in the piping systems due to expansion or contraction shall be prevented by the use of expansion bends and loops, or other Company approved means.

3.2.3 Support

Hangers and supports shall be installed so that they do not interfere with the free expansion and contraction of the piping between anchors.

3.3 Cold Spring Design

3.3.1 General

1. Cold spring shall be used only to reduce forces and moments, and thermal expansion.

2. Cold spring shall not be used to reduce stresses.

3.3.2 Method

1. Piping systems whose operating temperature exceeds 300 degrees F. shall be cold sprung during erection at the rate of 50 percent of the calculated thermal expansion from 70 degrees F. to nominal operating temperatures, except where otherwise specified on the drawings or herein.

2. All lines operating at less than 300 degrees F. shall be cold sprung only where specified on the Contract Drawings.

3.4 Hangers, Supports, and Flexibility

3.4.1 General

1. Hangers and supports shall be designed for fabrication and installation in accordance with ANSI B31.3, Chapter II, Part 5.
2. Supports shall be designed assuming that all lines shall be filled with water for hydrotesting.

3.4.2 Adjustable Hangers

1. Hangers that are adjustable under load shall be used for lines where it is desirable to maintain an exact elevation. Otherwise, rigid hangers may be used.
2. Where adjustable hangers are used, the adjusting nut shall be double nuts.

3.4.3 U-Bolts

1. All U-bolts and nuts shall be cadmium plated.
2. U-bolts shall use four (4) nuts each.

3.5 Anchors and Guides

3.5.1 General

The use of anchors and guides shall be kept to an absolute minimum as dictated only by their necessity to prevent extreme misalignment, localized overstressing of pipe materials, or excessive forces or moments on equipment.

3.5.2 Slip Shoes

1. Steel slip shoes shall be provided to prevent abrasion of both bare pipe and pipe insulation.
2. Steel slip shoes shall be at least 100 percent longer than the calculated axial movement of the piping, and shall have a minimum length of six (6) inches and a maximum length of twelve (12) inches.

3.6 Drains and Vents

3.6.1 Drains

1. Drain valves shall be installed where liquid can be trapped between isolating valves (bleed ring may be used in this instance).
2. Sample valves, where required, shall be placed upstream of control valves.

3.6.2 Vents

1. The high points of all lines shall be provided with 3/4 inch (minimum) vent connections which may be plugged without a valve (unless required for start-up or during operation, when a valve with plug or cap is required).
2. The low points of all lines shall be drained by the following minimum size connections:

Line Size	Drain Size
4 inch and smaller	3/4 inch
6 inch and larger	1 inch

3.7 Strainers

To ensure optimum operation, lines conveying materials containing foreign matter detrimental to the operation of instruments or equipment shall have strainers of adequate capacity and design.

3.8 Valves

3.8.1 Drain and Vent Valves

Miscellaneous drain and vent valves that are not piped to specific locations shall be plugged on the open end in sweet service, or blind flanged in sour service.

3.8.2 Relief Valves

Relief valves that relieve into the flare or relief systems shall be piped in such a manner that neither condensate nor entrained liquids can accumulate to form an abnormally high back pressure in the system.

3.8.3 Globe Valves

Globe valves shall be used only where throttling is required. Valves operated in wide open and blocked-in service shall be gate, plug, butterfly, or ball type as required for product and service.

3.8.4 Miscellaneous Valves

1. Fire water control and block valves shall be of the indicating type.
2. The first process valve from any piping header, vessel vent, drain, etc. shall be a minimum of 3/4 inch.

3.9 Piping to Pumps, Vessels, and Equipment

3.9.1 General

1. Piping at equipment shall be arranged and supported such that equipment, control valves, etc., can be readily removed with a minimum of dismantling and without the addition of supplemental supports.
2. Pipe or equipment supports shall be designed in such a manner that they do not have to be cut out for the removal of the supported pipe or equipment.

3.9.2 Pump Piping

1. Pump suction lines shall be routed to the pumps without creating vapor traps in the line.
2. Check valves in pump discharge lines shall be located between the pump and the first block valve.
3. Piping at pumps shall have adequate flexibility so that expansion or dead loads shall not impose excessive strains on the pump casings.
4. Removable spool pieces shall be provided on piping for which the arrangement does not permit removal of the pump without disturbing the piping. Flanged check valves or flanged fittings between discharge and suction block valves and pumps may be considered in lieu of spools.

5. Provisions shall be made for draining and venting suction and discharge lines as specified in Subsection 3.6. Pump drain connections shall be piped to closed drain headers.

6. Eccentric reducers used on horizontal pump suctions shall be installed with top flat (TF).

3.9.3 Centrifugal Compressor Piping

1. Suction and discharge piping shall be arranged to provide clearance for the removal of units and to facilitate pulling rotors with a minimum of pipe dismantling.

2. Piping shall be arranged to avoid obstruction to the compressor, instrumentation, and seal oil components.

3. Lube oil return piping shall be sloped without pockets from the compressor or turbine to the reservoir for gravity draining.

3.9.4 Reciprocating Compressor Piping

1. Suction and discharge piping shall be designed to eliminate or otherwise minimize the effects of pulsation and vibration.

2. Pulsation dampeners or bottles shall be located as near as practical to the compressor cylinders.

3. Piping shall be arranged to permit access for operation and maintenance.

3.9.5 Vessel Piping

1. Facilities for venting each vessel at its high point shall be provided either by a connection in the vessel or by a connection in the pipe exiting from the top of the vessel.

2. Relief valve vent piping, other than short stacks, shall be supported such that the valve can be removed without providing temporary support for the vent line.

3. Inlet and outlet connections shall be arranged to provide maximum distance between nozzles on horizontal separators and surge vessels.

4. Access to vessel manways, gauge glasses, and primary level instruments shall be kept clear of piping and other obstructions to facilitate operation and maintenance of the units.

5. Unions shall not be installed between a pressure vessel and the first block valve.

3.9.6 Exchanger Piping

1. Exchanger orientation and piping shall provide for operating access, maintenance clearance, removal of the exchanger as a unit, and shall permit pulling of the tube bundle, or rodding or replacement of tubes without extensive dismantling of piping.

2. Cooling water piping to tubular units shall be arranged such that the exchanger remains full of water during a water supply failure.

3. Air shall be self-venting from the exchanger.

4. Drain and vent connections on the shell and tube side of tubular units shall be provided with valves.

5. Valved chemical cleaning connections shall be provided as required.

3.10 Drawings

Piping drawings shall show dimensions in feet and inches except that inches only shall be used when the dimensions are less than two (2) feet.

4. PIPING CONNECTIONS

4.1 General

1. In general, all hydrocarbon piping two (2) inch and larger shall be of welded construction.

2. 2.Size 1-1/2 inch and smaller may be screwed, shall be 3/4 inch (minimum) in size, and shall include a

screwed plug or cap. Specifications for screwed piping also apply to pipe tubing and fittings.

4.2 Butt Weld Connections

4.2.1 Materials

Butt weld fittings for all piping shall conform to ANSI B16.9 and shall be in accordance with the individual piping specification for particular class of service.

4.2.2 Ells

1. Mitered ells shall not be used in pressurized piping system except under special conditions and with prior approval of Company.
2. Use of mitered ells is allowed in open deck drain system.
3. Short radius ells shall be used only where space is limited and with prior approval of Company.

4.2.3 Bevel

Butt welding of pipe and fittings shall be beveled for either 30 degrees or 37-1/2 degrees. (The 30 degree bevel is preferred). 30 degree bevels may be welded to 37-1/2 degree bevels.

4.3 Socket Weld Connections

Piping 1-1/2 inch or less in diameter shall be socket-welded for:

1. Hydrocarbon service above 200 degrees F. (Non-NACE).
2. Hydrocarbon service subject to vibration.
3. Glycol service (Non-NACE).
4. Heat transfer fluids.
5. Sour hydrocarbon service (NACE). No Screwed Piping Permitted.

Exceptions to these restrictions are permitted in special instances in accordance with API RP 14E, Section 2.7 and shall be approved by Company.

4.4 Flange Connections

4.4.1 Materials

Flanges shall conform to ANSI B16.5 and be in accordance with individual piping specification for the particular class of service intended.

4.4.2 Flange Faces

1. Raised face flanges shall have standard serrated finished faces.
2. Ring joint flanges shall have ANSI standard grooving.
3. Flanges mating to Class 125 pound cast iron flanges shall be flat face.

4.4.3 Weld Neck Flanges

Weld neck flanges are preferred for all services and shall be bored to the inside diameter of the connecting pipe.

4.4.4 Reducing Flanges

Reducing flanges or flanged fittings shall be used only where welding reducers, swage nipples, or standard fittings are impractical.

4.4.5 Slip-On Flanges

Slip-on flanges may be used on class 150 pound service if required due to space limitations and with prior approval of Company.

4.4.6 Flange Blinds

1. Spectacle blinds rather than spade-type blinds shall be provided.
2. The thickness of blinds shall be calculated in accordance with the ANSI B31.3.
3. Jack screws shall be provided as required.

4.4.7 Flange Gaskets

1. Insulating flange gasket sets shall be installed between submarine pipelines and platform risers, and between platform and bridge piping.
2. In cases where class 150 pound ANSI series steel flange is bolted to class 125 pound

ANSI cast iron flange, the steel flange shall be flat face and a full gasket shall be used.

4.5 Screwed Thread Connections

4.5.1 Materials

1. Swage and pipe nipples shall be in accordance with individual piping specification for particular class of service.
2. Forged steel screwed fittings shall conform to ANSI B16.11 and be in accordance with individual piping specification for particular class of service.
3. Pipe nipples which support gauges, valves, or other objects shall be a minimum of Schedule 160.
4. Square head plugs, threaded bushings, all-thread pipe nipples, or street ells shall not be used. Swage nipples shall be used instead of threaded bushings.
5. All threaded pipe connections shall have ANSI standard pipe taper threads.

4.5.2 Unions

1. Screwed piping shall use unions for removal of equipment.
2. Unions shall be located on the low pressure side of a block valve.
3. Unions shall not be installed between a pressure vessel and the first block valve.

4.5.3 Vibration

1. The arrangement of threaded piping shall be such that vibration shall be kept to a minimum.
2. All nipples, regardless of length, connected to a reciprocating pump or other equipment and piping where vibration is anticipated, shall be braced.

4.5.4 Connection to Welded Piping

Screwed hydrocarbon piping systems shall be isolated from welded piping systems by socket weld connections, with the exception that, 3/4 inch pipe used for vents, drains, sample gauge, test connections and instrument piping, threadolets or screwed couplings may be used.

5. SPECIAL PIPING

5.1 Hydrocarbon Service

5.1.1 Process Lines

1. Cast iron pipe or piping components shall not be used in hydrocarbon service.
2. Unions shall be kept to a minimum in hydrocarbon service.

5.1.2 Vent and Flare Exhaust

1. Vent header piping shall be arranged to avoid pockets where liquids may accumulate.
2. Headers shall be designed with a minimum 1/2 percent (0.5 percent) per 100 feet slope to the flare drum.

5.1.3 Instrument Connections (See Drawings for Typical Instrumentation Installation Details)

1. Instrument connections shall be provided as specified in TEX.I.100, "General Instrument Specification", or as indicated on the Contract Engineering and/or Utility Flow Diagram Drawings.
2. Service pressure gauge connections shall be 1/2 inch NPT, except in sour service where a two (2) inch flanged connection shall be used.
3. Service temperature connections shall be 3/4 inch NPT, except in sour service where a two (2) inch flanged connection shall be used.
4. Connections for pressure or flow instruments shall have a gate valve at the header or vessel.
5. Instrument bridles shall have block valves at the vessel.

5.1.4 Control, Relief, and Special Valves

1. A bleed valve shall be installed between each block valve (high pressure side only) and safety valve.
2. Safety valves which discharge into a closed header shall be arranged such that the discharge pipe enters above the header center line to prevent trapping liquids in the tail pipe.

5.2 Utilities

5.2.1 Water Lines

1. Potable and salt water utility lines shall be elevated when practical.
2. Hose connections of 3/4 inch size, with globe valve, shall be provided such that all working areas may be reached with a fifty (50) foot length of hose.

5.2.2 Air Lines

1. Service air systems shall be provided to supply air for maintenance tools, cleaning, and emergency use.
2. Hose connections of 3/4 inch size, with globe valve, shall be provided such that all working areas may be reached with a fifty (50) foot length of hose.
3. Instrument air supply headers shall be in accordance with TEX.I.100, "General Instrument Specification".

5.2.3 Drains and Sewer Lines

1. Operational low point drains in process service shall be piped to the drain system. Each line shall include a 3/4 inch minimum block valve.
2. Gravity flow drain and sewer lines shall be sloped not less than 1 percent in the pipe header areas, and shall not be smaller than four (4) inch diameter. Discontinuities in line slopes, such as slope changes or inverted siphons (sags), shall be avoided.

3. Branches shall be connected to mains at an angle of 45 degrees with a minimum slope of 1 percent.

4. Equipment and floor drains shall have traps or other means to prevent back flow of gases as noted on Contract Drawings.

5. Cleanouts shall be provided on all headers with reasonable access provided.

6. Cleanouts shall be provided for sewer lines and open drain lines at fifty (50) foot intervals.

7. Consideration shall be given to expected maximum rainfall in establishing the design capacity of drain systems.

5.2.4 Fire System Piping

1. The design and arrangement of the looped firewater main shall be in accordance with NFPA Standard 24.

2. The sizes of distribution mains, laterals, and risers shall be calculated to provide the flow rates and pressures required.

3. Where distribution mains are normally charged with saltwater, an allowance for corrosion shall be made.

4. For feeds to sprinkler and water spray systems, the transition between the distribution piping and the system piping shall be at the face of the discharge flange of the system block valve. Sprinkler and water spray system designs and arrangements shall be in accordance with NFPA Standard 13 and NFPA Standard 15.

5. Wet pipe sprinkler systems, utilizing saltwater, shall normally be charged with fresh water, or shall be provided with an adequate corrosion allowance.

5.3 Hot Surface Insulation

5.3.1 General

1. Process piping shall be insulated in accordance with TEX.M.110, "Thermal

Insulation Specification", unless otherwise indicated herein.

2. The insulation type and thickness shall be determined based on the operating temperature of the line(s) to be insulated.

5.3.2 Piping to be Insulated

1. Surfaces normally accessible to personnel with operating temperatures greater than 160 degrees F. (71 deg. C.), shall be insulated.

2. Piping for heat transfer media shall be insulated.

6. SERVICE DESIGNATION

The following is a list of the service designations:

AB	Breathing Air
AI	Instrument Air
AS	Starting Air
AU	Utility Air
BA	Bulk Barite
CA	Amine
CE	Bulk Cement
CG	Glycol
CH	Hypochlorite
CI	Corrosion Inhibiter
CM	Miscellaneous Chemicals
DC	Closed Drain
DE	Demulsifier
DD	Deck Drains
DO	Open Drain
DS	Sanitary Drain
EX	Engine Exhaust
FG	FueL Gas
FO	Diesel Fuel
GI	Gas Phase Corrosion Inhibitor
GU	Utility Gas
HM	Heating Medium
LI	Liquid Phase Corrosion Inhibitor
OH	Hydraulic Oil
OL	Lube Oil
OS	Seal Oil
PC	Polyelectrolyte

PF	Process Liquid and Two Phase Production
PI	Paraffin Inhibitor
PV	Process Vapor
SI	Scale Inhibitor
VA	Atmospheric Vent
VF	Vent to Flare
WC	Cooling Water
WD	Drilling Water
WF	Fire Water
WH	Chilled Water
WN	Demineralized Water
WP	Potable Water
WS	Sea Water
WW	Waste Water
WX	Produced Water

7. STANDARD ABBREVIATIONS

"A"

Approx.	Approximate
Asb.	Asbestos
Atmos.	Atmosphere

"B"

Bbl.	Barrel
BE	Beveled End
BF	Bottom Flat
Bl.	Black
Bld.Flg.	Blind Flange
B.O.P.	Bottom of Pipe
B-P	Beveled End-Plain End
Brz.	Bronze
B-T	Beveled End-Threaded End
Bt.	Bottom
BW	Butt Weld

"C"

C-C	Center to Center
CI	Cast Iron
CL	Center Line
Cplg.	Coupling
CS	Carbon Steel
Ch. Va.	Check Valve
c/w	Complete with
CWP	Cold Working Pressure

"D"

Dia.	Diameter
Dim.	Dimension
Disch.	Discharge
Dk.	Deck
Drn.	Drain
DW.	Domestic Water
Dwg.	Drawing

"E"

Ecc.	Eccentric
E-E	End to End
E-F	Electric Furnace
El.	Elevation
Elect.	Electrical
E.W.	Erector Weld
Ell.	Elbow
Exh.	Exhaust
Exp.	Expansion

"F"

Fab.	Fabricated
Fcg.	Facing
F&D	Faced & Drilled
FE	Flanged End
FF	Flat Faced
Flg.	Flange
FS	Forged Steel
Ft.	Foot
FW	Fire Water

"G"

Gal.	Gallon
Galv.	Galvanized
G.G.	Gauge Glass
Gl. Va.	Globe Valve
Gr.	Grade
Graph.	Graphite
G. Va.	Gate Valve

"H"

H.C.	Hose Connection
Hd.	Head
Hdr.	Header
Hex.	Hexagon
Horiz.	Horizontal

HP	Horsepower
Hvy.	Heavy
	"I"
ID	Inside Diameter
In.	Inch
Ind.	Indicating
Insul.	Insulating
	"J"
Jt.	Joint
JW	Jacket Water
	"L"
LCV	Level Control Valve
LLC	Liquid Level Control
L.P.	Low Pressure
LR	Long Radius
Lrgr.	Larger
	"M"
Max.	Maximum
MH.	Manhole
MI	Malleable
Min.	Minimum
Misc.	Miscellaneous
Mk.	Mark
MW	Manway
	"N"
No.	Number
Nod.	Nodular
Noz.	Nozzle
NPS	Nominal Pipe Size
NPT	National Pipe Thread
	"O"
OCT	Oil Center Tool Co.
OD	Outside Diameter
O.H.	Open Hearth
O-O	Outside to Outside
OS&Y	Outside Screw and Yoke
	"P"
PE	Plain End
PI	Pressure Indicating Gauge
Pl. Va.	Plug Valve

Plgd.	Plugged
Pot. W.	Potable Water
Press.	Pressure
PSIG	Pounds Per Square Inch Gauge
PVS	Pressure Safety Valve
P-T	Plain End-Threaded End

"R"

Rad.	Radius
Red.	Reducer
RF	Raised Face
Rtg	Rating
RTJ	Ring Type Joint

"S"

S.A.W.	Submerged Arc Weld
S.C.	Sample connection
Sch.	Schedule
Scrwd.	Screwed
SE	Screwed Ends
Smls.	Seamless
SO	Slip-On
Sq.	Square
SR	Short Radius
S-S	Seam to Seam
Std.	Standard
Std. Wt.	Standard Weight
Stl.	Steel
Suct.	Suction
S.F.	Semi-Finish
SS	Stainless Steel
SJ	Solder Joint
Smlr.	Smaller
SPS	Standard Pipe Size

"T"

TBE	Threaded Both Ends
T&C	Threaded & Coupled
Temp.	Temperature
TF	Top Flat
Thrd.	Threaded or Thread
TI	Temperature Indicator
TOE	Threaded One End
T.O.P.	Top of Pipe
TSE	Threaded Small End
TW	Thermometer Well

"V"

Va.	Valve
Vert.	Vertical

"W"

WE	Weld End
WN	Weld Neck
WP	Working Pressure
Weld	Welding
W.T.	Wall Thickness
W.O.G.	Water, Oil, Gas
W.P.	Working Pressure
W.S.P.	Working Steam Pressure

"X"

XS	Extra Strong
XXS	Double Extra Strong

PIPING MATERIALS SPECIFICATION

SPECIFICATION NO. TEX.P.110

FEB 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		
Approved by:		Company Approval:				

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Inspection and Testing Requirements Sheet YES[ ] NO[X]

2. Documentation Requirements Sheet YES[ ] NO[X]

TABLE OF CONTENTS

FIGURES

P0110F23 Piping Specification N
P0110F24 Piping Specification N1
P0110F25 Piping Specification P
P0110F26 Piping Specification Q1
P0110F27 Piping Specification R
P0110F28 Piping Specification S
P0110F29 Piping Specification T
P0110F30 Piping Specification U
P0110F31 Piping Specification V
P0110F32 Piping Specification W1
P0110F33 Piping Specification X
P0110F34 Piping Specification Z

1. SCOPE

The Piping Specification sheets in this specification define material usage requirements for the various piping services.

2. REFERENCES

2.1 Company Specifications

The following Company specification supplements this specification:

1. TEX.P.120, "Valves".

3. PIPING SERVICE DESCRIPTION

The Specification sheets are ordered in accordance with the following table.

In this specification "NACE" service shall be interpreted as service in which sulfide stress cracking (SSC) is anticipated.

CLASS	SERVICE	PRESSURE RATING
A	Condensate, Closed Drains, Process Vapor, Chilled Water, Vent to Flare, Atm. Vent, Demulsifier, Crude, Diesel Fuel, Open Deck Drains, Fuel Gas.	ANSI 150
A1	Process Vapor, Crude, Condensate, Closed Drain, Vent to Flare, Atm. Vent (NACE).	ANSI 150
A2	Hot Oil, Heating Medium, Engine Exhaust.	ANSI 150
A3	Produced Water.	ANSI 150
A4	Glycol (TEG), Amine (DGA) (NACE).	ANSI 150
A5	Freon Cooling Medium.	
B	Process Vapor, Condensate, Crude.	ANSI 300
B1	Process Vapor, Crude, Condensate (NACE).	ANSI 300

CLASS	SERVICE	PRESSURE RATING
B2	Glycol (TEG), Amine (DGA) (NACE).	ANSI 300
D	Condensate, Crude, Process Vapor.	ANSI 600
D1	Process Vapor, Condensdate, Crude (NACE).	ANSI 600
D2	Glycol (NACE).	ANSI 600
E	Process Vapor, Crude, Condensate.	ANSI 900
E1	Process Vapor, Crude, Condensate (NACE).	ANSI 900
F	Process Vapor, Crude, Condensate.	ANSI 1500
F1	Process Vapor, Crude, Condensate (NACE).	ANSI 1500
G	Process Vapor, Crude, Condensate.	ANSI 2500
G1	Process Vapor, Crude, Condensate (NACE).	ANSI 2500
J	Desalination/Demineralized Water, Hypochlorite.	ANSI 150
K	Starting Air, Inst. Air, Utility Air, Potable Water.	ANSI 150
L	Fire Water, Washdown Water.	ANSI 150
M	Sanitary Drain, Saltwater Cooling Headers.	ANSI 150
N	Breathing Air, Scale Inhibitor, Demulsifier, Corrosion Inhibitor, Polyelectrolyte, Paraffin.	TUBING
N1	Hydraulic Oil.	ANSI 2500
P	Sour Gas, Vent to Flare (NACE)	ANSI 150
Q1	Lube Oil, Seal Oil (NACE)	ANSI 150
R	Sour Gas (NACE)	ANSI 300
S	Sour Gas (NACE)	ANSI 900
T	Bulk Barite, Cement	ANSI 150
U	Lube Oil, Seal Oil (NACE)	ANSI 300
V	Sour Gas (NACE)	ANSI 150
W1	Lube Oil, Seal Oil (NACE)	ANSI 600
X	Sour Gas (NACE)	ANSI 300

CLASS	SERVICE	PRESSURE RATING
Z	Sour Gas (NACE)	ANSI 900

VALVE SPECIFICATION

SPECIFICATION NO. TEX.P.120

FEB. 97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		
Approved by:		Company Approval:				

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Inspection and Testing Requirements Sheet YES[X] NO[ ]

2. Documentation Requirements Sheet YES[X] NO[ ]

TABLE OF CONTENTS

1. SCOPE

This specification defines valve requirements for each valve designation identified on the piping material specification sheets.

Valve specifications are grouped by their first digit designation which corresponds to the pressure ratings in the piping material specifications sheets.

Valves designations or tags with a "K" for the final digit (e.g. A2RK) are for use in sour process service and shall be constructed of materials resistant to sulfide stress cracking in accordance with the National Association of Corrosion Engineers (NACE) Standard MR-01-75, latest edition. Alternate materials to those specified may be acceptable if they are in accordance with NACE Standard MR-01-75, latest edition and are approved by the Company.

2. REFERENCES

2.1 Company Specifications

The following Company specifications supplement this specification:

1. TEX.P.110, "Piping Materials Specification".

2.2 Codes and Standards

Valves shall be in accordance with the latest edition of the following codes and standards as applicable:

2.2.1 National Association of Corrosion Engineers (NACE)

1. MR-01-75, "Sulfide Stress Cracking Resistant Metallic Material for Oil Field Equipment".

3. GENERAL

1. Valves specified on the valve specification sheets and called out on mechanical flowsheets shall conform to the sheet's general specifications except in special services (i.e. high temperatures, high corrosion, etc.).

2. In high temperature service (i.e. treater, reboiler, etc.), Contractor shall select and install only those valves listed in the specification sheets with seating materials suitable for the highest service temperature at full valve working pressure.
3. In special service applications where materials different from specification sheets are required, Contractor shall select only approved, suitable valves, and notify Company of the selection.
4. Valves shall be readily accessible by means of access platforms, stairways or ladders.
5. Valves requiring periodic testing shall be accessed by means
6. Blasting and Painting of Valves
   a. During blasting and painting of valves, suitable flange covers shall be installed to prevent internal valve damage.
   b. Valve flange sealing surfaces and identification tags shall be suitably protected during blasting and painting.
   c. Identification tags shall be clearly legible after blasting and painting.
   d. Flange face surfaces shall be lightly buffed and greased after blasting and painting and prior to flange mating.
   e. Flange bolt holes shall be completely blasted and painted.
7. Except for check valves, each valve shall come equipped with a compatible handle or gear operator.
8. Valves shall have cast or forged steel bodies.

4. MANIFOLD VALVES

1. Valves shall be in-line repairable valves.
2. Where ball valves are called for, valves shall come equipped with a body cavity bleed plug.
3. Handles, if necessary, shall be modified for proper operation with no handle/stem interferences.

4. Valves shall be designed and laid out such that the valve stems are oriented ninety (90°) degrees from true vertical. In this configuration, valves shall be in-line repairable and each valve handle shall be secured to the valve with no interferences when fully rotated.

5. Valves shall be of firesafe design, properly certified for each size to API RP 6F, 6FA or 607 firetest standards. Uncertified valves shall be replaced with certified valves.

5. Ball Valves

1. Double block and bleed valves shall be equipped with a body cavity port with a 316 stainless steel valve.

2. Valves with bore sizes six (6") inches and larger shall be equipped with suitable gear operators. Six (6") inch reduced port valves may be equipped with wrench operators.

3. Valves shall be designed and laid out such that in the horizontal plane, valve stems are oriented ninety (90°) degrees from true vertical and valve ball rotation is "up and away" from flow with the ball in the closed position. This valve orientation reduces ball scoring in the presence of sand or trash accumulation in the bottom of the piping.

4. Reduced port ball valves with "non-centered" balls shall be oriented and installed with the "shorter end-to-ball dimension" upstream to flow direction.

5. Floating ball valves as a rule shall not be installed in the "vertical up" position.

6. Floating ball valves, three (3") inches regular port and smaller, shall be allowed in 600# ANSI service, provided breakaway torques are less than or equal to 200 ft-lbs. Only valve types listed in the 150# ANSI listings shall be acceptable.

7. Valves shall be of an A.P.I. standard length. Valves with threaded or tapped flange(s) shall not be allowed.

8. Orbit ball valves shall be prohibited in vessel drain valve or pigging applications.

9. Valves shall be of firesafe design, properly certified for each size to API RP 6F, 6FA or 607 firetest standards. Uncertified valves shall be replaced with certified valves.

6. CHECK VALVES

1. Check valves in most cases shall be of the swing (flapper) check valve type. Piston type check valves shall be employed downstream of rotating equipment (i.e., compressors, pipeline pumps).
2. Valves shall be designed and laid out in most cases in the horizontal plane. Where necessary, vertical swing check valves shall be installed only in the "vertical up" position provided the valve is equipped with a flapper stop to ensure flapper retraction.
3. Piston check valves shall be equipped and installed in accordance with manufacturer recommendations for different services and applications.
4. Check valves employed directly downstream of relief valves with near atmospheric pressure settings shall be properly counterbalanced such that the valves do not hold higher pressure than the pressure safety valve.
5. API valves shall be of firesafe design, properly certified for each size to API RP 6F, 6FA or 607 firetest standards. Uncertified valves shall be replaced with certified valves.

7. GLOBE VALVES

1. Globe valves shall be installed in most cases parallel to liquid level control valves.
2. Valve trim in valves shall be sized and installed as large as the trim in the parallel liquid level control valves.
3. Fisher globe valves shall be acceptable where parallel to liquid control valves. Valve bodies shall be like the liquid control valves but coupled to a suitable Fisher 1008 handwheel actuator. Where globe valves are not parallel to liquid level valves, Fisher globe valves with 1008 actuators

shall remain acceptable. The type of Fisher valve shall be determined by Company Engineer.

8. BUTTERFLY VALVES

1. Valves in vessel drain applications shall be of the type with a companion blind flange.
2. Valves shall be equipped with spring loaded handles with detents.

9. GATE VALVES

1. Gate valves, in general, shall be of the non-rising or rising stem, non-balanced or balanced, slab or wedge gate, bolted bonnet type.
2. Where gate valves are to be actuated, only valves with slab gates shall be used.

10. GAUGE VALVE

Gauge valves, in general, shall be soft or hard seated valves with fire resistent (graphitic material) stem packing.

11. NEEDLE VALVES

Needle valves, in general, shall be hard seated valves.

12. PRESSURE RELIEF VALVES

1. Valves shall be of the pilot ("no flow" pilot) operated, externally tested, type in most cases.
2. Spring actuated valves when specified shall be installed with means to properly isolate and test the valve.
3. Pilot operated valves shall be oriented and installed with the pistons in the vertical plane. Valves shall not be oriented and installed with pistons laid out ninety (90°) degrees from true vertical.

13. FLOW CONTROL VALVES (CHOKES)

Valves shall be of the rising needle, adjustable type, in most cases.

14. VALVE GROUP "A" SPECIFICATIONS

14.1 Gate Valves

D1ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem Disc, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D1S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem Disc, Disc & Seats; Graphited Asbestos Packing.

A1R 2" & Larger

ANSI l50# Raise-Face Flanged Ends with Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Disc, & Seats, Graphite Asbestos Packing, & Gear Operator on l2" & Larger or when recommended by the Manufacturer.

14.2 Ball Valves

D2ZK 1-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats. (Materials shall meet NACE standard MR-01-75 latest edition.)

D2S 1-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats.

A2RK 2" & Larger

ANSI l50# RF Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated replaceable Ball and Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball, Fire Safe, Teflon or reinforced Teflon Seats & Gear Operator on 8" & Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

A2R 2" & Larger

ANSI l50# RF Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated replaceable Ball and Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball, Fire Safe, Teflon or reinforced Teflon Seats & Gear Operator on 8" & Larger or when recommended by the Manufacturer.

A2W 2" & Larger

Minimum pressure rating of 285 psig at 100°F, Weld Ends, Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated replaceable Ball and Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball, Fire Safe, Teflon or reinforced Teflon Seats & Gear Operator on 8" & Larger or when recommended by the Manufacturer.

14.3 Globe Valves

D4ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited

Asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

D4S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing.

A4RK 2" & Larger

ANSI l50# RF Flanged Ends with Bolted Bonnet, Out-side Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

A4R 2" & Larger

ANSI l50# RF Flanged Ends with Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing.

A4W 2" & Larger

Minimum pressure rating of 285 psig at 100°F, Weld Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing.

14.4 Check Valves

Piston-type check valves shall be used where pulsating flow is anticipated.

D5ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS

Disc, Stellite Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D5S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends and screwed or bolted bonnet, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc, Stellite Seats.

A5RK 2" & Larger

ANSI l50# RF Flanged Ends with Horizontal Swing, Bolted Bonnet, Replaceable Clapper & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body Bonnet; 316 SS Clapper & Stellite Seats. Viton Seals in Gas Service. (Materials shall meet NACE Standard MR-01-75 latest edition.)

A5R 2" & Larger

ANSI l50# RF Flanged Ends with Horizontal Swing, Bolted Bonnet, Replaceable Clapper & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body Bonnet; 316 SS Clapper & Stellite Seats. Viton Seals in Gas Service.

A5W 2" & Larger

Minimum pressure rating 285 psig at 100°F, Weld Ends, Horizontal Swing, Bolted Bonnet, Replaceable Clapper & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body Bonnet; 316 SS Clapper & Stellite Seats. Viton Seals in Gas Service.

A5RWK 2" & Larger

ANSI l50# RF Flanged Facings, Horizontal Swing, Wafer Type, Replaceable Clapper & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body Bonnet; 316 SS Clapper & Stellite Seats. Viton Seals in Gas Service. (Materials shall meet NACE Standard MR-01-75 latest edition.)

A5RW 2" & Larger

ANSI l50# RF Flanged Facings with Horizontal Swing, Wafer Type, Replaceable Clapper & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body; 316 SS Clapper & Stellite Seats. Viton Seals in Gas Service.

14.5 Needle Valves

F6SK l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F6S l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete 2with SS operator.

F9SK l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F9S l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

14.6 Butterfly Valves

A7RK 3" & Larger

150# ANSI, Raised Face, High Performance, Lug Type (tapped) Body, Replaceable Disc & Seats, Cast Steel (ASTM A216-WCB) Body, 316 SS Disc, Pins & Shaft; Offset & Eccentric Shaft. TFE Seats & Seals, complete with positioning Lever Operator; 10" & Larger Gear Operator, Fire Safe. (Materials shall meet NACE Standard MR-01-75 latest edition.)

A7R 3" & Larger

150# ANSI, Raised Face, High Performance, Lug Type (tapped) Body, Replaceable Disc & Seats, Cast Steel (ASTM A216-WCB) Body, 316 SS Disc, Pins & Shaft; Offset & Eccentric Shaft. TFE Seats & Seals, complete with positioning Lever Operator; 10" & Larger Gear Operator, Fire Safe.

14.7 Three Way Valve

K9R 2" & Larger

Three way, ANSI l50# RF Flanged Ends with Reduced Ports (unless otherwise noted), Bolted Bonnet, Non-lubricated replaceable Ball and Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball, Fire Safe, Teflon or reinforced Teflon Seats & Gear Operator on 8" & Larger or when recommended by the Manufacturer.

15. VALVE GROUP "B" SPECIFICATIONS

15.1 Gate Valves

D1ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem Disc, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D1S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem Disc, Disc & Seats; Graphited Asbestos Packing.

B1RK 2" & Larger

ANSI 300# RF Flanged Ends with Bolted Bonnet, Out-side Screw & Yoke-rising Stem, Solid Wedge Disc, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Disc, & Seats, Graphite Asbestos Packing, & Gear Operator on l2" &

Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

15.2 Ball Valves

D2ZK 1-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats. (Materials shall meet NACE standard MR-01-75 latest edition.)

D2S 1-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats.

B2RK 2" & Larger

ANSI 300# RF Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball; Fire Safe; Teflon or Reinforced Teflon Seats & Gear Operator on 6" & Larger or when recommended by the Manufacturer for Smaller Sizes. (Materials shall meet NACE Standard MR-01-75 latest edition.)

B2R 2" & Larger

ANSI 300# RF Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball; Fire Safe; Teflon or Reinforced Teflon Seats & Gear Operator on 6" & Larger or when recommended by the Manufacturer for Smaller Sizes.

15.3 Globe Valves

D4ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

D4S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing.

B4RK 2" & Larger

ANSI 300# RF Flanged Ends with Bolted Bonnet, Out-side Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug; Stellite Seats, & Graphite Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

B4R 2" & Larger

ANSI 300# RF Flanged Ends with Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug; Stellite Seats, & Graphite Asbestos Packing.

15.4 Check Valves

Piston checks shall be used where pulsating flow is anticipated.

D5ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc, Stellite Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D5S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends and screwed or bolted bonnet, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc, Stellite Seats.

B5RK 2" & Larger

ANSI 300# RF Flanged Ends with Horizontal Swing, Bolted Cover, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Disc & Seat. Viton '0' Rings. (Materials shall meet NACE Standard MR-01-75 latest edition.)

B5R 2" & Larger

ANSI 300# Raise-face Flanged Ends with Horizontal Swing, Bolted Cover, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Disc & Seat. Viton '0' Rings.

15.5 Needle Valves

F6SK l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F6S l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9SK l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and

rising stem, tight stem seal. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F9S l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

15.6 Butterfly Valves

B7R 3" & Larger

300# ANSI, RF, High Performance, Lug Type (tapped) Body; Replaceable Disc & Seats; Cast Carbon Steel (ASTM A216-WCB) Body, 316 SS Disc; Pins & Shaft of Nitronic 50; Offset & Eccentric Shaft; TFE Seats & Seals; Positioning Lever Operator; 10" & Larger Gear Operator, Fire Safe.

16. VALVE GROUP "D" SPECIFICATIONS

16.1 Gate Valves

D1ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem Disc, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D1S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem Disc, Disc & Seats; Graphited Asbestos Packing.

D1JK 2" & Larger

NSI 600# ANSI, R.T.J. Flanged Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing & Gear Operator on 10" & Larger or when recommended

by Manufacturer. (Materials shall meet NACE Standards MR-01-75 latest edition.)

D1J 2" & Larger

ANSI 600# ANSI, R.T.J. Flanged Ends, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Solid Wedge Disc; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing & Gear Operator on 10" & Larger or when recommended by Manufacturer.

16.2 Ball Valves

D2ZK 1-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats. (Materials shall meet NACE standard MR-01-75 latest edition.)

D2S 1-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats.

D2JK 2" & Larger

600# ANSI, R.T.J. Flanged Ends, Reduced Port (unless otherwise noted), Bolted Cover, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Ball; Fire Safe; Ryton Seats; Gear Operator - 6" & Larger or when recommended by Manufacturer for smaller sizes. Trunnion mounted. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D2J 2" & Larger

600# ANSI, R.T.J. Flanged Ends, Reduced Port (un-less otherwise noted), Bolted Cover, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Ball; Fire Safe; Ryton Seats; Gear Operator -

6" & Larger or when recom-mended by Manufacturer for smaller sizes. Trunnion mounted.

16.3 Globe Valves

D4ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

D4S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing.

D4JK 2" & Larger

600# ANSI, R.T.J. Flanged Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Disc, Stellite Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D4J 2" & Larger

600# ANSI, R.T.J. Flanged Ends, Reduced Port, Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Disc, Stellite Seats; Graphited Asbestos Packing.

16.4 Check Valves

Piston checks shall be used where pulsating flow is anticipated.

D5ZK l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Socket Weld Ends, Horizontal Swing, Bolted Cover, Replace-able Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc, Stellite Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D5S l-1/2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends and screwed or bolted bonnet, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc, Stellite Seats.

D5JK 2" & Larger

600# ANSI, RTJ Flanged Ends, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Cover; 316 SS Disc, & Stellite Seats; Viton 'O' rings. (Materials shall meet NACE Standard MR-01-75 latest edition.)

D5J 2" & Larger

600# ANSI, RTJ Flanged Ends, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Cover; 316 SS Disc, & Stellite Seats; Viton 'O' rings.

16.5 Needle Valves

F6SK l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F6S l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9SK l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F9S l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

17. VALVE GROUP "E" SPECIFICATIONS

17.1 Gate Valves

E1ZK l½" & Smaller

Minimum pressure rating of 2200 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet, SS Stem, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E1Z l½" & Smaller

Minimum pressure rating of 2200 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet, SS Stem, Disc & Seats; Graphited Asbestos Packing.

17.2 Ball Valves

E2JK 2" & Larger

ANSI 900# RTJ Flanged Ends with Reduced Port (un-less otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Trunnion mounted ball, Teflon, Ryton or Teflon reinforced seats and gear operator on 6" and Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E2J 2" & Larger

ANSI 900# RTJ Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Trun-nion mounted ball, Teflon, Ryton or Teflon rein-forced seats and gear operator on 6" and Larger or when recommended by the Manufacturer.

E2WK 2" & Larger

Minimum pressure rating of 2200 psig at 100°F, weld ends, with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Trunnion mounted ball, Teflon, Ryton or Teflon reinforced seats and gear operator on 6" and Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E2W 2" & Larger

Minimum pressure rating of 2200 psig at 100°F, weld ends, with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Trunnion mounted ball, Teflon, Ryton or Teflon reinforced seats and gear operator on 6" and Larger or when recommended by the Manufacturer.

17.3 Plug Valves

E3JK 900# ANSI RTJ flanged ends with reduced port (un-less otherwise noted) bolted bonnet, replaceable tapered plug and seats, cast carbon steel (ASTM A216-WCB) body and bonnet, 316 SS plug and stem, Teflon, Ryton or Teflon reinforced seats and gear operator on 10" and larger or when recommended by Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition).

E3J 900# ANSI Ring-Joint flanged ends with reduced port (unless otherwise noted) bolted bonnet, replaceable tapered plug and seats, cast carbon steel (ASTM A216-WCB) body and bonnet,

316 SS plug and stem, Teflon, Ryton or reinforced seats and gear operator on 10" and larger or when recommended by Manufacturer.

17.4 Globe Valves

E4ZK l½" & Smaller

Minimum pressure rating of 2200 psig at 100°F Socket Weld Ends, Reduced Port, Bolted Bonnet, OS&Y, Ris-ing Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E4Z l½" & Smaller

Minimum pressure rating of 2200 psig at 100°F Socket Weld Ends, Reduced Port, Bolted Bonnet, OS&Y, Ris-ing Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing.

E4JK 2" & Larger

ANSI 900# RTJ Flanged Ends with Bolted Bonnet, Out-side Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing. Gear Operator on 4" & Larger or when recommended by Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E4J 2" & Larger

ANSI 900# RTJ Flanged Ends with Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing. Gear Operator on 4" & Larger or when recommended by Manufacturer.

17.5 Check Valves

Piston checks shall be used where pulsating flow is anticipated.

E5ZK l½" & Smaller

Minimum pressure rating of 2200 psig at 100°F, Socket Weld Ends, Horizontal, Piston Check, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc; Stellite Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E5Z l½" & Smaller

Minimum pressure rating of 2200 psig at 100°F, Socket Weld Ends, Horizontal, Piston Check, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc; Stellite Seats.

E5JK 2" & Larger

900# ANSI RTJ Flanged Ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E5J 2" & Larger

900# ANSI RTJ Flanged Ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat.

E5JBK 2" & Larger

900# ANSI RTJ Flanged Ends with Horizontal Swing, Counter Weight, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat. (Materials shall meet NACE Standard MR-01-75 latest edition.)

E5JB 2" & Larger

900# ANSI RTJ Flanged Ends with Horizontal Swing, Counter Weight, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat.

E5WK 2" & Larger

Minimum pressure rating of 2200 psig at 100°F, weld ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon

Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat. (Materi-als shall meet NACE Standard MR-01-75 latest edi-tion.)

E5W 2" & Larger

Minimum pressure rating of 2200 psig at 100°F, weld ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat.

17.6 Needle Valves

F6SK l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F6S l" & Smaller

6,000 psi minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9SK l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F9S l" & Smaller

6,000 psi, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

18. VALVE GROUP "F" SPECIFICATIONS

18.1 Gate Valves

F1ZK 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; SS Stem, Disc & Seats; Graphited Asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F1Z 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; SS Stem, Disc & Seats; Graphited Asbestos Packing.

18.2 Ball Valves

F2JK 2" & Larger

ANSI 1500# RTJ Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Stem & Trunnion Mounted Ball, Teflon, Ryton or Teflon Reinforced Seats & Gear Operator on 4" & Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F2J 2" & Larger

ANSI 1500# RTJ Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Stem & Trunnion Mounted Ball, Teflon, Ryton or Teflon Reinforced Seats & Gear Operator on 4" & Larger or when recommended by the Manufacturer.

F2WK 2" & Larger

Minimum pressure rating of 3705 psig at 100°F, Weld Ends, Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated

Replaceable Ball & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Stem & Trunnion Mounted Ball, Teflon, Ryton or Teflon Reinforced Seats & Gear Operator on 4" & Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F2W 2" & Larger

Minimum pressure rating of 3705 psig at 100°F, weld ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated Replaceable Ball & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Stem & Trunnion Mounted Ball, Teflon, Ryton or Teflon Reinforced Seats & Gear Operator on 4" & Larger or when recommended by the Manufacturer.

18.3 Plug Valves

F3JK 2" & Larger

ANSI 1500# RTJ Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Replaceable Tapered Plug & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Plug and Stem, & Gear Operator on 10" & Larger or when recommended by the Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F3J 2" & Larger

ANSI 1500# RTJ Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Replaceable Tapered Plug & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Plug and Stem, & Gear Operator on 10" & Larger or when recommended by the Manufacturer.

18.4 Globe Valves

F4ZK 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing.

(Materials shall meet NACE Standard MR-01-75 latest edition.)

F4Z 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Asbestos Packing.

F4JK 2" & Larger

ANSI 1500# RTJ Flanged Ends with Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing. Gear Operator on 3" and Larger or when recommended by Manufacturer. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F4J 2" & Larger

ANSI 1500# RTJ Flanged Ends with Bolted Bonnet, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing. Gear Operator on 3" and Larger or when recommended by Manufacturer.

18.5 Check Valves

Piston checks shall be used where pulsating flow is anticipated.

F5ZK 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Horizontal, Piston Check, Bolted Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc; Stellite Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F5Z 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Horizontal, Piston Check, Bolted Cover, Replaceable Disc & Seats; Forged

Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Disc; Stellite Seats.

F5JK 2" & Larger

ANSI 1500# RTJ Flanged Ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Disc & Seat. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F5J 2" & Larger

ANSI 1500# RTJ Flanged Ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet, 316 SS Disc & Seat.

F5JBK 2" & Larger

900# ANSI RTJ Flanged Ends with Horizontal Swing, Counter Weight, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F5JB 2" & Larger

900# ANSI RTJ Flanged Ends with Horizontal Swing, Counter Weight, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat.

F5WK 2" & Larger

Minimum pressure rating of 3705 psig at 100^{o}F, weld ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F5W 2" & Larger

Minimum pressure rating of 3705 psig at 100^{o}F, weld ends with Horizontal Swing, Bolted Bonnet, Replaceable Disc & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Steel Disc & Seat.

18.6 Needle Valves

F6SK l" & Smaller

6,000 psig minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F6S l" & Smaller

6,000 psig minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9SK l" & Smaller

6,000 psig, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F9S l" & Smaller

6,000 psig, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

19. VALVE GROUP "G" SPECIFICATIONS

19.1 Gate Valves

G1ZK 1½" & Smaller

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

G1Z 1½" & Smaller

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Forged Carbon Steel (ASTM A105) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing.

19.2 Ball Valves

G2JK 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends, Bolted Cover, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) or Forged Carbon Steel Body, 316 SS Ball & Stem, Fire Safe; Teflon or Reinforced Teflon Seats; complete with Operator; Gear Operator 4" & Larger or when recommended by Manufacturer for Smaller Sizes. Trunnion Mounted. (Materials shall meet NACE standard MR-01-75 latest edition).

G2J 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends, Bolted Cover, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) or Forged Carbon Steel Body, 316 SS Ball & Stem, Fire Safe; Teflon or Reinforced Teflon Seats; complete with Operator; Gear Operator 4" & Larger or when recommended by Manufacturer for Smaller Sizes. Trunnion Mounted.

G2WK 2" & Larger

6000 psig CWP, Weld End, Reduced Port, Bolted Cover, Non-lubricated, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & End Connections, 17-4 PH SS Ball, Stem & Seat Carriers, Viton 'O' Rings; Flouromyte Stem Seal; Complete with handle. Gear operator for 4" and larger or when recommended by Manufacturer for smaller sizes Trunnion mounted. (Materials shall meet NACE standard MR-01-75 latest edition.)

G2W 2" & Larger

6000 psig CWP, Weld End, Reduced Port, Bolted Cover, Non-lubricated, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & End Connections, 17-4 PH SS Ball, Stem & Seat Carriers, Viton 'O' Rings; Flouromyte

Stem Seal; Complete with handle. Gear operator for 4" and larger or when recommended by Manufacturer for smaller sizes Trunnion mounted.

19.3 Globe Valves

G4ZK 1½" & Smaller

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-Plug Disc, Replace-able Disc & Seats; Forged Carbon Steel (ASTM A105) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

G4Z 1½" & Smaller

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Reduced Port, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-Plug Disc, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing.

G4JK 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends; Reduced Port, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-Plug Disc, Replaceable Disc & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Disc, Stellite Seats; Graphited Non-asbestos Packing; Gear Operator-3" & Larger or when recommended by the Manufacturer for Smaller Sizes. (Materials shall meet NACE standard MR-01-75 latest edition.)

G4J 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends; Reduced Port, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-Plug Disc, Replaceable Disc & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Disc, Stellite Seats; Graphited Non-asbestos Packing; Gear Operator-3" & Larger or when recommended by the Manufacturer for Smaller Sizes.

19.4 Check Valves

G5ZK 1½" & Smaller

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Lift Check, Screwed Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105) Body & Cover; 316 SS Disc; Stellite Seats. (Materials shall meet NACE standard MR-01-75 latest edition.)

G5Z 1½" & Smaller

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Lift Check, Screwed Cover, Replaceable Disc & Seats; Forged Carbon Steel (ASTM A105) Body & Cover; 316 SS Disc; Stellite Seats.

G5WK 2" & Larger

Minimum pressure rating of 6000 psig at 100°F, Weld End, Horizontal Swing, Bolted Body; Replaceable Seat Ring and Flapper; Cast Carbon Steel (ASTM A216-WCB) Body & End Connections; Armco 17-4 PH SS Seat Ring, Flapper Assembly; Viton 'O' Rings. (Materials shall meet NACE standard MR-01-75 latest edition.)

G5W 2" & Larger

Minimum pressure rating of 6000 psig at 100°F, Weld End, Horizontal Swing, Bolted Body; Replaceable Seat Ring and Flapper; Cast Carbon Steel (ASTM A216-WCB) Body & End Connections; Armco 17-4 PH SS Seat Ring, Flapper Assembly; Viton 'O' Rings.

G5JK 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Cover; 316 SS Disc. Stellite Seats, Viton 'O' Rings. (Materials shall meet NACE standard MR-01-75 latest edition.)

G5J 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends, Horizontal Swing, Bolted Cover, Replaceable Disc & Seats, Cast Carbon Steel (ASTM A216-WCB) Body & Cover; 316 SS Disc. Stellite Seats, Viton 'O' Rings.

G5JNK 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends, Piston Control, Bolted Body; Replaceable Seat Ring & Piston; Cast Carbon Steel (ASTM A216-WCB) Body & End Connections; 316 SS Piston & Seat; 316 SS Orifice Plug (Materials shall meet NACE standard MR-01-75 latest edition.)

G5JN 2" & Larger

2500-lb. ANSI, RTJ Flanged Ends, Piston Control, Bolted Body; Replaceable Seat Ring & Piston; Cast Carbon Steel (ASTM A216-WCB) Body & End Connections; 316 SS Piston & Seat; 316 SS Orifice Plug.

19.5 Needle Valves

F6SK l" & Smaller

6,000 psig minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F6S l" & Smaller

6,000 psig minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9SK l" & Smaller

6,000 psig, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and

rising stem, tight stem seal. (Materials shall meet NACE Standard MR-01-75 latest edition.)

F9S l" & Smaller

6,000 psig, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

20. VALVE GROUP "J" SPECIFICATIONS

(Service: Desalination/Demineralized Water, Hypochlorite)

20.1 Ball Valves

J2Z 2" & Smaller

Non-shock Working Pressure shall be 150 psig at 75°F. Valve shall be Socket Ends, Double Union type to permit In-line Maintenance without disconnecting Pipe. Valve body shall be of CPVC construction. Seals shall be Viton 'O' Rings. Seats shall be self-lubricating Teflon. Valves shall be full port.

20.2 Globe Valves

J4Z 2" & Smaller

Non-shock Working Pressure shall be 150 psig at 75°F. Valve shall be Socket Ends, have Removable Bonnet for In-line Maintenance. Valve body shall be of CPVC Construction. Sealing Disc shall be plug type CPVC or Polypropylene.

20.3 Check Valves

J5Z 4" & Smaller

Non-shock Working Pressure shall be 150 psig at 75°F. Valve shall be Socket Ends, Double Union type to permit In-line Maintenance without Disconnecting Pipe. Valve body shall be of CPVC Construction. Seals shall be Viton 'O' Rings. Ball shall be supported by a system of guide ribs to give full flow with minimum turbulence & chatter.

20.4 Butterfly Valves

J7F 4" & Smaller

Non-shock working pressure shall be 150 psig at 75°F. Valve body shall be of CPVC Construction, Flanged Ends. Valve shall have solid CPVC Wafer Disc; Viton Seats; Viton 'O' Ring Shaft Seals, 316 SS Shaft; & Glass filled Teflon Bearings.

21. VALVE GROUP "K" SPECIFICATIONS

(Service: Starting Air, Inst. Air, Utility Air, Potable Water)

21.1 Gate Valves

K1S 2" & Smaller

300-lb. Minimum CWP, Full Port, Screwed Ends, Screwed Bonnet, Inside Screw, Non-rising Stem; Wedge Type Disc; 316 SS Body & Bonnet, 316 SS Stem, Disc, & Seats; Manufacturer's Standard Packing.

21.2 Ball Valves

K2S 2" & Smaller

300-lb., Reduced Port, Screwed Ends, Non-Lubri-cated, Replaceable Ball & Seats; Carbon Steel Body & Cover, 316 SS Stem & Ball; Teflon, Ryton or Teflon Reinforced Seats, Complete with Lever Operator.

K2R 2" & Smaller

150# ANSI RF Flanged Ends, Regular Port, Non-Lubricated, Replaceable Ball & Seats; Carbon Steel Body & Cover, 316 SS Stem & Ball; Teflon, Ryton or Teflon Reinforced Seats, Complete with Lever Operator.

21.3 Globe Valves

K4S 2" & Smaller

300-lb. Minimum CWP, Screwed Ends, OS&Y, Rising Stem, Plug or Semi-Plug Disc. Replaceable Disc & Seats; 316 SS Body, Disc & Seats.

21.4 Check Valves

K5S 2" & Smaller

300-lb. Minimum CWP, Horizontal Swing, Screwed Ends, Bolted Cover, Replaceable Disc; 316 SS (A351-CF8M) Body & Cover, 316 SS Disc & Seats.

K5RW 3" & Larger (Wafer Type)

ANSI l50# RF Flanged Facings with Horizontal Swing, Wafer Type, Replaceable Clapper & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body; 316 SS Clapper & Stellite Seats. Teflon, Ryton or Teflon Reinforced Seals in Gas Service.

21.5 3-Way Valves

K9R 2" & Larger

150-lb. ANSI, R.F. 3-Way Flanged Ends, Reduced Port, Bolted Cover, Non-Lubricated, Replaceable Ball & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; 316 SS Stem & Ball; Teflon or Reinforced Teflon Seats; Gear Operator - 8" & Larger or when recommended by the Manufacturer for Small Sizes.

21.6 Needle Valves

F6S l" & Smaller

6,000 psig minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9S l" & Smaller

6,000 psig, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

22. VALVE GROUP "L" SPECIFICATIONS

(Service: Fire Water, Washdown Water)

22.1 Ball Valves

D2S 2" & Smaller

Minimum pressure rating 1,480 psig at 100°F, Screwed Ends, End Entry, replaceable Ball & Seats; Forged Carbon Steel (ASTM A105-II) Body & Cover; 316 SS Stem & Ball; Fire Safe; Teflon, Ryton or reinforced Teflon Seats.

A2R 3" & Larger

ANSI l50# Raise-Face Flanged Ends with Reduced Port (unless otherwise noted), Bolted Bonnet, Non-lubricated replaceable Ball and Seats, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem & Ball, Fire Safe, Teflon or reinforced Teflon Seats & Gear Operator on 8" & Larger or when recommended by the Manufacturer.

22.2 Globe Valves

L4R 2" & Larger

ANSI l50# Raise-Face Flanged Ends with Bolted Bon-net, Outside Screw & Yoke-rising Stem, Plug or Semi-plug Disc, Replaceable Plug & Seat, Cast Carbon Steel (ASTM A2l6-WCB) Body & Bonnet, 316 SS Stem, Plug, & Seat, & Graphite Asbestos Packing.

22.3 Check Valves

L5S 2" & Smaller

150-lb. ANSI, Screwed End, Screwed Cover, Bronze Body, Cover, Disc, Pin & Busing; Teflon, Ryton or Teflon Reinforced Cover Seal & Disc Seal.

L5RW 3" & Larger (Wafer Type)

150-lb. ANSI, Flange Facing Wafer Valve, Lug Type Body, Replaceable Disc & Seats; Cast Carbon Steel (ASTM A-216-WCB) Body; 316 SS Disc & Pin, Stellite Seat; and Inconel Springs.

22.4 Needle Valves

F6S l" & Smaller

6,000 psig minimum CWP, MNPT one connection, FNPT other end; Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet & Packing Nut; 316 SS, Plug, Washers & Retainer; Monel Stem; Teflon Packing; Delrin Seats, complete with SS operator.

F9S l" & Smaller

6,000 psig, 316 SS bar stock body, 3/4" or 1/2" MNPT x three 1/2" FNPT, soft seat with retaining lugs or notches, inside screw and rising stem, tight stem seal.

22.5 Butterfly Valves

L7R 3" & Larger

150-lb. ANSI, Raised Face, High Performance, Lug Type (Tapped) Body, Replaceable Disc & Seats, Cast Carbon Steel (ASTM A216-WCB) Body; 316 SS Disc, Pins & Shaft; Offset & Eccentric Shaft. TFE Seats & Seals, Complete with Position Lever Indicator; 10" & up Gear Operator; Fire Safe.

23. VALVE GROUP "M" SPECIFICATIONS

(Service: Sanitary Drain, Saltwater Cooling Headers)

Note: For 1½" and smaller valves in this service use valve group "K" valves.

23.1 Gate Valves

M1R 2" & Larger

150-lb. ANSI, FF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge Disc; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; Bronze Disc, & Bronze Seats & Stem; Graphited Non-asbestos Packing, Handwheel Operator.

23.2 Globe Valves

M4R 2" & Larger

150-lb. ANSI, FF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Replaceable Disc & Seats; Cast Carbon Steel (ASTM A216-WCB) Body & Bonnet; Bronze Seat & Stem; Graphited Non-asbestos Packing.

23.3 Check Valves

M5R 2" & Larger

150-lb. ANSI, FF Flanged Ends, Horizontal Swing, Bolted Cover, 316 SS Body & Cover; Monel Disc, Pin Bushing & Seat; Teflon, Ryton or Teflon Reinforced Disc Seal.

23.4 Butterfly Valves

M7R 3" & Larger

150-lb. ANSI, FF Flanged Ends, High Performance Butterfly, Lug Type Tapped Body, Replaceable Monel Disc & Shaft, 316 SS Body; Offset & Eccentric Shaft; TFE Seats & Seals, Complete with Positioning Lever Operator; For 10" & Larger Provide Gear Operator.

23.5 Diaphragm Valves

M8R 2" & Larger

150-lb. ANSI, FF Flanged Ends, Rising Stem, Cast Carbon Steel (ASTM A216-WCB) Body, Teflon Lined, Teflon High Temperature Diaphragm, Handwheel Operator.

24. VALVE GROUP "N" SPECIFICATIONS

24.1 24.1 Gate Valves

N1S 3/4" thru 2"

Minimum pressure rating of 3000 psig at 100^{o}F, Screwed Ends, Bolted Bonnet, Outside Screw & Yoke rising Stem, Solid Wedge Disc; SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc; Hard Faced Seats; Graphited Asbestos Packing.

N1Z 3/4" thru 2"

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Outside Screw & Yoke, Seal Welded Bonnet, Rising Stem, Solid Wedge Disc; SS (A182-F316 or A351-CF8M) Body & Bonnet; 316 SS Stem, Disc & Seats, Graphited Asbestos Packings.

24.2 Ball Valves

N2U ½" and Smaller

6000 psig Reduced Port, Swagelok Ends, Replaceable Ball & Seats, 316 SS Body, End Connections, Stem, Ball, Seat Carrier, Carrier Guide, & Seat Springs; Kel-F Seat Material, Trunnion Mounted Ball, Handle Operator. WHITEY '83' series or equal.

24.3 Globe Valves

N4S ½" and Larger

Minimum pressure rating of 3000 psig at 100°F, Screwed Ends, Bolted Bonnet, Outside Screw & Yoke, Rising Stem, Loose Disc Plug, Integral Seats; SS (ASTM-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, & Disc; Graphited Asbestos Packing.

N4Z 3/4" thru 2"

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Outside Screw & Yoke, Rising Stem, Seal Welded Bonnet, Reduced Port, SS (A182-F-316 or A351-CF8M) Body & Bonnet; 316 SS Stem, Disc & Seats, Replaceable Disc & Seats, Graphited Asbestos Packings.

24.4 Check Valves

N5UL ½" and Smaller

Minimum pressure rating of 6000 psig at 100°F, Horizontal Lift, Swagelok Ends, Union Bonnet, Replaceable 17-4 PH SS Lift Plug, 316 SS Seats; Body & Bonnet 316 SS Whitey '53-58' series or equal.

N5S 3/4" and Larger

Minimum pressure rating of 3000 psig at 100°F, Screwed Ends, Piston Check, Bolted Bonnet,

Integral Stellite Seat; SS (ASTM A351-CF8M or A182-F316) Body & Cover, 316 Stainless Disc.

N5Z 3/4" and Larger

Minimum pressure rating of 6000 psig at 100°F, Socket Weld Ends, Piston Check, Bolted Bonnet, Integral Stellite Seat; SS (ASTM A351-CF8M or A182-F316) Body & Cover, 316 Stainless Disc.

24.5 Needle Valves

F6U l-1/2" & Smaller

6,000 psig, Swagelok Ends, Screwed Bonnet; inside Screw-rising Stem; Replaceable Seats; 316 SS Body, Bonnet, Stem and Ends; TFE Packing; KEL-F Stem or High Density Teflon Stem Tip. Whitey "NB" Series or equal.

25. VALVE GROUP "P" SPECIFICATIONS

(Service: Sour Gas, Vent to Flare)

25.1 Gate Valves

P1ZK 1½" & Smaller

Minimum pressure rating of 740 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

P1RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

25.2 Ball Valves

P2ZK 1½" & Smaller

Minimum Pressure Rating 740 psig at 100°F, Reduced Port, Socket Weld Ends, End Entry, Replaceable Ball & Seats; 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Stem &

Ball; Fire Safe, Teflon or Reinforced Teflon Seats. (Materials shall meet NACE standard MR-01-75 latest edition.)

P2RK 2" & Larger

150-lb. ANSI, RF Flanged Ends; Reduced Port (unless otherwise noted,) Bolted Cover; Replaceable Ball & Seats; 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Stem & Ball; Fire Safe, Reinforced Teflon or other Seats good for 350°F at 500 psig, Gear Operator - 6" & Larger or when recommended by the Manufacturers for Smaller Sizes. (Materials shall meet NACE standard MR-01-75 latest edition.)

25.3 Globe Valves

P4ZK 1½" & Smaller

Minimum pressure rating of 740 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-Plug Disc, Replaceable Disc & Integral Seat; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

P4RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Plug or Semi-Plug disc; Replaceable Disc & Integral Seat; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

25.4 Check Valves

P5ZK 1-1/2" & Smaller

Minimum pressure rating of 740 psig at 100°F, Socket Weld Ends, Swing Type, Bolted Cover, Integral Seats, 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Stem & Disc. (Materials shall meet NACE standard MR-01-75 latest edition.)

P5RK 2" & Larger

150-lb. ANSI, Raised Face, Lug Type Body with Straight Through Bolt Holes, Wafer, Replaceable Disc; 316 SS (ASTM A351-CF8M or A182-F316) body; 316 SS Disc, Seats, Pin & Springs. (Materials shall meet NACE standard MR-01-75 latest edition.)

P5RNK 2" & Larger

150-lb. ANSI, RF Flanged Ends; Piston Control, Bolted Body, Replaceable Seat Ring & Piston; 316 SS (ASTM A351-CF8M or A182-F316) Body & End Connections; 316 SS Piston & Seat; 316 SS Orifice Plug. (Materials shall meet NACE standard MR-01-75 latest edition.)

26. VALVES GROUP "Q" SPECIFICATIONS

(Service: Lube Oil, Seal Oil)

26.1 Gate Valves

Q1RK 3/4" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc, Cast or Forged Carbon Steel (ASTM A216-WCB or A105) Body & Bonnet; 316 SS Stem, Disc, & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

26.2 Globe Valves

Q4RK 3/4" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Plug or Semi-Plug disc, Replaceable Disc & Integral Seat; Cast or Forged Carbon Steel (ASTM A216-WCB or A105) Body & Bonnet; 316 SS Stem, & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

26.3 Check Valves

Q5RK 3/4" & Larger (Swing Check)

150-lb. ANSI, RF Flanged Ends, Horizontal swing, Bolted Cover (for 2" & larger). Replaceable Disc & Seats (for 2" & larger);

Cast or Forged Carbon Steel (ASTM A216-WCB or A105) Body & Cover; 316 SS Disc, Seats, Pin & Springs. (Materials shall meet NACE standard MR-01-75 latest edition.)

Q5RWK 2" & Larger (Wafer Check)

150-lb. ANSI, Raised Faced Ends, Lug Type Body with Straight Through Bolt Holes, Wafer; Replaceable Disc; Cast or Forged Carbon Steel (ASTM A216-WCB or A105) Body; 316 SS Disc, Seats, Pin, & Springs. (Materials shall meet NACE standard MR-01-75 latest edition.)

27. VALVES GROUP "R" SPECIFICATIONS

(Service: Sour Gas)

27.1 Gate Valves

R1ZK 1½" & Smaller

Minimum pressure rating of 1480 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

R1RK 2" & Larger

300-lb. ANSI, RF Flanged Ends; Bolted Bonnet; OS&Y, Rising Stem, Double Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc, & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

27.2 Ball Valves

R2RK 2" & Larger

300-lb. ANSI, RF Flanged Ends; Reduced Port (unless otherwise noted,) Bolted Cover; Replaceable Ball & Seats; 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Stem & Ball; Fire Safe, Reinforced Teflon or other Seats good for 350°F at 500 psig, Gear Operator - 6" & Larger or when recommended by the Manufacturers for Smaller Sizes. (Materials

shall meet NACE standard MR-01-75 latest edition.)

27.3 Globe Valves

R4ZK 1½" & Smaller

Minimum pressure rating of 1480 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-Plug Disc, Replaceable Disc & Integral Seat; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

R4RK 2" & Larger

300-lb. ANSI, RF Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Plug or Semi-Plug disc, Replaceable Disc & Integral Seat; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

27.4 Check Valves

R5ZK 1-1/2" & Smaller

Minimum pressure rating of 1480 psig at 100°F, Socket Weld Ends, Swing Type, Bolted Cover, In-tegral Seats, 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Stem & Disc. (Materials shall meet NACE standard MR-01-75 latest edition.)

R5RK 2" & Larger

300-lb. ANSI, Raised Face, Lug Type Body with Straight Through Bolt Holes; Wafer, Replaceable Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body; 316 SS Disc, Seats, Pin, & Springs. (Materials shall meet NACE standard MR-01-75 latest edition.)

R5RNK 2" & Larger

300-lb. ANSI, RF Flanged Ends, Piston Control, Bolted Body, Replaceable Seat Ring & Piston; 316 SS (ASTM A351-CF8M or A182-F316) Body & End Connections; 316 SS Piston & Seat; 316 SS

Orifice Plug. (Materials shall meet NACE standard MR-01-75 latest edition.)

28. VALVES GROUP "S" SPECIFICATIONS

(Service: Sour Gas)

28.1 Gate Valves

S1ZK 1½" & Smaller

Minimum pressure rating of 3600 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Solid Wedge; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Wedge & Seats, Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

S1JK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc, & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE standard MR-01-75 latest edition.)

28.2 Ball Valves

S2JK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Full Port (unless otherwise noted), Bolted Cover, Replaceable Ball & Seats; 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Stem & Ball; Fire Safe, Teflon or Reinforced Teflon Seats or Equal for up to 300°F; Trunnion Mounted, Gear Operator - 4" & larger or when recommended by the Manufacturer for Smaller Sizes. (Materials shall meet NACE standard MR-01-75 latest edition.)

28.3 Globe Valves

S4ZK 1½" & Smaller

Minimum pressure rating of 3600 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug, Replaceable Disc & Integral Seat; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem & Disc;

Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

S4JK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Plug or Semi-plug disc, Replaceable Disc and Integral Seat; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard Mr-01-75 latest edition.)

28.4 Check Valves

S5ZK 1½" & Smaller

Minimum pressure rating of 3600 psig at 100°F, Socket Weld Ends, Horizontal Piston Type, Bolted Cover, Integral Seats, 316 SS (ASTM A351-CF8M or A182-F316) Body & Cover; 316 SS Piston. (Materials shall meet NACE Standard MR-01-75 latest edition.)

S5JNK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Piston Control, Bolted Body, Replaceable Seat Ring & Piston; 316 SS (ASTM A351-CF8M or A182-F316) Body & End Connections; 316 SS Piston & Seat; 316 SS Orifice Plug or Spring Loaded Type for Piston Control. (Materials shall meet NACE Standard MR-01-75 latest edition.)

29. VALVES GROUP "U" SPECIFICATIONS

(Service: Lube Oil, Seal Oil)

29.1 Gate Valves

U1RK ½" & Larger

300-lb. ANSI, RF Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Double Disc; 316 SS (ASTM A351-CF8M or A182-F316) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

29.2 Globe Valves

U4RK ½" & Larger

300-lb. ANSI, RF Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Plug or Semi-plug disc, Replaceable Disc & Integral Seat; Cast or Forged Carbon Steel (A216-WCB or A105) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

29.3 Check Valves

U5RK ½" & Larger (Swing Check)

300-lb. ANSI, RF Flanged Ends, Horizontal Swing, Bolted Cover (for 2" & Larger), Replaceable Disc, Replaceable Seats (for 2" & Larger); Cast or Forged Carbon Steel (A216-WCB of A105) Body & Cover; 316 SS Disc, Seats, Pin & Springs. (Materials shall meet NACE Standard MR-01-75 latest edition.)

U5RWK 2" & Larger (Wafer Check)

300-lb. ANSI, Raised Face, Lug Type Body with Straight Through Bolt Holes; Replaceable Disc; Cast or Forged Carbon Steel (A216-WCB or A105) Body; 316 SS Disc, Seats, Pin & Springs. (Materials shall meet NACE Standard MR-01-75 latest edition.)

30. VALVES GROUP "V" SPECIFICATIONS

(Service: Sour Gas for 100 psig at 300^{o}F)

30.1 30.1 Gate Valves

V1ZK 1½" & Smaller

Minimum pressure rating of 740 psig at 100^{o}F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

V1RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

30.2 Ball Valves

V2ZK 1½" & Smaller

Minimum Pressure Rating 740 psig at 100°F, Reduced Port, Socket Weld Ends, End Entry, Replaceable Ball & Seats; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Cover; Stem & Ball; Fire Safe, Teflon or Reinforced Teflon Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

V2RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Reduced Port (unless otherwise noted), Bolted Cover, Replaceable Ball & Seats; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Cover; Stem & Ball; Fire Safe, Teflon or Reinforced Teflon Seats; Gear Operator - 8" & Larger or when recommended by the manufacturer for Smaller Sizes. (Material shall meet NACE Standard MR-01-75 latest edition.)

30.3 Globe Valves

V4ZK 1½" & Smaller

Minimum pressure rating of 740 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Integral Seat; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Material shall meet NACE Standard MR-01-75 latest edition.)

V4RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seat; Graphited Non-

asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

30.4 Check Valves

V5ZK 1-1/2" & Smaller

Minimum pressure rating of 740 psig at 100°F, Socket Weld Ends, Piston Check with Orifice in Piston or similar design for operation in pulsating gas flow; Bolted Cover, High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body, Piston, Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

V5RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Piston Check with Orifice in Piston or similar design for operation in pulsating gas flow; Bolted Cover, High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body, Piston, Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

31. VALVES GROUP "W" SPECIFICATION

(Service: Lube Oil, Seal Oil)

31.1 Gate Valves

W1RK ½" & Larger

600-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; Cast or Forged Carbon Steel (A216-WCB or A105) Body & Bonnet; 316 SS Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

31.2 Globe Valves

W4RK ½" & Larger

600-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug disc, Replaceable Disc & Integral Seat; Cast or Forged Carbon Steel (A216-WCB or A105) Body & Bonnet; 316 SS Stem & Disc; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

31.3 Check Valves

W5RK ½" & Larger (Swing Check)

600-lb. ANSI, RF Flanged Ends, Horizontal Swing, Bolted Cover (for 2" & Larger), Replaceable Disc, Replaceable Seats (for 2" & Larger); Cast or Forged Carbon Steel (A216-WCB or A105) Body & Cover; 316 SS Disc, Seats, Pin & Springs. (Materials shall meet NACE Standard MR-01-75 latest edition.)

W5RWK 2" & Larger (Wafer Check)

600-lb. ANSI, Raised Faced Ends, Lug Type Body, with Straight Through Bolt Holes, Wafer; Replaceable Disc; Cast or Foged Carbon Steel (A216-WCB or A105) Body; 316 SS Disc, Seats Pin & Springs. (Materials shall meet NACE Standard MR-01-75 latest edition.)

32. VALVE GROUP "X" SPECIFICATIONS

(Service: Acid Gas for 460 psig at 285^{o}F)

32.1 Gate Valves

X1ZK 1½" & Smaller

Minimum pressure rating of 1480 psig at 100^{o}F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Double Disc; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

X1RK 2" & Larger

300-lb. ANSI, RF Flanged Ends; Bolted Bonnet; OS&Y, Rising Stem, Double Disc; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

32.2 Ball Valves

X2RK 2" & Larger

300-lb. ANSI, RF Flanged Ends, Reduced Port (unless otherwise noted), Bolted Cover, Replaceable Ball & Seats; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-

32.3 Globe Valves

X4ZK 1½" & Smaller

Minimum pressure rating of 1480 psig at 100°F, Socket Weld Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Integral Seat; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Material shall meet NACE Standard MR-01-75 latest edition.)

X4RK 2" & Larger

150-lb. ANSI, RF Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Seat; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

32.4 Check Valves

X5ZK 1-1/2" & Smaller

Minimum pressure rating of 1480 psig at 100°F, Socket Weld Ends, Piston Check with Orifice in Piston or similar design for operation in pulsating gas flow; Bolted Cover, High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body, Piston, Seats. (Materials shall meet NACE Standard MR-01-75 latest edition.)

X5RK 2" & Larger

300-lb. ANSI, RF Flanged Ends, Piston Check with Orifice in Piston or similar design for operation in pulsating gas flow, Bolted Cover; Replaceable Piston; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body,

Piston, Seats, & Pin. (Materials shall meet NACE Standard MR-01-75 latest edition.)

33. VALVES GROUP "Z" SPECIFICATION

(Service: Sour Gas)

33.1 Gate Valves

Z1ZK 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Bolted Bonnet; OS&Y, Rising Stem, Solid Wedge; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

Z1JK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Bolted Bonnet; OS&Y, Rising Stem, Flexible Wedge Disc; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

33.2 Ball Valves

Z2JK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Reduced Port (unless otherwise noted), Bolted Cover, Replaceable Ball & Seats; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Cover, Stem & Ball; Fire Safe; Teflon or Reinforced Teflon Seats or equal for up to 300°F Seats; Trunnion Mounted, Gear Operator - 4" & larger or when recommended by the Manufacturer for smaller sizes. (Materials shall meet NACE Standard MR-01-75 latest edition.)

33.3 Globe Valves

Z4ZK 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Bolted Bonnet; OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc

& Integral Seat; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

Z4JK 2½" & Larger

900 ANSI, RTJ Flanged Ends, Bolted Bonnet, OS&Y, Rising Stem, Plug or Semi-plug Disc, Replaceable Disc & Integral Seat; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Bonnet, Stem, Disc & Seats; Graphited Non-asbestos Packing. (Materials shall meet NACE Standard MR-01-75 latest edition.)

33.4 Check Valves

Z5ZK 1½" & Smaller

Minimum pressure rating of 3705 psig at 100°F, Socket Weld Ends, Horizontal Piston Type, Bolted Cover, Integral Seats; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Cover, & Piston. (Materials shall meet NACE Standard MR-01-75 latest edition.)

Z5JK 2"

900-lb. ANSI, RTJ Flanged Ends, Horizontal Piston Type, Bolted Cover, Integral Seats; High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body & Cover, & Piston. (Materials shall meet NACE Standard MR-01-75 latest edition.)

Z5JNK 2½" & Larger

900-lb. ANSI, RTJ Flanged Ends, Horizontal Piston Control, High Grade Nickel Alloy (UNS N08904 Alloy, Cast or Forged) Body, Cover, Piston, & Seats; Bolted Cover, Orifice in Piston or Spring Loaded Type for Piston Control. (Materials shall meet NACE Standard MR-01-75 latest edition.)

SPECIFICATION FOR FABRICATION, ERECTION, TESTING, AND INSPECTION OF PIPING

SPECIFICATION NO. TEX.P.130

FEB.97

0	23 JUL 97	ANYALA/MADU Development-For Bid				
REV	DATE	DESCRIPTION	ORIG	APPROVALS		

Approved by:	Company Approval:

Date:	**Date:**

Foreward

To cover a broad range of document applications, this specification may be accompanied by attachments. When indicated, the following attachments become an integral part of this specification:

1. Inspection and Testing Requirements Sheet YES[X] NO[ ]

2. Documentation Requirements Sheet YES[X] NO[ ]

3. Addendum 1
   Requirements for North Sea U.K. Sector YES[ ] NO[ ]

TABLE OF CONTENTS

1. SCOPE

This specification defines minimum requirements for the fabrication, erection, testing, and inspection of piping systems to be installed on offshore platforms.

2. REFERENCES

2.1 Company Specifications

The following Company specifications supplement this specification:

1. TEX.P.100, "Piping Design Specification".
2. TEX.G.140, "Painting and Corrosion Protection Specification".
3. TEX.M.110, "Thermal Insulation Specification".
4. TEX.I.100, "General Instrument Specification".
5. TEX.I.120, "Local Safety Shutdown Panel Specification".
6. TEX.G.110, "Skid Mounted Process Equipment Specification".
7. TEX.S.400, "Offshore Structures Fabrication Specification".

2.2 Codes and Standards

The fabrication, erection, testing, and inspection of piping systems shall be in accordance with the latest edition of the following Codes and Standards:

2.2.1 American Iron and Steel Institute (AISI)

2.2.2 American National Standards Institute (ANSI)

1. ANSI/ASME B1.2, "Gages and Gaging for Unified Screw Threads".
2. ANSI/ASME B16.5, "Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys".
3. ANSI/ASME B16.9, "Factory-Made Wrought Steel Buttwelding Fittings".
4. ANSI B16.11, "Forged Steel Fittings, Socket-Welding and Threaded".

5. ANSI/ASME B16.25, "Buttwelding Ends".
6. ANSI/ASME B31.3, "Chemical plant and Petroleum Refinery Piping".
7. ANSI/ASME B31.4, "Liquid Petroleum Transportation Piping Systems".
8. ANSI/ASME B31.8, "Gas Transmission and Distribution Piping Systems".

2.2.3 American Petroleum Institute (API)

1. PI RP 14E, "Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems".
2. API Standard 1104, "Welding Pipelines and Related Facilities".

2.2.4 American Society of Mechanical Engineers (ASME)

"ASME Boiler and Pressure Vessel Code".

2.2.5 American Society for Testing and Materials (ASTM)

1. ASTM A 105, "Specification for Carbon Steel, for Piping Components".
2. ASTM A 106, "Specification for Seamless Carbon Steel Pipe for High-Temperature Service".
3. ASTM A 193, "Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service".
4. ASTM A 194, "Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service".
5. ASTM A 234, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures".
6. ASTM A 283, "Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars".
7. ASTM A 285, "Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength".

8. ASTM A 333, "Specification for Seamless and Welded Steel pipe for Low-Temperature Service".

9. ASTM A 516, "Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service".

2.2.6 American Water Works Association (AWWA)

2.2.7 National Association of Corrosion Engineers (NACE)

NACE MR0175, "Sulfide Stress Cracking Resistant Metallic Material for Oilfield Equipment".

2.2.8 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

2.2.9 National Fire Protection Association (NFPA)

1. NFPA 13, "Installation of Sprinkler Systems".

2. NFPA 15, "Water Spray Fixed Systems for Fire Protection".

3. NFPA 24, "Installation of Private Service Mains".

2.2.10 Occupational Safety and Health Administration (OSHA)

U.S. Code of Federal Regulations, Title 29, Part 1910, Occupational Safety and Health Act (OSHA) Standards

2.2.11 US Department of the Interior (USDI)

USDI, Minerals Management Service (MMS), Outer Continental Shelf (OCS) Orders Gulf of Mexico.

2.2.12 US Environmental Protection Agency (EPA)

2.2.13 Federal, State, and Local Laws and Regulations

In case of conflict between this specification and the Codes and Standards above, the most stringent requirement shall govern.

3. GENERAL

3.1 General

3.1.1 Piping design shall conform to TEX.P.100.

3.1.2 Materials shall be new and free of damage and defects.

3.1.3 Piping shall be carried on properly adjusted hangers or properly leveled supports.

3.1.4 Lines operating at less than 300 degrees F. shall be cold sprung only where specified on the Contract Drawings.

3.2 Pipe Supports

3.2.1 Design

1. Design of pipe supports shall consider ease of maintenance.
2. When selecting steel profiles, consideration shall be given to minimizing corrosion and ease of painting.

3.2.2 Adjustable Hangers

1. Hangers that are adjustable under load shall be used for lines where it is desirable to maintain an exact elevation.
2. Where adjustable hangers are used, rod threads shall engage the full length of the threaded portion of the turnbuckle or adjusting nut.
3. The adjusting nut shall be double nuts.

3.2.3 U-Bolts

1. U-bolts and nuts shall be cadmium plated.
2. U-bolts shall use four (4) nuts each.

3.2.4 Attachment and Fabrication

1. Pipe supports shall not be welded directly to piping in hydrocarbon service unless previously approved by Company.
2. Corners of angle iron supports shall be rounded.

3.3 Anchors and Guides

Piping anchors and guides shall be installed in accordance with pipe stress requirements and this specification.

3.4 Drains and Vents

3.4.1 Drains

1. Drain valves shall be installed where liquid can be trapped between isolating valves (bleed ring may be used in this instance).
2. Sample valves, where required, shall be placed upstream of control valves.

3.4.2 Vents

1. The high points of all lines shall be provided with 3/4 inch (minimum) vent connections which may be plugged without a valve (unless required for start-up or during operation, then a valve with plug or cap is required).
2. The low points of all lines shall be drained by the following minimum size connections:

Line Size	Drain Size
4 inch and smaller	3/4 inch
6 inch and larger	1 inch

3.4.3 Vent and Drain Connections

The Contractor shall determine the locations of high point vents and low point drains and indicate them on the piping fabrication isometrics in accordance with the requirements of this Subsection.

3.5 Temporary Strainers

1. Temporary strainers shall be installed in suction lines to all major equipment (compressors, pumps, etc.) for removal of dirt, trash, and other foreign material.

2. Piping shall be arranged so that these screens can be removed from flanged joints without altering the pipe or supports.

3.6 Piping to Pumps, Vessels, and Equipment

3.6.1 General

Pipe and equipment supports shall be installed in such a manner that they do not have to be cut out for the removal of the supported pipe or equipment.

3.6.2 Vessel Piping

Blinds shall be provided where indicated on the Contract Engineering and/or Utility Flow Diagram Drawings.

3.7 Material Storage and Protection

3.7.1 General

Contractor shall be responsible for the off-loading, storage and control of piping materials.

3.7.2 Storage

1. Materials and equipment shall be stored in a manner approved by Company.
2. Materials subject to damage from the elements shall be protected by painting, greasing, installation of rust preventive oil, coverings or protectors, etc. to protect externally and internally from mechanical damage or damage due to humidity, precipitation, temperature and atmospheric conditions or environment.

3.7.3 Losses

Losses from inventory of Company furnished items shall be for Contractor's account.

4. PIPING CONNECTIONS

4.1 Line-Up of Butt Weld Connections

To insure proper line-up, exterior line-up clamps shall be used where possible.

4.2 Spacing of Socket Weld Connections

Where socket welding valves or fittings are used, the pipe shall be so spaced in the socket that no stresses shall be imparted to the weld due to "bottoming" of the pipe in the socket.

4.3 Flange Connections

4.3.1 Flange Faces

1. Flange faces shall be covered with protective caps during sand blasting, painting and storage.
2. Raised face flanges shall be wire brushed by hand (no power brushes or grinders) and lightly coated with grease before installing.
3. Grooves of ring type joint flanges shall be greased prior to installation.

4.3.2 Flange Bolts

1. Where flange faces are vertical, bolt holes shall straddle the vertical center line.
2. Where flange faces are horizontal, bolt holes shall straddle the platform north-south center line.
3. Bolt threads shall extend 1/4 inch past nuts when tightened in place.

4.3.3 Slip-On Flanges

Slip-on flanges shall be welded on front and back in accordance with ANSI B31.3.

4.4 Screwed Thread Connections

4.4.1 Screwed threads shall be clean cut with no burrs or stripping and shall be in accordance with ANSI B2.1. Tapered dies shall be new, sharp, and properly designed for the piping material. Male threads shall be made up with teflon tape. Piping shall be made up sufficiently for the threads to seize.

4.4.2 The length of thread engagement between internal and external taper threads shall be in accordance with Section 13.0 of ANSI B2.1.

4.4.3 The cutting fluid used during thread cutting operation shall be cleaned with a suitable solvent.

4.5 Soldered Connections

4.5.1 Preparation

1. Tubing shall be cut to the desired length with a tubing cutter or a fine-toothed hack saw and a miter box.
2. Internal and external burrs shall be removed with a reamer or file.
3. The inside of the fitting and tube (to a length slightly greater than the cup depth) shall be cleaned and polished with a fine grade of sandcloth or steel wool (No. 00) until a bright finish is achieved. (The cleaned areas of the tube or fittings shall not be handled after they have been cleaned.)
4. Before soldering, a thin coat of flux shall be applied to the cleaned portion of the tube and fitting.

4.5.2 Joining

1. The two parts shall, if possible, be fitted together with a rotary motion.
2. A clean cloth shall be used to wipe away excess flux adhering to the outside of the joint.
3. The joint shall be heated to the desired temperature (as specified by the solder manufacturer) quickly and evenly.
4. When solder melts upon contact with the heated fitting, the proper soldering temperature has been reached.
5. Remove flame and feed solder to the joint at one or two points until a ring of solder appears at the end of the fitting.

4.5.3 Clean Up

Surplus solder shall be wiped off with a clean cloth and the joint allowed to cool before the application of any strain to the joint.

5. SPECIAL PIPING

5.1 Hydrocarbon Service

5.1.1 Process Lines

3/4 inch sample connections shall be provided as shown on the Contract Engineering and/or Utility Flow Diagram Drawings.

5.1.2 Vent and Flare Exhaust

Operational high point vents in process service shall be piped to a process vent header. Each line shall include a 3/4 inch minimum block valve.

5.1.3 Control, Relief, and Special Valves

Control, relief, and special valves shall be provided as indicated on the Contract Engineering and/or Utility Flow Diagram Drawings.

5.2 Fire System Piping

The installation of the looped firewater main shall be in accordance with the NFPA Standard 24.

5.3 Hot Surface Insulation

In the yard no insulation shall be installed around the bolts and flanges in H^2S service.

5.4 "Bondstrand" Fiberglass Piping

5.4.1 Assembly

1. Bondstrand Fiberglass Pipe shall be installed in accordance with publication "Bond-strand Assembly Instructions: Adhesive-Bonded Quick-Lock Joints." This publication may be obtained from Ameron Inc., Fiberglass Pipe Division, P.O. Box 801148, Houston, TX 77280, U.S.A.
2. Additional installation information is avail-able in the "Bondstrand" Marine Fittings Engineering Guide".

5.4.2 Fabrication and Installation Personnel

1. Fabrication and installation personnel shall be trained, tested and certified by

Ameron prior to beginning work on any Bondstrand Piping.

2. A copy of the valid Ameron certification card for each man on the job shall be given to Company prior to start of work.

3. Uncertified personnel working on Bondstrand pipe shall be removed from the work and all work performed by them shall be rejected and replaced at no cost to Company.

5.4.3 Storage

Storage of Bondstrand products shall be in accordance with Ameron Engineering Bulletin EB-12 (latest edition), "Factory Packaging, Receiving and Storing of Bondstrand Products."

5.4.4 Protection of Installed Pipe Assemblies

To prevent damage to installed Bondstrand Pipe Assemblies, the following guidelines shall be followed:

1. In areas where Bondstrand pipe is subject to damage due to impact from falling objects, the pipe shall be protected by placing plywood shields (minimum thickness 1/2") over the top of the pipe. The plywood shall be secured to the pipe with metal or nylon strapping. The plywood shall be removed from the pipe prior to shipment.

2. In areas where Bondstrand pipe will be exposed to heat from welding or cutting, the pipe shall be protected from damage by placing a non-asbestos fire resistant blanket between the heat source and the pipe.

3. Abrasion damage from sandblasting operations shall be prevented by installing sheet metal shields around the pipe in the vicinity of the sandblasting operations. These shields shall be removed after sandblasting is complete.

5.5 Chlorinated Polyvinyl Chloride (CPVC) Piping

5.5.1 Fabrication of CPVC piping shall be in accordance with ANSI B31.3 and manufacturers' recommendations.

5.5.2 Fabrication of threaded connections are not allowed.

5.5.3 Piping shall be protected against direct sunlight and other damage, i.e. weld splatter after erection and hydro testing.

5.6 Copper Piping

5.6.1 Copper piping shall be fabricated in accordance with API RP 14E and manufacturers' recommendations.

5.6.2 Brazing socket type connections shall generally be used.

6. ASSEMBLY

6.1 General

6.1.1 General

1. The assembly of piping systems shall be in accordance with Contractor designed and Company approved drawings.
2. Items which may be easily damaged shall be installed after heavy construction is completed if possible.
3. No piping or tubing shall be laid directly on or under the skid floor without specific written permission from Company.
4. No small lines shall be installed on engine or compressor cylinder heads except for operational purposes.
5. Temporary supports shall be installed during erection so as not to over-stress piping, or the equipment to which piping is being connected.
6. Pipe and fittings that are not properly stamped and identified shall be unsuitable for the intended use and shall be degraded for general use.

7. Pipe and piping components shall be checked for damage or distortion and any debris removed prior to fit-up.

8. The cap or seal of an opening shall not be broken until final field erection is imminent.

9. Minor surface defects may be removed by grinding, provided the wall thickness is not reduced below the allowable tolerances. The Company Inspector shall be informed of any repairs to check and approve wall thickness tolerances.

10. Piping shall be erected to line and level on pipe supports in a natural unstressed condition. If the piping does not fit it shall be removed, cut and adjusted to suit. The use of force, temporary braces or supports welded to the piping shall not be allowed.

11. Where piping is connected by flange joints the joint shall be disconnected after completion of the piping erection and welding to indicate correct alignment. Any springing of the flange shall be corrected by refabrication of the piping. The installation and protection of proprietary items shall be in accordance with the manufacturers instructions.

6.1.2 Fabrication Tolerances

1. Piping tolerances shall be in accordance with ANSI B31.3.

2. The location of piping terminations, such as at the edge of skids shall be within +/- 1/8 inch in each direction and within 1/2 degree of being square.

3. Dimension shall be taken from the nearest main structural member.

6.1.3 Field Installed Spools

1. Field installed spools where directed by Company shall be fit up prior to loadout and hydrotested during the main testing.

2. Spools shall then be removed and prepared for shipment.

6.1.4 Painting

Piping shall be painted in accordance with TEX.G.140 unless otherwise specified herein.

6.2 Welding

6.2.1 General

1. Welding operations shall be protected from wind and rain.
2. Welding is prohibited when the surrounding air temperature is less than 32 degrees F.

6.2.2 Welding Procedure Qualification

1. Weld procedures shall be provided for all welds.
2. Evidednce of a previous qualification test may be accepted at the sole discretion of Company.
3. Welding procedures for pipe welds and other items fabricated to the requirements of ANSI B31.3 shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, and revisions.
4. Pipeline and riser welding procedure qualification shall comply with the requirements of API Standard 1104 and the fabrication requirements of ANSI B31.4 and/or ANSI B31.8.
5. The Fabricator/Contractor shall submit his welding procedure specifications and qualification records to Company for review and approval.
6. Weld procedure qualifications for piping in sour (NACE) service shall meet the requirements of NACE MR-01 and shall include sufficient hardness testing to insure that the entire base metal and HAZ shall have a hardness of RC 22 or less. Each weld tested shall be checked at a minimum of four (4) locations around weld

circumference with testing at four (4) locations across HAZ at each point.

6.2.3 Welder Performance Qualification

1. Welders and welding operators, shall be qualified in accordance with ASME Section IX, and to a qualified welding procedure.
2. ANSI B31.3 shall be the governing fabrication code.
3. A record shall be maintained by the Contractor for all qualified welders which shall indicate the procedures, position, and process to which they are qualified.

6.2.4 Welding Processes

1. Welding shall be conducted by one of the following processes:
   a. Shielded Metal Arc (SMA).
   b. Tungsten Inert Gas (TIG).
   c. Submerged Arc (SA).
   d. Metal Inert Gas (MIG) (Root passes only).
2. The above processes may be used in combination provided the qualification test has also used the same combination and sequence of processes.

6.2.5 Filler Materials

1. Welding filler metals shall comply with the requirements of ASME Section IIC, SFA-5.1, SFA-5.5, SFA-5.17, SFA-5.18.
2. Manual metal arc welding electrodes shall be of the low hydrogen type.
3. Upon removal from container, electrodes shall be stored in a heated oven maintained at 500 degrees F.
4. Before use, electrodes shall be stored in a portable rod oven.
5. Electrodes shall not be exposed to ambient air for more than four (4) hours.

6.2.6 Joint Backup

1. Permanent backing rings shall not be used.
2. Backing rings to facilitate welding shall be removed at the completion of the weld joint.
3. Consumable backings such as inserts of the compatible type are prohibited for root pass of single side closures and pipe butt joints.
4. Purging and damming procedures for inert gas welding shall be approved by Company.

6.2.7 Joint Preparation

1. End preparation of steel pipe shall be beveled in accordance with ANSI B31.3 and the fitting end preparation shall be in accordance with ANSI B16.25.
2. Weld metal and heat-affected zone hardness, for piping systems deemed sour, shall not exceed Rockwell C-22 or Brinell 235.
3. Prior to welding, all surfaces, internal and external of the welding bevel shall be thoroughly cleaned of scale, rust, oil, paint, and other contaminants for a distance of one (1) inch from the bevel.
4. Welding shall not be started until the pipe is properly aligned, and tack welded. Slag and flux shall be removed prior to starting the next weld bead. Blow holes, porosity, slag, undercut, and other defects shall be removed by grinding or other acceptable methods, before proceeding with welding.

6.2.8 Welding

1. Interruption of welding is permitted if 3/8 inch or 25 percent of the pipe wall thickness, whichever is greater, has been welded, and the weld has been insulated with an insulating blanket to slow the cooling rate. The joint shall be heated to the preheat temperature before resumption of welding.
2. Weld contour shall comply with the requirements of ANSI B31.3, Chapter 5.

3. Socket welds shall have a minimum end gap of 1/16 inch prior to welding. This gap shall be assured by providing full engagement of the pipe into the socket, scribing a line on the pipe next to the socket, then backing the pipe out 1/16 to 3/32 of an inch.

4. Piping or supports shall not be welded to coded vessels.

6.2.9 Welder Identification

1. Each welder employed for shop or field welding of piping, shall be assigned an identifying metal stamp and corresponding number.

2. The metal stamp shall have rounded metal impressions of the stress free type.

3. A list of welders and their respective identifying numbers shall be maintained.

4. Additions and deletions to the list of welders shall be reported promptly.

5. Deleted numbers shall not be reused.

6. Upon completing a joint, the welder shall stamp his identifying number and the last two (2) digits of the year in which the work was performed on the pipe approximately three (3) inches from the weld.

6.2.10 Heat Treatment

1. Preheat and postweld heat treatment (stress relieving) shall be in accordance with ANSI B31.3, Tables 331.2.1 and 331.3.1 for carbon steel.

2. Postweld heat treatment shall be required for all carbon steel welds of 1/2 thickness and greater that are considered to be subject to vibration stresses such as compressor piping where specified by Company.

3. Postweld heat treatment of welds is required for piping systems deemed as sour (NACE) service.

6.3 Seal Welding

Seal welding shall be performed as follows:

1. Screwed steel fittings shall be thoroughly cleaned of all oil, grease, or other contaminants with a solvent such as Stoddards solvent.
2. The joint shall then be made-up dry, without thread sealant.
3. After the joint is securely tightened, a seal bead shall be welded around the joint.

6.4 Piping, Valve, And Insulation Identification

6.4.1 Line Designation

1. Each line on the Contract Mechanical Flow Sheets and Piping Arrangement Drawings shall be clearly marked to denote:
   a. Nominal line size.
   b. Service designation.
   c. Line number.
   d. Pipe material specification.
   e. Insulation class (optional).

   For example:

   6" - PF - 101 - D - 01

   6" Designates nominal line size

   PF Designates the service designation.

   101 Designates the line number

   D Designates the pipe specification

   01 Designates the insulation class.

2. Line numbering shall start with the number 101. These line markings shall also appear on the Contract Mechanical Flow Sheets and Isometrics Drawings.
3. Pipe Fabrication Spools shall be marked with:
   a. Line number.
   b. Piping specification.
   c. Piece mark.

For example:

100-D-3

The last number in the block (3) is the piece number; if E precedes this number, the piece is an erector spool. The entirety is the piece mark.

4. The piece mark and the proper spool break (either flange break, field weld, or erection weld), shall be shown on the Isometric Drawings.

5. The piece mark shall be tagged in at least two (2) places on all fabricated spool pieces. Pipe stenciling shall not be permitted. At least one (1) tag shall be a stenciled steel tag connected to the spool with sixteen (16) gage stainless steel wire. Attachment should be such that accidental loss could only be due to the breaking of the wire.

6. Location of a change in piping specification shall be indicated on the Contract Flow Sheet and Piping Arrangement Drawings.

6.4.2 Service Designation

The following is a list of the service designations:

AB	Breathing Air
AI	Instrument Air
AS	Starting Air
AU	Utility Air
BA	Bulk Barite
CA	Amine
CE	Bulk Cement
CG	Glycol
CH	Hypochlorite
CI	Corrosion Inhibiter
CM	Miscellaneous Chemicals
DC	Closed Drain
DE	Demulsifier
DD	Deck Drains

DO	Open Drain
DS	Sanitary Drain
EX	Engine Exhaust
FG	FueL Gas
FO	Diesel Fuel
GI	Gas Phase Corrosion Inhibitor
GU	Utility Gas
HM	Heating Medium
LI	Liquid Phase Corrosion Inhibitor
OH	Hydraulic Oil
OL	Lube Oil
OS	Seal Oil
PC	Polyelectrolyte
PF	Process Liquid and Two Phase Production
PI	Paraffin Inhibitor
PV	Process Vapor
SI	Scale Inhibitor
VA	Atmospheric Vent
VF	Vent to Flare
WC	Cooling Water
WD	Drilling Water
WF	Fire Water
WH	Chilled Water
WN	Demineralized Water
WP	Potable Water
WS	Sea Water
WW	Waste Water
WX	Produced Water

6.4.3 Valve Designation

1. Each valve on the Contract Drawings and Mechanical Flowsheets shall be clearly marked to denote:

   a. Valve specification group.

   b. Valve type.

c. Valve facing.

d. Special valve type.

For example:

2"-D2JFK

2" Denotes the nominal valve size
D Denotes valve specification
2 Denotes valve type
J Denotes valve facing
F Denotes full port, (blank) denotes regular port
K Denotes sulphide stress cracking (NACE) service

2. Digit Description

1st Digit - A single letter designation which represents the valve specification group and corresponds to the pressure ratings from the piping materials specifications.

2nd Digit - A number identifying the valve type from the following list:

1-Gate, 2-Ball, 3-Plug, 4-Globe, 5-Check, 6-Needle, 7- Butterfly, 8-Diaphragm, 9-Three-way.

3rd Digit - A letter identifying the valve facing from the following list:

S-Screwed, R-Raised Face, F-Flat Face, J-RTJ, W-Welded, Z- Socket Weld, V-Victaulic Coupling, X-Solder Joint, U- Union, G-Grayloc.

4th Digit - A letter identifying a special valve type from the following list:

F-Full Opening, S-Short Pattern, V-Venturi, W-Wafer Check, P-Pipeline Gate, L-Lift Check, T-Tilting Disc, Y-Lug Type, M-Full Opening Short Pattern, N-Piston Check, H-Male/Female Ends, B-check w/counter balance weight, G-Multi-port gauge.

Last Digit - Letter identifying type of service for valve materials from the following list:

(Blank)-Non-Corrosive Service, K-Sulfide Stress Cracking Service (NACE)

6.5 Color Coding

1. If required, process piping shall be color coded with two (2) inch wide pressure sensitive teflon tape in ten (10) foot intervals.
2. Colors shall be in accordance with Company's color schedule below.

Piping Color Coding Schedule

Process Gas	Light Green
Fuel Gas	White
Flare Gas	Orange
Oil	Light Brown
Condensate	Dark Brown
Wellstream	Red Brown
Diesel Oil	Violet
Thermal Fluid	Pink
Firewater	Red
Cooling Water	Blue
Potable Water	Light Blue
Air	Arrow Only
Freon	Arrow Only
Open Drains	Black
Closed Drains	Black
Glycol	Arrow Only
Chilled Water	Green
A/C Condensate	Green

6.6 After-Fabrication Treatment

6.6.1 General

Prior to the assembly of component parts of the piping system, each prefabricated piece, straight length of pipe, or fitting shall be visually checked for dirt, rubbish, grease, loose scale, etc., and cleaned if necessary.

6.6.2 Internal Cleaning

1. Blasting (Where Required)

a. Piping shall be cleaned internally by dry blasting to grey metal.

b. Material used for blasting shall be dry and free of organic material.

c. Straight pipe lengths of 20 foot maximum are recommended to ensure proper cleaning and removal of blast material.

d. After each weld is made, it shall be cleaned internally by blasting, wire brushing, or grinding.

e. Threaded connections and flange faces shall be protected during blasting.

f. Immediately following blasting, or after hydrotesting, the inside of piping shall be sprayed with a suitable corrosion protection solution approved by Company, or as an alternative, the protection may be applied in a crystalline powder form.

g. After interior surfaces are treated, and as rapidly as possible, openings shall be sealed off to prevent exchange of atmosphere.

2. Pickling (Where Required)

a. Pickling shall include degreasing, rinsing, passivating, drying, and the application of protective coating.

b. A detailed pickling and protective coating procedure and a list of materials to be used shall be supplied.

6.6.3 Flushing

1. General

a. Unless otherwise specified, piping systems shall be flushed with fresh industrial water.

b. Equipment shall be blanked off and shall neither be flushed through, nor allowed to accumulate foreign matter removed from the piping.

2. Fire System Piping

a. Fire main pipe, hydrants and sprinkler system headers shall be flushed out thoroughly.

b. A flow sufficient to produce a velocity of five (5) to six (6) feet per second shall be provided.
c. The following flow in gallons per minute shall be required:

4 inch pipe	-	500 GPM
6 inch pipe	-	750 GPM
8 inch pipe	-	1,000 GPM
10 inch pipe	-	1,500 GPM
12 inch pipe	-	2,000 GPM

d. The primary fire water system shall be flushed before connections are made to sprinkler systems or water spray systems.
e. Each hydrant and control valve shall be opened and closed under water pressure to ensure proper operation.

7. INSPECTION AND TESTING

7.1 General

7.1.1 Company has the right to inspect certificates, materials, and procedures at any time.

7.1.2 If errors are discovered, they shall be corrected to the satisfaction of the Company at Contractor's expense.

7.1.3 If at the time of fabrication mill certificates are not available, the Contractor with Company approval, may proceed with fabrication on the understanding that failure to obtain proper mill certificates shall require the removal and replacement of questionable materials at Contractor's expense.

7.2 Inspection

7.2.1 Extent of Inspection

All fabrication shall be subject to inspection.

7.2.2 Weld Inspection

1. All welds shall be visually inspected.

2. No cracks, undercut, slag inclusions, other defects or evidence of poor workmanship shall be permitted.

3. Radiographic inspection of welds shall be conducted in accordance with the requirements of ANSI B31.3, paragraph 344.5, and Pressure Vessel Code, Section V, Article 2.

4. The following extra requirements are required at branch welds and reinforcing pad welds.

   a. For flange ratings ANSI Class 900 pound and higher, all welds shall merge smoothly with the surface of the pipe with no notches or under cut.

   b. Sharp corners on reinforcing pads shall be ground off.

7.2.3 Radiography

1. Pipes shall not be x-rayed if they contain liquid.

2. When inspection reveals a rejectable defect, the weld shall be repaired or replaced.

3. After repairs are complete, welds shall be reexamined and evaluated based on the criteria of paragraphs 7.2.4 and 7.2.5.

4. Progressive examination of additional welds shall be required upon the rejection of welds subject to random inspection. Progressive examination shall meet the requirements of ANSI B31.3 paragraph 341.3.4.

5. Socket welds, branch connections utilizing weld-o-let, thread-o-let, sock-o-let, or elbowlet fittings, and welds which cannot be radiographed because of obstructions in the vicinity of the weld, may, with Company's prior approval, be inspected as follows:

   a. Socket Welds and/or Branch Connections (At Pipe to Fitting Joint)

1. Magnetic particle inspection shall be used for ferrous materials.
2. Liquid penetrant inspection shall be used for non-ferrous materials.

b. Butt Welds: Pipe Size ³ 2 inches, Wall Thickness ³ 0.25 inches.

1. Ultrasonic inspection and magnetic particle inspection shall be used together to inspect the weld.
2. Inspection techniques and evaluation of flaws shall meet the requirements of ANSI B31.3 section 344 except as modified in paragraph 7.2.5.
3. Liquid penetrant inspection may be substituted for magnetic particle inspection only when inspecting non-ferrous materials.

c. Butt Welds: Pipe Size < 2 inches or Wall Thickness < 0.25 inches.

1. Magnetic particle inspection shall be used for ferrous materials.
2. Liquid penetrant inspection shall be used for non-ferrous materials.

6. Initial radiographs and radiographs required due to defective welds shall be provided by Contractor.
7. Company reserves the right to require additional radiography or reshots if the quality of the radiographs is not in accordance with the ASME Boiler and Pressure Vessel Code, Section V, Article 2.
8. Additional radiography due to poor quality, damaged, or defective radiographs shall be at Contractor's expense.
9. Company may employ a third party to examine any weld. The Contractor shall grant the third party access to his yard. Copies of the x-ray reports will be given to the Contractor. If a defect is found, the Contractor shall bear all costs of repairs and re-x-ray.

10. Radiographs shall be the property of Company and shall be turned over to Company upon completion of the Contract Scope of Work.
11. Contractor shall inventory and box all radiographs in suitable containers prior to delivery to Company.
12. Company shall have unencumbered access to radiographs during the project.
13. Company may take possession of radiographs prior to the end of the Contract.
14. If Company takes possession of radiographs prior to the end of the project, Contractor shall be relieved of the requirement to inventory and box the radiographs, but Contractor shall provide copies of traceability documentation upon completion of the Contract Scope of Work.

7.2.4 Extent of Radiography

1. Welds on piping in H_2S service (all pressure classes), welds on piping with design pressure 1000 psig or higher (hydrocarbon and non-hydrocarbon), and welds on piping subject to high frequency cyclic loads from reciprocating machinery such as compressors or engines (all pressure classes and services) shall be 100% radiography inspected.
2. Welds on all other piping (hydrocarbon and nonhydrocarbon) shall be inspected by 10% random radiography. Company's inspection personnel shall select all welds for random radiography. Welds inspected by random radiography shall be radiographed around the full circumference of the pipe (no spot radiography).

7.2.5 Acceptance Criteria for Radiographs

Acceptance criteria for radiographs shall be as follows:

1. Welds subject to 100% radiography shall be evaluated on the basis of ANSI B31.3, Table 341.3.2A, Severe Cyclic Conditions.

2. No root defects open to the interior of the pipe shall be permitted for piping in H_2S service.
3. Welds in piping which operates at pressures in excess of that allowed by the ANSI B16.5 Class 2500 rating shall be evaluated by the provisions of ANSI B31.3, Table K341.3.2A.
4. Welds subject to 10% random radiography shall be evaluated on the basis of ANSI B31.3, Table 341.3.2A, Normal Service Conditions.

7.3 Pressure Testing

7.3.1 General

1. All welding, heat treatment and nondestructive testing shall be completed prior to pressure testing.
2. Company shall approve the system prior to testing.
3. Piping systems shall be hydrostatically tested to a test pressure of 150 percent of the design pressure of the weakest element in the system.
4. Pressure tests shall be performed in accordance with ANSI B31.3.
5. The test pressure shall be maintained for 2 hours.
6. Tests shall be witnessed and verified by the Company Inspector.
7. Substitution of an air test for the hydrostatic test shall require Company approval.
8. Test procedures, test sheets, and schedules shall be submitted to Company for approval.
9. Lines venting to atmosphere shall not be tested, except for leak testing of HP and LP flare systems.
10. Drain lines shall be pressure tested upstream of the last block valve in the line.

11. Deck drain piping shall be leak tested by blocking the deck discharge point and filling the system with water.
12. High and low pressure vent lines shall be pressure tested upstream of vent scrubber vessels.
13. Atmospheric vent lines connected to and upstream from the Atmospheric Vent Scrubber shall be pressure tested.
14. Non destructive inspection and hydrotesting of C.S. (Lined Piping) shall be performed prior to lining.
15. Manufacturer's written approval of the maximum test pressure that can be applied to Manufacturer's valve in the closed position shall be obtained if the valve is to be tested in the closed position.
16. All test systems shall be reviewed to ensure that vents, drains, blind flanges, etc. are installed as necessary whether shown on drawings or not.
17. Temporary supports where required due to additional weights of testing medium shall be provided.
18. Instrument piping up to the first block valve shall be tested with the piping or equipment to which it is connected.
19. All in line valves shall be open.
20. Closed valves shall not be used to separate test systems.
21. Open ends of a system shall be fitted with flanges, blinds or plugs prior to pressure test.
22. Positive provisions shall be made to protect pressure sensitive equipment and instruments such as gauges, controllers, relief valves, etc., during testing.
23. Pressure tests shall be carried to a successful conclusion.

24. During tests both pressure and temperature of the test fluid shall be recorded and submitted for approval by the Company.

25. Prior to testing, piping systems shall be flushed with test fluid until the inside of the lines is thoroughly cleaned. Utilizing a Retroject type facility or Company approved equivalent.

26. After testing and flushing all lines shall be completely drained. Precautions shall be taken to ensure that debris is not flushed into associated vessels, equipment or dead ends. Soft seat valves shall be removed and "pup" pieces installed until flushing is completed.

27. Until completion of pressure testing, all piping joints (including flanged, threaded or welded) shall be left uninsulated.

28. Untested welds shall only be prime coated to a minimum distance of 2 inches on either side of the joint.

29. Control valves shall be removed during the pressure test. Ball valves shall be removed during flush and three-quarters open during test. All other valves shall be fully open during flush and test.

30. Pumps, turbines, compressors, and exchangers shall be excluded from piping pressure tests.

7.3.2 Testing Materials and Equipment

1. The Contractor shall supply all materials and equipment for the test.

2. The hydrotest shall employ two (2) pressure gauges, one (1) dead weight tester, one (1) pressure recorder (chart type) and one (1) temperature recorder (chart type) and one (1) chart pressure recorder.

3. Material such as gaskets, bolting, etc., damaged during tests shall be replaced.

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

5. Materials shall be suitable for the hydrostatic test temperatures. Special consideration shall be given to the possibility of brittle fracture.

7.3.3 Test Medium

1. The test medium shall be fresh water mixed with a corrosion inhibitor.

2. The test medium shall be approved by Company prior to use.

3. The water used shall be clean and free of contaminants such as silt, sand, and rust.

4. Where freezing is a danger during testing, the testing medium shall include glycol or methanol in sufficient concentration to eliminate the possibility of freezing. No residue shall remain after testing.

5. Substitution of an air test shall be permitted only with written approval of Company.

7.3.4 System Preparation

1. Block Valves

a. A block valve shall never be tested in the closed position with pressures greater than the valve's working pressure.

b. If a valve must be exposed to pressure greater than its working pressure, the valve shall be left "half" open to equalize through the valve body.

2. Check Valves

a. A check valve shall never be tested with a pressure greater than its working pressure against the flapper.

b. If a valve must be exposed to pressure greater than its working pressure against the flapper, the flapper shall be removed or pressure shall be

equalized across the valve by means of a jumper.

c. Any valve flapper that is removed shall be secured to or near the valve during the test.

d. Flapper replacement shall be verified by the Company Inspector in writing.

3. Relief Valves

a. Relief valves in the system shall be isolated from the test pressure.

b. Isolation of relief valves from the test pressure may be accomplished by removing the valve and blind flanging or by installing a skillet at the valve's inlet flange.

4. Skillets

a. Skillets shall be installed at each point where the system pressure changes.

b. The skillet shall be installed by slipping in between a flange pair.

c. The diameter of the skillet shall match the raised face portion of the flange.

d. The skillet shall have a handle that extends at least six (6") inches from the outside diameter of the flange.

e. The skillet shall be installed with approved gaskets on both sides.

5. Blind Flanges

If blind flanges are used to isolate systems, the piping downstream that is disassembled shall be hydrotested after reassembly.

6. Pressure Vessels

Pressure vessels that have a working pressure equal to or greater than that of the system shall preferably be tested with

the system. However, the following precautions shall be taken:

a. The rupture disk and relief valve shall be removed and blind flanges installed.

b. All sight glasses shall be tested to their working pressure, then isolated and vented.

7.3.5 Written Test Procedure

Prior to any testing, the Contractor shall provide a written test procedure to Company for approval. This procedure shall include the following information:

1. Drawings showing the location of all skillets, blind flanges, check valves with flappers removed and other modification to the system for the test.

2. Listing of systems to be tested including test pressure.

7.3.6 Notice of Testing

The Contractor shall provide Company twenty-four (24) hour notice prior to the start of any testing.

7.3.7 Acceptance of Testing

The Company Inspector shall accept the pressure test based on the following criteria:

1. The test was carried out in accordance with these specifications and the Contractor's approved test procedure.

2. The system was free of leaks, seeps and other abnormalities by visual inspection while under pressure.

3. The system maintained test pressure for two (2) hours. This shall be witnessed by the Company Inspector and verified by the pressure recorder and temperature recorder charts. The charts shall include the date and time of the test, as well as the Company Inspector's and Contractor's representative's signature.

7.3.8 Post Test Procedures

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

1. Temporary blanks and blinds shall be removed, operating blinds shall be returned to proper position and all lines and piping components shall be completely drained.
2. All vents of lines being drained shall be open.
3. Piping systems downstream of check valves shall be inspected to ensure complete drainage.
4. The system shall be purged with compressed air.
5. Drain and vent valves shall be operated several times during purging to remove the maximum amount of water.
6. Valves, orifice plates, expansion joints and short pieces of piping which have been removed shall be reinstalled with correct gaskets in place.
7. Skillets shall be removed and flanges tightened to the satisfaction of the Company Inspector. The Inspector may require, at his discretion, a leak test for the flange.
8. Check valve flappers removed for the test shall be reinstalled to the satisfaction of the Company Inspector.
9. The Inspector may require, at his discretion, a leak test for the reassembled piping.
10. Flanges and/or weld caps welded at the end of a pipe to facilitate hydrotesting shall be removed after the test is completed and the pipe end shall be beveled in accordance with ANSI B31.3.
11. Direct connected transmitters at orifice flanges shall be disconnected when

replacing orifice plate to avoid distorting the connections.

12. After lines have been drained, temporary supports shall be removed and insulation and painting completed.
13. Spring hangers provided with stops to carry the test load shall have these stops removed after load out.
14. Consideration shall be given to insulation if the system is to be gas leak tested.
15. Flanged joints at which test blinds have been removed shall not be retested.
16. Special length bolting and gaskets shall be removed and replaced with line class bolts and gaskets.
17. Instruments which were removed or blocked out for test shall be reinstalled and blocks placed in the normal operating position.
18. Vessels and piping shall be treated with an industrial corrosion inhibitor solution to minimize internal corrosion.

7.3.9 Test Report

Test procedures and results shall be documented in a report which shall include:

1. Verification that the system has been returned to operational condition.
2. Pressure and temperature recorder charts.
3. A pressure test system drawing for each piping system or spool. The drawing shall indicate:
   a. Test medium.
   b. Test pressure.
   c. Test duration.

7.4 Leak Test

7.4.1 A system leak test using air or inert gas with the system in its normal operating condition (i.e. with blinds removed, orifice plates

installed, equipment connected and instruments installed) shall follow the pressure test.

7.4.2 The leak test shall be at 100 psig or at maximum operating pressure, whichever is lower.

7.4.3 Operating fluid under operating conditions may be used for the leak test at the discretion of Company.

8. DOCUMENTATION

8.1 Drawings

8.1.1 Shop Drawings

1. The Contractor shall prepare shop drawings (isometrics) of each line to be fabricated.
2. Company review of shop drawings shall not relieve Contractor of his responsibilities and obligations to fabricate all items in accordance with the Contract, Specifications, and Contract Drawings.
3. Shop drawings shall include the following:
   a. Fabrication dimensions.
   b. Identification of Company supplied material.
   c. Required radiographic inspection.
   d. Welding procedures.
   e. Location and type of pipe supports.
   f. Material take off.
   g. Weight take off.
   h. Weld numbering system to identify each weld. This weld numbering system shall be used for all NDT identification purposes.
   i. Clearly identified field installed spools.

8.1.2 As-Built Drawings and Specifications

1. As-built drawings shall be made by revising the original fabrication drawings,

supplemented by additional drawings if necessary.

2. As-built drawings shall reflect all Company approved changes, additions, corrections, or revisions made during the course of fabrication.

3. Specifications shall be corrected to reflect any changes made during the purchase of material, equipment, or machinery.

8.2 Certificates

Piping materials, valves, etc., shall be supplied with certificate types as required by TEX.P.110.

8.3 Documentation for H_2S Pipe, Fittings, and Valves

8.3.1 Mill Certificates

1. Mill Certificates and testing for all piping flanges and fittings shall be required for piping used in sour (NACE) service.

2. Mill certificates shall be required on all pipe in H_2S service.

3. Mill certificates shall be obtained in a timely manner to meet the construction schedule.

8.3.2 Traceability

1. Full traceability of sour service piping components shall be required.

2. The Contractor shall obtain and keep complete records of mill certification for each component (pipes, valves, fitting, bolts, etc.).

8.3.3 Material Handling and Storage Procedure

1. A materials handling and storage procedure shall be prepared for Company review and approval.

2. The procedure shall assure the use of only certified components, to the proper specification, in sour systems.

3. The procedure shall define materials handling and storage from materials receipt through component installation.
4. The procedure shall define the following for sour service piping components:
   a. Checking of mill certificates.
   b. Marking (color code/ stamp, etc.).
   c. Storage separate from non-certified materials.
   d. Retrieval for fabrication.

8.4 Weld Records

A record of all welds shall be maintained and shall indicate:

1. Line and weld numbers.
2. Welder identification.
3. Dates and type of NDE performed.
4. Repairs and associated NDE.

9. STANDARD ABBREVIATIONS

"A"

Approx.	Approximate
Asb.	Asbestos
Atmos.	Atmosphere

"B"

Bbl.	Barrel
BE	Beveled End
BF	Bottom Flat
Bl.	Black
Bld.Flg.	Blind Flange
B.O.P.	Bottom of Pipe
B-P	Beveled End-Plain End
Brz.	Bronze
B-T	Beveled End-Threaded End
Bt.	Bottom
BW	Butt Weld

"C"

C-C	Center to Center
CI	Cast Iron

CL	Center Line
Cplg.	Coupling
CS	Carbon Steel
Ch. Va.	Check Valve
c/w	Complete with
CWP	Cold Working Pressure

"D"

Dia.	Diameter
Dim.	Dimension
Disch.	Discharge
Dk.	Deck
Drn.	Drain
DW.	Domestic Water
Dwg.	Drawing

"E"

Ecc.	Eccentric
E-E	End to End
E-F	Electric Furnace
El.	Elevation
Elect.	Electrical
E.W.	Erector Weld
Ell.	Elbow
Exh.	Exhaust
Exp.	Expansion

"F"

Fab.	Fabricated
Fcg.	Facing
F&D	Faced & Drilled
FE	Flanged End
FF	Flat Faced
Flg.	Flange
FS	Forged Steel
Ft.	Foot
FW	Fire Water

"G"

Gal.	Gallon
Galv.	Galvanized
G.G.	Gauge Glass
Gl. Va.	Globe Valve
Gr.	Grade
Graph.	Graphite
G. Va.	Gate Valve

"H"

H.C.	Hose Connection
Hd.	Head
Hdr.	Header
Hex.	Hexagon
Horiz.	Horizontal
HP	Horsepower
Hvy.	Heavy

"I"

ID	Inside Diameter
In.	Inch
Ind.	Indicating
Insul.	Insulating

"J"

Jt.	Joint
JW	Jacket Water

"L"

LCV	Level Control Valve
LLC	Liquid Level Control
L.P.	Low Pressure
LR	Long Radius
Lrgr.	Larger

"M"

Max.	Maximum
MH.	Manhole
MI	Malleable
Min.	Minimum
Misc.	Miscellaneous
Mk.	Mark
MW	Manway

"N"

No.	Number
Nod.	Nodular
Noz.	Nozzle
NPS	Nominal Pipe Size
NPT	National Pipe Thread

"O"

OCT	Oil Center Tool Co.
OD	Outside Diameter
O.H.	Open Hearth

O-O	Outside to Outside
OS&Y	Outside Screw and Yoke

"P"

PE	Plain End
PI	Pressure Indicating Gauge
Pl. Va.	Plug Valve
Plgd.	Plugged
Pot. W.	Potable Water
Press.	Pressure
PSIG	Pounds Per Square Inch Gauge
PVS	Pressure Safety Valve
P-T	Plain End-Threaded End

"R"

Rad.	Radius
Red.	Reducer
RF	Raised Face
Rtg	Rating
RTJ	Ring Type Joint

"S"

S.A.W.	Submerged Arc Weld
S.C.	Sample connection
Sch.	Schedule
Scrwd.	Screwed
SE	Screwed Ends
Smls.	Seamless
SO	Slip-On
Sq.	Square
SR	Short Radius
S-S	Seam to Seam
Std.	Standard
Std. Wt.	Standard Weight
Stl.	Steel
Suct.	Suction
S.F.	Semi-Finish
SS	Stainless Steel
SJ	Solder Joint
Smlr.	Smaller
SPS	Standard Pipe Size

"T"

BE	Threaded Both Ends
T&C	Threaded & Coupled
Temp.	Temperature
TF	Top Flat

Thrd.	Threaded or Thread
TI	Temperature Indicator
TOE	Threaded One End
T.O.P.	Top of Pipe
TSE	Threaded Small End
TW	Thermometer Well

"V"

Va.	Valve
Vert.	Vertical

"W"

WE	Weld End
WN	Weld Neck
WP	Working Pressure
Weld	Welding
W.T.	Wall Thickness
W.O.G.	Water, Oil, Gas
W.P.	Working Pressure
W.S.P.	Working Steam Pressure

"X"

X.S.	Extra Strong
X.X.S.	Double Extra Strong