

OIL & GAS DEVELOPMENT COMPANY LIMITED
PROCUREMENT DEPARTMENT, ISLAMABAD
FOREIGN SECTION A

(To be completed, filled in, signed and stamped by the principal)

ANNEXURE 'A'

Material FIRE WATER JOCKEY PUMPS
Tender Enquiry No PROC-FA/CB/P&P/PUMP-4423/2019
Due Date
Evaluation Criteria MAIN ITEM

SCHEDULE OF REQUIREMENT

Sr No	Description	Unit	Quantity	Unit Price (FOB)	Total Price (FOB)	Unit Price C & F BY SEA	Total Price C & F BY SEA	Deviated From Tender Spec. if Any
1	Explosion Proof Motor Driven Fire Water Jockey Pump with complete Instrumentation as per attached specifications and TOR	Number	2					
2	Commissioning and Operational Spare Parts for Two years	Number	1					

Note:

1. **Bid bond and Bid Validity:** Pursuant to tender clause # 2.2, 11.4, 13 & 35.3.2, bid(s) must be accompanied by an upfront bid bond in the form of pay order/ demand draft or bank guarantee issued by scheduled bank of Pakistan or a branch of foreign bank operating in Pakistan, for an amount of **US\$ 600/-** (US\$ Six hundred only) or equivalent Pak Rupees, with technical bid and valid for 150 days from the date of opening of the bids. The bank guarantee must be issued in accordance with the format as per Annexure-C of the tender documents.
2. **Shipment from ACU member Countries:** In case of shipment from ACU member countries, the LC beneficiary should be of that particular country from where the consignment is being shipped.
3. **Terms and conditions:** Bidders are advised to carefully read all the terms and conditions of the Tender Document available at OGDCL web site in the master tender document.
4. **Summary rejection criteria:** - The summary rejection criteria at clause 35 of the tender document may also be examined carefully. Any bid not meeting the criteria spelled in the clause # 35 shall be summarily rejected without any right of appeal. The detailed tender document is available on OGDCL website as "Master set of tender document-Foreign".
5. **Payment Terms:** Clause No: 3 of Section-III (Part-B) i.e. Conditions of Contract "Special" of Tender Document has been amended and following will be the payments methods.
 - i. **Tender value less than or equal to US\$ 200,000:** Payment to the Contractor/ bidder in foreign currency shall be made by establishing in favor of the Contractor an irrevocable Letter of Credit (hereinafter called the L/C). 70 % Payment (s) under the L/C will be made for the FOB/ CFR / CPT (as the case may be) price of material of each shipment upon submission of the shipping documents. Balance 30% Payment will be released after receipt, inspection and acceptance of material.
 - ii. **Tender value more than US\$ 200,000:** Payment to the Contractor/ bidder in foreign currency shall be made by establishing in favor of the Contractor an irrevocable Letter of Credit (hereinafter called the L/C). 80 % Payment (s) under the L/C will be made for the FOB/ CFR / CPT (as the case may be) price of material of each shipment upon submission of the shipping documents. Balance 20% Payment will be released after receipt, inspection (in addition of pre-shipment inspection) and acceptance of material.

Mirza
SAJID ULLAH
Chief Engr. (Mech.)

TERMS OF REFERENCES

1. Original Authority Letter for participation in the bid from manufacturer must be provided with technical bid.
2. Manufacturer should be well reputed, having 5 years' experience of manufacturing of fire water pump.
3. In Technical Bid, bidder must provide documentary evidence (copy of Purchase Order, Contract etc.) for supply of fire water pump in Pakistan.
4. Names of recommended manufacturers for fire water pump to be confirmed in Technical Bid.
5. Technical literature for fire water pump, explosion proof motor and control system should be provided with Technical Bid.
6. All the standard accessories and optional accessories must be mentioned in the Technical bid.
7. Operational manual should also be provided with supply of fire water pump.
8. The bidder should have established after sales service facilities within Pakistan.
9. The bidder should offer guarantee of 01 year operational / 18 months after shipment, which come earlier.
10. List of 02 years spare parts to be attached with bid (with cost of each spare part).
The cost of 02 years spare parts & optional spare parts will not be included in financial evaluation. OGDCL will select the spare parts at its own choice.
11. Delivery period is 120 days from issuance of L/C.
12. Pump along with controller should be NFPA-20 compalince and UL listed / FM approved.
13. Bidder to confirm supply of material as per attached Specification # 0180-MRK-9000 & P&ID # 2310-PB-2068 (Sh. 2 of 2).

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AMIN ULLAH
Dy. Chief Engr. (Mech.)



Job No. 14-0180	
Spec. No. 0180-MRK-9000	
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SCOPE & SPECIFICATION FOR FIRE WATER JOCKEY PUMP

**Project: INTEGRITY ASSESSMENT AND RELIABILITY
CHECK OF DAKHNI PLANT**

Owner: Oil & Gas Development Co. Ltd.

Prepared by: MR
Checked by: SFA
Approved by: AHB
Revised by: -

Rev.	Description of Revision	Date	Revised Page Nos.
0	ISSUED FOR BIDDING	Dec. 27, 2017	



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1.0 INTRODUCTION

This specification covers the minimum requirements for the supply of Fire Water Jockey Pumps that is to be installed at OGDCL's Dakhni Gas Processing Plant.

1.1 Definitions

Terms used in this specification have the following meanings:

“Company” means “Oil and Gas Development Company Limited (OGDCL)”

“Engineering Consultant” shall mean “ENAR Petrotech Services (Pvt.) Limited”

“Supplier” means Entity with whom the Company will execute a Contract for supply of equipment/material as per this document

“Project” means “Integrity Assessment and Reliability Check of Dakhni Plant”

1.2 Error or Omission

The review and comments by Company / Engineering Consultant on Supplier's or its manufacturer's drawings procedures or documents shall only indicate acceptance of general requirements and shall not relieve the Supplier of its obligations to comply with the requirements of this specification and other referenced documents.

All deviations to this specification, other referred document or attachments shall be brought to the knowledge of the Company / Engineering Consultant in the bid. All deviations made during the design, procurement, manufacturing, testing and inspection shall be with written approval by the Company / Engineering Consultant prior to execution of work. Such deviations shall be shown in the documentation prepared by the Supplier.

1.3 Conflicting Requirements

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



1.4 Language and Units of Measurement

The governing language shall be English language.

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

1.5 Order of Precedence

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

The order of precedence shall be as follows:

1. Data Sheet and P&ID for Firewater Pumps.
2. This specification document and the referenced Documents.
3. Referenced International Codes and Standards.

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

1.6 Reporting Procedure

A reporting and documentation system shall be agreed between the Company and the Supplier for the status of procurement, design, manufacturing, inspection, testing and shipment of the Firewater Jockey Pumps to be supplied under this specification. Supplier shall provide reports and summaries for production performance and testing operations in conformance with a manufacturing schedule approved by Company.

1.7 Company's Intention

It is intention of the Company to procure the Firewater Jockey Pumps based on attached Data Sheet, P&IDs, this specification document and referenced specifications attached with this document. Supplier shall be responsible to supply the Firewater Jockey Pump,



in view of the requirements as detailed in relevant Data sheets and specifications, procure material, perform mechanical design (Supplier shall submit the pump general arrangement drawings for Company's approval prior to finalization of design), manufacture, paint, test and prepare for shipment. Supplier shall also obtain approval from Company to buy any component of the pumps. Supplier shall also be responsible for all Sub-suppliers coordination, data and other documents, provision of guarantees, provision of equipment and personnel for the trial assembly, and functional testing of complete pumps at Supplier's works and packaging and delivery as specified in this document.

1.8 Reference Codes and Standards

Following codes and standards shall form a part of this specification, except as modified herein: -

NFPA 20	Installation of Stationary Pumps for Fire Protection Service
NFPA 25	Inspection and Testing of Water-Based Fire Protection Systems
ASME B31.3	Chemical Plant & Petroleum Refinery Piping
ASTM	American Society for Testing of Materials
ASME B16.5	Pipe Flanges and Flanged Fittings
ANSI/HI 1.1-1.5	Centrifugal Pumps, Nomenclature, Definition, Application and Operation
ASME V	Non Destructive Examination
ASME B73.1M	Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process
NFPA 70	National Electric Codes (NEC)
UL 1004	UL Standard for Safety for Electric Motors
NEMA MG-1	Motors and Generators
ISO 3046	Reciprocating internal combustion engines



All applicable Codes and Standards of ASTM, ASME, API, NFPA, OSHA.

Compliance by the Supplier with the provisions of this specification does not relieve him of his responsibility to furnish the Jockey pumps of a proper mechanical design suited to meet the specified service conditions and/or codes governing health and safety.

1.9 Supplier Responsibility

The Supplier shall be responsible for the complete design, manufacturing, supply, and inspection and testing of Firewater Jockey Pump including full compliance with all applicable design codes and standards listed in Section 1.8, of this document, and with the requirements of the certifying authority, if applicable.

Any work or material found to be defective or which doesn't meet the requirement of this specification, datasheet, P&ID and other reference specifications shall be replaced by the Supplier at his own expense.

2.0 SCOPE OF SUPPLY

2.1 The Supplier shall provide the Fire water Jockey Pumps in accordance with NFPA 20:

Sr. No.	Qty.	Tag No.	Title
1	02	901-GA-3A/B	Motor Driven Firewater Jockey Pumps

2.2 Commissioning Spares and List of Spares for two years of operation for each pump.

2.3 The Supplier shall furnish all equipments and necessary ancillaries for the safe and reliable operation of Firewater Jockey Pump. Following shall be included in firewater jockey pump but not be limited to:

- a) Two (02) 2x100% duty motor driven Jockey pumps complete with the following:
 - Electric Motor.
 - Base Plate (Drain Rim Type).
 - Discharge & Suction Reducers for mating line size.
 - Mating Flanges (at suction & discharge) as per ASME B16.5.
 - All seals, couplings and guards (spark proof).



- All necessary noise suppression equipment (where applicable).
 - All necessary start-up and commissioning spares.
 - Export packaging of all items.
 - Suction and discharge piping is excluded from Supplier's scope. However supplier will provide piping for pressure switch.
 - Control panel suitable for outdoor installation for each pump as per NFPA 20.
 - Pressure Switches for High and Low adjustments in compliance with NFPA 20 shall be provided for each pump.
 - Flow Indicator on Pump discharge.
 - The pressure adjustment for High and Low pressure switches.
 - Pressure Recorder (UL listed/FM approved) for sensing and recording the pressure in each fire pump controller for Seven Days (07) without being reset.
 - Pressure gauges at suction and discharge as per NFPA 20.
 - Alarm monitoring / signaling devices.
 - Controller/Transfer switches & Isolation switch.
 - Automatic & Manual controllers.
 - One set of shim plates as required for normal alignment.
 - Foundation bolts and nuts, leveling base screws for each Pump.
- 2.4 Equipment shall be installed on the base plate with all supports, as required, to prevent excessive equipment and piping vibration.
- 2.5 Supplier's instrumentation and equipment scope shall be shown in the attached P&ID.



3.0 ENVIRONMENTAL DESIGN CRITERIA

3.1 General

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

3.2 Area Classification

All instrumentation and electrical equipment shall conform to non classified locations.

3.3 Site, Environmental & Utility Design Data

Pumps shall be designed for outdoor location with utility & site conditions and NEQs as given in Site, Environment & Utility Design Data (4908-A-1001).

3.4 Noise

The noise level from Firewater Jockey Pump shall not exceed 85 dBA at 1m.

4.0 DESIGN REQUIREMENT

4.1 General

- a) The Firewater pumps shall be horizontally mounted and complying with NFPA 20 requirements. Fire water jockey pump shall be UL Listed/FM Approved.
- b) Firewater jockey pumps shall be listed and approved for fire protection service.
- c) Supplier shall have the responsibility that the jockey pumps, consisting of pump driver shall perform in compliance with this specification document as an entire unit when installed or when components have been replaced.
- d) Jockey pumps and its drivers shall be mounted on common fabricated base plate.
- e) All vents/drains shall be terminated at skid edge and where practical collected at common location.



- f) Fire water system with complete instrumentation and controllers shall be provided in compliance with NFPA 20. All equipment required for wiring and termination (Cables, Cable Glands and Junction Boxes) shall be provided by supplier. If any equipment is supplied separately, Supplier shall be responsible to provide all the installation documents, drawings, installation accessories, material etc complete in all respect.
- g) The firewater Jockey pump shall be mounted on a heavy-duty structural steel baseplate designed to suit transport, lift and installation conditions. The firewater Jockey pump shall be suitable for remote, unattended operation.

4.2 Material

Material for pump parts shall be designed and fabricated in accordance with ANSI/ASTM/NFPA-20 standard. All material shall be new & best quality. Material grade which are equivalent to ANSI/ASTM shall be quoted with equivalency chart showing chemical and mechanical properties.

- a) Pump casting shall be smooth and free from scale, cracks, lumps, blister, sand hole & defects of any nature. Pump casing and bearing frame shall be of Cast Iron.
- b) Impeller shall be of Bronze & keyed to a 316SS stainless steel shaft.
- c) Casing & Impeller shall be fitted with replaceable bronze wearing rings. The rings shall be secured in a manner that will not permit rotational or axial movement. Shaft Sleeve and Packing glands will be of Bronze.
- d) Shaft shall be of 316SS stainless steel type fitted with replaceable corrosion resistant shaft sleeve.
- e) Shaft shall be mounted in two dust tight deep grooves, sealed and permanently greased ball bearings.
- f) Bearing shall be mounted in a cartridge type housing so that they shall be replaceable without opening the pump casing. Bearings shall be removable



without the need of special tools or bearing puller, but only by rotating the bearing removal nut.

- g) Each stuffing box shall be fitted with a three piece bronze split gland. Stuffing box shall be fitted with an extension to facilitate the packing rings removal.
- h) Packing rings shall be removable without disturbing wetted parts or the pump bearings. Water seal rings made from non-corroding material shall be piped to pump volute.
- i) Base Plate shall be of Cast Iron.
- j) Following Material grades shall be furnished by supplier for pump components.
 - Casing.....Cast Iron (ASTM A48)
 - Impeller.....Bronze (ASTM B62)
 - Shaft.....Stainless Steel (AISI 316SS)
 - Shaft Sleeve.....Bronze (ASTM B62)
 - Case Wear Ring.....Bronze (ASTM B62)

4.3 Nozzles and Miscellaneous Connections

- a) All suction and discharge connections shall be flanged.
- b) The pump casing shall be furnished with tapped and plugged vent and drain openings for priming, which shall be valved unless plugs are specified.
- c) Drain and vent shall not be smaller than ½" where practical. All pipe and nipples shall be Schedule 80 pipe class.
- d) Suction nozzle flanges shall be of the same rating as the discharge nozzles flanges and shall be as per ASME B16.5.

4.4 Minimum Fittings

The following minimum fittings shall be provided as per NFPA20:

- a) Suction & Discharge Pressure Gauges.



- b) ¼-inch size Gauge Cocks and Nipples.
- c) 1/2 inch Air release valve, UL/FM listed for fire pump service.

4.5 Couplings

Supplier shall supply and install the coupling with a removable protecting guard in compliance with ANSI B 15.1 (as necessary). This protection shall be made of anti-spark material. Coupling shall be flexible, spacer type complete with easily removable guard.

4.6 Base Plate

- a) Firewater jockey pumps will be supplied in its base frame individually.

4.7 Electrical Design Requirement for Fire Water Jockey Pump Motor

Supplier scope of work will include but not limited to the selection of electrical equipment suitable for environmental conditions (IP55min.) and as required for the entire package including motors, starters, junction boxes, distribution boxes, earthing material etc. i.e. all the distribution & utilization equipment, interconnecting power, control cables shall be in the scope of package supplier supply.

The different voltages requirement whether AC & DC for the package utilization equipments motorized and non-motorized (electrical & instrumentation loads) shall be accommodated by the supplier through its own distribution system. The company shall provide a single power feeder 400 VAC, 3 Phase, 50Hz with Neutral from the own reliable distribution system to the supplier Control panels including feeders/ motor starters. This Company provided power supply shall energize the supplier distribution system and feed all electrical loads including motorized and non motorized loads, electrical & instrumentation loads of the fire water pump package

The supplier shall provide a block diagram of the package which shall clearly identify power supply requirements of package, from the purchaser.

- 4.7.1 Below characteristics shall be followed as minimum design requirements for the electrical system of the fire water jockey pump motor package. The Manufacturer/ Supplier may enhance these minimum requirements for safe and reliable operation of



the supplied package. The supplier shall specify the electrical load requirement for the power feeder of 400VAC, 50Hz, 3 Phase and Neutral & 230 VAC, 50Hz. The electrical equipment supplied by the Supplier shall be suitable for below available power supply:

Power Supply

- System voltage (3-phase, 4-wire) 400 V
- System voltage (1-phase, 3-wire) 230 V
- Frequency 50 Hz
- AC UPS (1 phase) 230Vac
- Motors (0.37kW and less) 230 Vac - 1 phase (Special condition)
- Motors (above 0.37 kW) 400 Vac - 3 phase
- Instruments & Control 230V, 50 Hz, 1-phase from UPS

Maximum supply voltage and frequency variations shall be as follows:

- Steady State voltage variation $\pm 5\%$ (AC Supplies)
- Frequency variation $\pm 2\%$

For any other voltage levels other than those mentioned above, the Supplier shall be responsible to provide the voltage transformation system.

4.7.2 Motors shall be designed for suitable starting method and shall be continuously rated and suitable for continuous operation at full load rating under combined variation of both voltage and frequency, as cited above.

Starting method for motors shall be applicable as given below.

Up to 37KW	Direct On-Line
>37 < 100KW	Star Delta
>100KW	Variable Frequency Drive/ Soft Starting

The offered electric motors shall be squirrel cage induction motors supplied in accordance with the latest international standards and shall suit for Jockey Pump services.

All motors will be continuously rated, and all motors will be suitable for direct-on-line starting.



All motors shall be rated for maximum design ambient temperature. Motors will have class F insulation with a temperature rise limited to class B at minimum. The minimum degree of protection for motor enclosures will be IP55 to IEC-60529 and for motor terminal boxes will be IP65.

LV motors will have TEFC enclosures.

The service factor of electric motor shall be 1.0. An external earthing point shall be provided with the offered motors.

Motor equal or greater than 55 kW rating will have anti-condensation heaters.

Efficiencies of all the motors shall be minimum IE2 or greater and p.f greater than 0.9

Supplier shall identify the manufacturer of the offered motors and shall provide the preliminary manufacturer data sheet.

4.7.3 Jockey Pump Motor Controller Requirement

- a. The Jockey Pump Motor Controller supplied by the supplier shall be "Listed as per NFPA 20".
- b. The jockey pump motor controller shall be complete with motor starters, protection, indications. The controller shall be NEMA 4X suitable for outdoor installation.
- c. The Controller and the electric motor shall be internally pre-wired by the Manufacturer. The Client shall only provide 400V AC, 3 – Phase, 50 Hz electric power to the package.
- d. Supplier shall mention the required feeder rating of jockey pump controller.
- e. Pressure Recorder for sensing and recording the pressure in each fire pump controller for Seven Days (07) without being reset.
- f. The controller shall have provision for interface with plant DCS for monitoring. Supplier shall provide monitoring signals that will be interfaced with plant DCS with bid. The supplier shall also provide dry contacts for interfacing with DCS.



- g. The electric motor driven pump shall start automatically by pressure switch low actuation.
- h. Provision for manual starting and operation of Jockey Pump shall also be provided through push button switch. The switch shall be arranged such that the operation of engine when manually started cannot be affected by pressure switch.
- i. Provision for manual (by push button) and automatic pump shutdown shall be provided for each pump in compliance with NFPA 20.
- j. The pumps arranged for automatic shutdown after starting causes have returned to normal, a running period timer set for at least 10 minutes running time permitted to commence at initial operation in compliance with NFPA 20.

5.0 PAINTING & PREPARATION FOR SHIPMENT

Painting, protective coatings and the procedures used for the preparation of surfaces shall be as specified in the Specification Doc. No. 4989-GS-9502.

Packing and Preservation shall be suitable for transportation of materials and equipment during their handling, inland transportation and storage at site for up to 6 months in an uncovered and unheated location. Packing shall account for the fragility and physico-chemical/ mechanical damages of items.

All Loose parts etc. shall be properly tagged to allow easy identification/site assembling.

Unpainted surfaces shall be protected from corrosion during shipment and subsequent outdoor/indoor storage by coating with a rust preventative.



6.0 QA/QC AND CERTIFICATION

6.1 Quality Assurance & Control

6.1.1 Quality Management System

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

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

Company reserves the right to visit the premises of Supplier for the purpose of undertaking Quality Audits relating to the unit and services covered by this specification, the extent of which will be discussed with Supplier before PO award.

Prior notice will be given to Supplier of any such audits. A copy of the audit report will be forwarded to Supplier on completion. Any findings resulting from such audits shall necessitate the implementation of appropriate corrective actions based on a time scale to be agreed with Company.

6.1.2 Quality Control

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



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

To assist Supplier in evaluating the expected level of Company involvement applicable to this scope and specification, the following activities in Quality Control Level by Company have been identified:

- QC Plan review/markup.
- Surveillance of major Sub-suppliers.
- Certification and manufacturing data review.

6.1.3 Material Traceability & Certification

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

6.2 Certification & Manufacturing Records

6.2.1 Inspection and Certification Records

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



6.2.2 Certification and Manufacturing Data Requirements

Certification and manufacturing data requirements consist of a collection of original and type test certification, inspection and test records and final release documentation generated during the approval, manufacture and testing of the unit or material.

All Certification and Manufacturing Data (04 sets) is to be issued to Company.

7.0 SPARES

The supply of Firewater Jockey Pumps shall include the commissioning spare and list of recommended two years operational spares.

7.1 Commissioning Spares

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

7.2 Two Years Operational Spares

Supplier shall recommend and provide list of spare parts needed for two (02) years of operation.

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

8.0 PERFORMANCE GUARANTEE & WARRANTY

The Supplier will warrant the Firewater Jockey Pumps to be free of defects in material and workmanship, and that it is of adequate size and capability to fulfill the design and operating conditions specified herein. The Supplier shall replace and install, without



cost to the Company, any materials, supplies, or equipment which fails under design conditions due to defects in material or workmanship, if the defect is observed and/or such failure occurs within warranty period. Acceptance of this order will signify acceptance of all conditions of this guarantee. The complete pumping assembly and all control equipment shall be guaranteed in writing for pressure, capacity & power consumption as required by NFPA-20.

9.0 DOCUMENTATION REQUIREMENT

9.1 Use of the English Language

All documents shall be written in the English Language.

9.2 Documents to be submitted with the Bid

The bidder shall submit the following details as a minimum on the Firewater Jockey Pumps with the bid:

Technical Documents:

1. Name of Pumps Supplier and country of manufacturing.
2. Pumps & drivers Outline drawings showing part list , materials & other details.
3. Pumps & drivers Cross Sectional Drawings.
4. Shaft Seal Drawing.
5. Shaft coupling assembly drawing with details of allowable misalignment tolerances style of coupling guard. Materials and names of the mechanical seal and coupling manufacturer.
6. Primary and auxiliary sealing schematic.
7. Electrical and instrumentation schematics and list of components.
8. Pump Performance curves which include Differential head, Efficiency, Water NPSH & brake horsepower (KW), all expressed as function of capacity.
9. Pump head capacity curve for maximum impeller diameter.
10. Deviation/Exception list for this scope & other referenced documents and specifications /NFPA 20.
11. Completed datasheet.
12. Listing certification.
13. Controller schematic diagram.
14. Equipment installation details.
15. Noise levels.
16. Commissioning spares and List of recommended Spare parts for 02 years operation.
17. Dimensional drawing of motor.



18. Name of motor/engine manufacturer and country of manufacturing.
19. Motor/engine performance data.
20. Motor/engine hazardous area classification.
21. Motor/engine startup details.
22. Civil Foundation drawings showing anchor bolts location and loading of each skid, dry and operating.
23. Recommended method for starting motor/engine driven pump.
24. Cable Termination Drawings.
25. Electrical Equipment Data sheets including Manufacturer's Electric Motor Data Sheet etc.
26. Dynamic Loading calculation of Pumps.
27. Listing certificate of controller.

Financial Documents:

1. Price breakup of all the Components of Firewater Jockey Pumps.
2. Performance Bank Guarantee(s).
3. Schedule of Deliveries.
4. Priced list of spare parts for two years operation (if any) with FOB and CFR Karachi basis.
5. Comments or exceptions/contractual deviations to specifications and datasheets.
6. Other requirements as specified in specifications and datasheets.



9.3 Documents to be submitted after Purchase Order (for Approval)

1. Finalized Production Schedule
2. Data required for foundation design
3. Material test certificates
4. Pump operating manual including characteristic curves
5. Mechanical design calculations
6. G.A drawings
7. Sectional details/drawings
8. Hydro testing certificates
9. Performance and NPSH test certificates
10. Controller (jockey pump controller) schematic drawings, wiring and termination diagrams.
11. Motors datasheets, technical details, dimension details and performance curves etc.
12. Manufacturing Data Records (MDR)
13. Any other documents not specified above, but essential to make the unit operational and maintainable

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

9.4 Final Documentation

A fabrication dossier shall be compiled concurrently with fabrication such that a full record of the fabrication, materials, inspection and testing is available.

All items in the dossier shall be numbered and bound in an A4 four post binder;

Contents shall include but not be limited to the following (as applicable):

1. Front cover sheet detailing:
 - P.O. No.
 - Project Title



- Equipment Title
 - Equipment Item No.
2. Index.
 3. Company/ Engineering Consultant Release Note.
 4. Purchase Order.
 5. A list of all applicable codes, standards and specifications.
 6. All drawings "As-built" - wherever legibility can be preserved reduced to A3 and folded, where legibility cannot be preserved drawings to be folded to A4 size and inserted into pre-punched plastic wallets.
 7. All Hydrostatic/ Performance/other test reports.
 8. Photocopy of nameplate.
 9. Material chemical analysis and mechanical test certification.
 10. Final signed quality plan.
 11. Operating manuals shall also be assembled into bound volumes and shall contain:
 - a. Operating and maintenance procedures
 - b. Commissioning instructions
 - c. All "As-built" drawings
 - d. Schedules of commissioning and operating spare parts for two years service.

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

9.5 Transmittals

All documents submitted to the Company/ Engineering Consultant after the award of contract shall be accompanied by a transmittal completed by the Supplier. All transmittals will be sequentially numbered.

Minimum 04 days shall be required for review and approval of drawings and documents submitted to Company/ Engineering Consultant by the Supplier.



9.6 Drawing Sizes

Sizes A1, A2, A3, and A4 shall be used.

A0 size drawings are NOT acceptable.

9.7 Scale Ratios

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

9.8 Electronic Data

Supplier shall also submit electronic/soft copies of all design data, documents, drawing, etc. This also includes design details by Supplier's Sub-Suppliers.

All drawings shall be provided in AutoCAD 2004 format. All documentation shall be prepared in MS Office 2003.

10.0 NAME PLATE

Name plate shall be as per NFPA-20 requirement.

Stainless steel Name Plate shall be permanently affixed to the each pump. The Name Plate for the motor shall contain the minimum data specified in the motor specification.

Name Plate for pumps shall contain the following data:

- Name of Manufacturer
- Date of Manufacturer
- Model No.
- Equipment Tag No.
- Body material
- Design code
- Pressure rating
- Capacity
- Pump head
- Casing hydrostatic test pressure
- Horse Power
- Speed

Direction of rotation shall be affixed at a visible place on the pump.



11.0 REFERENCE DOCUMENTS

- 1) P&ID of Firewater Jockey Pumps (2310-PB-2068, Sheet 2 of 2).
- 2) Data Sheet of Motor Driven Firewater Jockey Pumps (0180-DS-1000).
- 3) Data Sheet LV Induction Motor (14-0180-650I-A)
- 4) Specification for LV Induction Motors (14-0180-ELA-6500)
- 5) Site Environment and Utility Design Data (4908-A-1001).
- 6) Specification for Painting (4989-GS-9502).
- 7) Specification for Steel Structure (4989-STA-4003)



*Specification for Fire Water Jockey Pump
Integrity Assessment And Reliability Check Of Dakhni Plant*

PIPING & INSTRUMENT DIAGRAM (P&ID) OF FIRE WATER JOCKEY PUMPS PACKAGE



Data Sheet of Motor Driven Firewater Jockey Pumps



**INTEGRITY ASSESSMENT AND RELIABILITY CHECK
OF DAKHNI PLANT
DATA SHEET
FIRE WATER JOCKEY PUMPS**

Doc.No 0180-DS-1000
Prep. UH: Chk MAS Apr AHB
Date 27-Dec-17
Sheet 1 of 1 Rev. 0

Client OGDCL Site Dakhni Gas Processing Plant
Unit Fire Water System Service Water
No. Req'd 02 No. Motors Req'd 02 Provided By Mtd By
Item No. 901-GA-03 A/E Item Description Fire Water Jockey Pumps
No. Engines Req'd No. Turbines Req'd Provided By Mtd By
Pump Mfr. Size and Type Serial No.

OPERATING CONDITIONS, EACH PUMP				PERFORMANCE (NOTE-5)	
Liquid	Water	Flow at PT. (gpm) Nor.	Rated 30.0	Proposed Curve No.	
PT. (°F) Nor.	77	Disch. Press. (psig) at PT.	Rated 150.00	RPM	NPSHr (Water)
Sp.Gr. at PT.	1.0	Suct. Press. (psig) at PT.	Rated 1.00	Eff.	50% BHP Rated 5.22
Vap. Press. at PT. (psia)	0.46	Diff. Press. (psi)	149.00	Max. BHP rated IMP	
Vis. at PT. (cP)	1.00	Diff. Head (ft)	343.69	Max. Head Rated IMP	
Corr./Eros. Caused by		NPSHa (ft)	32.00	Min. Continuous	gpm
Location:	<input type="radio"/> Indoor <input checked="" type="radio"/> Outdoor	Area:	<input type="radio"/> Safe <input type="radio"/> Hazardous	Rotation (Viewed from CPLG End)	
Working:	<input checked="" type="radio"/> Continuous <input type="radio"/> Intermittent <input type="radio"/> Random	Hyd. Power (HP)	2.61	Shut off Head(ft) (ft)	
App. Code	<input type="radio"/> API-610 <input type="radio"/> ANSI <input type="radio"/> Other NFPA-20				

CONSTRUCTION				SHOP TESTS	
Nozzles	Size	Rating	Facing	Location	
Suction	4" (NOTE-1)	150#	RF		<input type="radio"/> Non-Wit. Perf. <input type="radio"/> Wit. Perf.
Discharge	3" (NOTE-1)	150#	RF		<input type="radio"/> Non-Wit. Hydro <input checked="" type="radio"/> Wit. Hydro
Case-mount:	<input checked="" type="radio"/> Centerline <input type="radio"/> Foot <input type="radio"/> Bracket <input type="radio"/> Vert. (Type)				<input type="radio"/> NPSH Req'd. <input checked="" type="radio"/> Wit. NPSH
Split:	<input type="radio"/> Axial <input checked="" type="radio"/> Rad.	Volute Type:	<input type="radio"/> SGL <input type="radio"/> DBL <input type="radio"/> Diffuser		<input checked="" type="radio"/> Shop Inspection
Press:	<input type="radio"/> Max. Allow. _____ psi @ _____ °F	Hydro Test	_____ psig		<input type="radio"/> Dismant. & Insp. After Test
Connect:	<input checked="" type="radio"/> Vent <input type="radio"/> Drain <input type="radio"/> Gage				<input checked="" type="radio"/> Other Mechanical Run
Impeller Dia. :	<input type="radio"/> Rated _____ Max. _____	Type:			
Mount:	<input type="radio"/> Between Bearings <input type="radio"/> Overhung				
Bearings-type:	<input type="radio"/> Radial <input type="radio"/> Thrust				
Lube:	<input type="radio"/> Ring Oil <input type="radio"/> Flood <input type="radio"/> Oil Mist <input type="radio"/> Flinger <input type="radio"/> Pressure				
Coupling:	<input type="radio"/> Mfr. <input type="radio"/> Model				
Driver Mtd. By:	<input checked="" type="radio"/> Pump Mfr. <input type="radio"/> Driver Mfr. <input type="radio"/> Purchaser				
Packing:	<input type="radio"/> Mfr. & Type _____ Size/No. of Rings _____				
Mech. Seal:	<input type="radio"/> Mfr. & Model _____ <input type="radio"/> Mfr. Code _____				

AUXILIARY PIPING				VERTICAL PUMPS (N/A)	
<input type="radio"/> C.W. Pipe Plan _____	<input type="radio"/> CS <input type="radio"/> SS	Tubing:	<input type="radio"/> Pipe	Pit or Sump Depth	
<input type="radio"/> Total Cooling Water Req req	ft ³ /h	<input type="radio"/> Sight F.I. Req'd		Min. Submergence Req'd.	
<input type="radio"/> Packing Cooling Injection Req'd:	Total, ft ³ /h	<input type="radio"/> psig		Column Pipe:	<input type="radio"/> Flanged <input type="radio"/> Threaded
<input type="radio"/> Seal Flush Piping Plan _____	<input type="radio"/> CS <input type="radio"/> SS	<input checked="" type="radio"/> Tubing	<input type="radio"/> Pipe	Line Shaft:	<input type="radio"/> Open <input type="radio"/> Enclosed
<input type="radio"/> External Seal Flush Fluid _____	ft ³ /h	<input type="radio"/> psig		Brgs:	<input type="radio"/> Bowl <input type="radio"/> Line Shaft
<input type="radio"/> Auxiliary Seal Plan _____	<input type="radio"/> CS <input checked="" type="radio"/> SS	<input checked="" type="radio"/> Tubing	<input type="radio"/> Pipe	Brg. Lube	<input type="radio"/> Water <input type="radio"/> Oil <input type="radio"/> Grease
<input type="radio"/> Aux. Seal Quench Fluid _____				Float & Rod	<input type="radio"/> CS <input type="radio"/> SS <input type="radio"/> BRZ <input type="radio"/> None
				Float Switch	
				Pump thrust, lb.	<input type="radio"/> UP <input type="radio"/> Down

MOTOR DRIVER				MATERIALS (NOTE-2,3)	
KW 5.5 (VTC)	RPM	VTS	Frame	VTS	Vols./Phase/Cycles 400/3/50
Mfr.	VTS	Bearings	VTS	CASE	
Cooling Type	IEFC	Insulation	F	IMPELLER (S)	
Cable Entries	Fixed (VTC)	Temp. Rise	B	PUMP SHAFT	
Enclosure			IP55	WEAR RING	
Terminal Box	IP65			BEARING	
				SUCTION STRAINER	
				SLEEVE / COUPLING	

NOTE : The vendor shall confirm the kW rating & satisfactory operation of equipment at site / environmental conditions after applying the applicable derating factors including ambient temperature, Altitude, Relative Humidity etc

- NOTES:**
- 1) Suction and Discharge line Sizes. Vendor to specify pump suction and Discharge nozzle sizes accordingly and to provide connecting flanges and reducers.
 - 2) Refer to Section 4.2 of Scope and Specification for Fire Water Pump Package, Doc. No. 0180-MRK-9000.
 - 3) Data Presented in this sheet is based on preliminary estimates. Contractor to update the data sheet based on firm detailed engineering
 - 4) VTS = Vendor To Specify
 - 5) VTC = Vendor To Confirm
 - 6) PT = Pumping Temperature
 - 7) Refer to attached motor Data sheet 14-0180-ELA-6501-A & Specification for Induciton Motors 14-0180-ELA-6500
 - 8) For site conditions refer to Site, Environment and Utility Design Data 4985-A-1000.



*Specification for Fire Water Jockey Pump
Integrity Assessment And Reliability Check Of Dakhni Plant*

Data Sheet of Firewater Jockey Pumps Motor



INTEGRITY ASSESSMENT AND RELIABILITY CHECK OF DAKHNI PLANT

ISSUED FOR REVIEW & APPROVAL

REV	DATE	DESCRIPTION	ORIG	CHKD	LE	QA	PM	LOCAL REPR.	PROJ. MAN.	
A	3-Jan-2018	Issued for Review & Approval	JAB	ZHW	AIB	MHQ	AHB			
REVISIONS			APPROVAL					OWNER APPROVAL		
ENAR PETROTECH SERVICES (PVT.) LTD. 7-B, KORANGI INDUSTRIAL AREA, KORANGI-KARACHI			TITLE :							
			DATA SHEET FOR FIRE WATER JOCKEY PUMP MOTOR (901-GA-03 A/BM)							
CONTRACT NO. 14-0180			DOCUMENT NO:							
			14 - 0180 - ELA - 6501 - A							
			PROJECT. CODE	DOCUMENT TYPE	SEQUENTIAL NUMBER	REVISION				
							PAGE 1 OF 2			



**DATA SHEET FOR FIRE WATER JOCKEY PUMP MOTOR
(901-GA-03 A/BM)**

PROJECT NO. : 14-0180

REV. NO. : A

PROJECT NAME : INTEGRITY ASSESSMENT AND RELIABILITY
CHECK OF DAKHNI PLANT

DATE : 3-Jan-18

CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD.
(OGDCL)

SHEET : 2 of 2

ENAR PETROTECH SERVICES
(PRIVATE) LIMITED

Plot No. 7-B, Sector-7A Korangi Industrial Area
Karachi-74900

DOCUMENT NO. : 14-0180-ELA-6501-A

LV ELECTRICAL INDUCTION MOTORS

GENERAL SPECIFICATION				VENDOR DATA		
1	Equipment Tag	901-GA-03 A/BM	Qty 2	34	Manufacturer	VTA
2	Equipment Service	Fire Water Jockey Pump Motor		35	Frame Size	VTA
3	Motor Type	Squirrel Cage Induction Motor		36	Frame Material	VTA
4	Rated Output	5.5 (VTC)	kW	37	Full Load Current	VTA A
5	Rated Voltage	400	V	38	Locked Rotor Current	VTA A
6	Allowable Volatage Variation	± 5%		39	Starting Current Ratio	VTA A
7	Frequency (Hz)	50		40	Rated Torque	VTA Nm
8	Allowable Frequency Variation	± 2%		41	Moment of Inertia	VTA kgm ²
9	Phase	3		42	Rated Power	5.5kW (VTC)
10	Speed	To suit application		43	Starting Power Factor	VTA
11	No. of Poles	To suit application		44	Mounting	VTA
12	Duty Type	Continuous		45	Coupling Method	<input checked="" type="checkbox"/> Direct <input type="checkbox"/> V-Belt <input type="checkbox"/> Gear Box
13	Service Factor	1.0		46	Rotation (Facing Drive End)	<input type="checkbox"/> Clockwise <input type="checkbox"/> Anti-Clockwise
14	Enclosure	TEFC		47	Noise Level	85 dBA at 1 m
15	Ingress Protection	IP 55 Motor	IP 65 Terminal Box	48	Hazardous Area Certification	N/A
16	Insulation Class	F		49	Weight of Motor	VTA kg
17	Temperature Rise	B		50	Vibration	IEC-60034 & applicable IEC standards
18	Motor Starting Method	<input checked="" type="checkbox"/> DOL	<input type="checkbox"/> Y-D <input type="checkbox"/> VFD <input type="checkbox"/> SoftStart	51	Efficiency	IE2-Efficiency Class as per IEC-60034-30-1
19	Location	<input checked="" type="checkbox"/> Outdoor	<input type="checkbox"/> Indoor	52	100% Load	VTA %
20	Area Classification	<input type="checkbox"/> Hazardous	<input checked="" type="checkbox"/> Safe	53	75% Load	VTA %
21	Class	N/A		54	50% Load	VTA %
22	Division	N/A		55	No Load	
23	Group	N/A		56	Power Factor	
24	Temperature Class	T3		57	100% Load	≥ 0.9
25	Altitude	1100 ft Above Mean Sea Level		58	75% Load	≥ 0.9
26	Humidity	75%		59	50% Load	VTA
27	Ambient Temperature	50°C Maximum	0°C Minimum	60	No Load	VTA
28	Space Heater	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	VTA Watt 230 Volt	61	Bearing	
29	Winding RTD	<input type="checkbox"/> Yes <input type="checkbox"/> No	2 Nos. Per / ph	62	Type	VTA
30	Power Cable Size	Later		63	Drive End	VTA
31	No. of Power Cable Runs	01 (One)		64	Non-Drive End	VTA
32	Cable Type	0.6/1kV,CU/XLPE/PVC/SWA/PVC		65	Lubricant	VTA
33	Cable Gland	Later		66	Motor Specification	14-0180-ELA-6500-A

NOTES:

1. Vendor shall provide the Motor Data Sheet with Performance Curves of the offered model.
2. Please refer to Specification for Motor 14-0180-ELA-6500 for detail specification.
3. Vendor shall provide a routine test certificate for each motor.
4. Equipments shall be designed as per area classification.
5. Vendor to submit the coupling method details with drawings for OGDCL approval prior to manufacturing.
6. Vendor to ensure that voltage surges or rate of rise of Voltage surges shall not jeopardize the motor winding and its insulation life.
7. Cable Gland shall be nickel plated brass & suitable for area classification.
8. Vendor shall fill the remaining unfilled data of this data sheet.
9. Power factor of all LV Motors shall be greater than or equal to 0.9 at 100% & 75% load.

VTA - Vendor to Advise/Provide VTC - Vendor to confirm

N/A - Not Applicable



*Specification for Fire Water Jockey Pump
Integrity Assessment And Reliability Check Of Dakhni Plant*

Specification for LV Induction Motors



Job No. 14-0180	
Spec. No. 14-0180-ELA-6500	
Page 1 of 17	Rev. A

SPECIFICATION FOR LV INDUCTION MOTORS

Project: INTEGRITY ASSESSMENT AND RELIABILITY CHECK OF DAKHNI PLANT

Owner: Oil & Gas Development Co. Ltd.

Prepared by: **JAB**
 Checked by: **AIB**
 Approved by: **AHB**
 Revised by: **-**

ISSUED FOR REVIEW & APPROVAL

Rev.	Description of Revision	Date	Revised Page Nos.
A	Issued for Review & Approval	Jan 03, 2018	



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1. PURPOSE

This specification covers the minimum requirements for the supply ,design, construction and performance of alternating current, squirrel cage, induction motors.

Equipment shall comply with the Reference Standards and Codes. Where the manufacturer's standards differ from other supplementary requirements of this Specification and its associated Data Sheet, details shall be submitted to the Purchaser for approval.

This specification forms a part of other specifications for equipment, which require electric motors. The equipment specification / data sheet shall specify quantity, type, rating, speed, coupling arrangement, area classification and special requirements, if any.

In case discrepancies are found between this specification and other documents, Purchaser shall be referred for correct interpretation.

2. REFERENCE STANDARDS & CODES

The equipment and material selection, design, manufacturing, testing and inspection shall conform to the latest editions of the following codes and Standards. Any changes and alterations and necessary re-certification of the equipment for compliance with the applicable Codes and Standards requirements shall be at the expense of the Supplier.

IEC 60034	Rotating electrical machines (Part I to Part 15)
IEC 60038	IEC Standard Voltages
IEC 60050	International electromechanical vocabulary
IEC 60060	High voltage test techniques
IEC 60068-2-38	Test Z/AD: Composite temperature/humidity cyclic test
IEC 60072-1	Dimensions and output ratings frame numbers 56 to 400
IEC 60072-2	Dimensions and output ratings - frame 355 to 1000
IEC 60079	Electrical apparatus for explosive gas areas
IEC 60085	Recommendations for the classification of insulating materials in relation to their thermal stability in service
IEC 60182	Basic dimensions of winding wires
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC 60751	Industrial Platinum Resistance Thermometer Sensors
IEC 60851	Methods of test for winding wires
IEC 60894	Guide for test procedure for the measurement of loss tangent on coils and bars for machine windings
ISO 15	Rolling Bearings, Radial Bearings, Boundary Dimensions Rolling Bearings-Dynamic Load Ratings and Rating Life
ISO 9001:2000	Quality System Requirements



ISO 1132	Occupational Health and Safety Management Systems
ISO 14001	Environmental Management Systems

Any other Standards referred to in above Standards.

In addition to the above, the following codes shall be considered;

- NFPA-20 National Fire Protection Association
- API Recommend Practice 500
- Relevant British Standard Specification and Codes of Practice
- The Institute of Petroleum – Model Code of Sage Practice Electrical
- The Institute of Electrical Engineers, Regulations for Electrical Installation- Latest Edition.
- Institute of Electrical & Electronic Engineers (IEE)
- Electricity Act. 1973 (Govt. of Pakistan)
- Oil & Gas (Safety in Drilling and Production) Regulation 1974, Govt. of Pakistan.

3. SERVICE CONDITIONS

Electrical design shall be based on the following:

Temperature: 50°C Max. 0°C Min

Humidity: 75%

Altitude: 1100ft Above Mean Sea Level

4. MAIN DESIGN & CONSTRUCTION REQUIREMENTS

4.1. DESIGN

Motors shall be three phase squirrel cage induction motors, totally enclosed fan cooled (TEFC) with non-sparking corrosion resistant fans of standard size, duty type S1 in accordance with IEC 60034 and shall not be adversely affected by long periods of inactivity in an environment that includes high humidity, storms, salt-laden air, insects, plant life, fungus and rodents

The motor and all individual items forming part of the motor shall be suitable for outdoor use without protective shelter and exposed to direct sunlight.

The required motor rating and speed will be as per driven equipment manufacturer. It shall be in accordance with IEC 60072 Parts 1 and 2 and be based on Class F insulation with temperature rise limited to Class B based on site maximum ambient temperature.



Motors shall be of standard size. Motors installed in hazardous area shall comply with API RP 500.

The degree of protection shall be IP 55 for motors outdoor in non-hazardous area, auxiliaries and bearing housings. It shall be in accordance with IEC 60529 classification of degree of protection by enclosures for electrical equipment. Degree of protection for terminal boxes should be IP 65 for all areas.

Dimensions of foot-mounted motors, mounting flanges of motors and frame sizes shall be standard in accordance with International Standard IEC 60072.

The motor shall have power factor of not less than 0.85 at nominal load & at rated voltage.

The equipment covered by this specification shall be suitable for the specified operating conditions and shall be designed and constructed accordingly.

The power supply system characteristics applicable to motors shall be as follows:

- | | |
|------------------------------------|---------------------------------------|
| • System voltage (3-phase, 4-wire) | 400 V |
| • System voltage (1-phase, 3-wire) | 230 V |
| • Frequency | 50 Hz |
| • AC UPS (1 phase) | 230Vac |
| • Motors (0.37kW and less) | 230 Vac - 1 phase (Special condition) |
| • Motors (above 0.37 kW) | 400 Vac - 3 phase |

Maximum supply voltage and frequency variations shall be as follows:

- | | |
|----------------------------------|-------------------|
| • Steady State voltage variation | ±5% (AC Supplies) |
| • Frequency variation | ±2% |

(*Motors shall be designed for full voltage direct on line starting and shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency, as above. Vendor to ensure that it does not jeopardize the integrity of the equipment.

The torque – speed characteristics shall be adequate for starting the driven load under the most arduous conditions specified, e.g., open pump discharge valve, at 80% rated voltage at motor terminals.

Motors shall be suitable for three starts in succession (coasting to rest between starts) with the motor initially at design ambient temperature or two consecutive starts (coasting to rest between starts) with the motor initially at a temperature not exceeding its rated load operating temperature. Otherwise, starting performance of motors, in general, shall be in accordance with IEC 34 Part 12.



Motors with rated voltage and frequency applied shall have locked rotor current not more than 6.5 times the motor rated current and the maximum full load slip not exceeding 3%. The minimum locked rotor torque shall not be less than 100% of the rated full load torque, whereas, the breakdown torque shall not be less than 200% of the rated full load torque. The developed torque at any speed up to that at which breakdown torque occurs, with rated voltage and frequency applied, shall be at least 1.3 times the torque obtained from a curve that varies as the square of the speed and is equal to 100% of the rated full load torque at rated speed. Where these limits will have an adverse effect on other characteristics, particularly efficiency, the Supplier shall state the effect and recommend preferred values.

Vibration in any direction as measured at the bearing housing and on the shaft shall not exceed the limits defined in IEC 34, Part 14.

Noise level shall comply with the limits defined in IEC 34 Part 9, in general, with a maximum of 85 dB.

If the Supplier takes any exceptions to the driven equipment specification or this specification, such exceptions shall be stated in his quotations, in a separate list for approval, any deviations / exceptions out of this list shall not be considered later on.

4.2. CONSTRUCTION

4.2.1. Windings and Insulation

All motors shall have non-hygroscopic insulation systems including leads and connections and shall be adequate for use in petrochemical plants. Insulation shall be Class F and the temperature rise shall not exceed the value given by IEC 34 for this class reduced by the amount by which the design ambient temperature exceeds 40° C.

Coils shall be secured tightly in slots. Strand insulation shall adhere tightly to the strand. Strand and turn insulation integrity shall be maintained at all times. Additional turn insulation shall be used as required to maintain turn insulation integrity in the noses or other areas of coil deformation.

The insulation system shall be impervious to the service conditions specified above, and if oil mist lubrication is specified, all insulating materials used, including the lead insulation, shall be impervious to oil attack. Special provisions shall be made to seal the leads where they exit the coil.



Coil ends shall be braced to prevent insulation cracking and fatigue from motion during operation, starting and to withstand an external three phase short-circuit at full load and rated voltage.

All insulation systems shall be service proven and shall have had thermal evaluation in accordance with IEC 34, Part 18.

Stator lamination core plate shall be of at least C-5 quality per ASTM A 345. C-3 shall not be used.

4.2.2. Enclosures and Frames

Enclosure of motors shall generally be totally enclosed type and shall preferably be cast iron up to frame 315 or welded steel, corrosion resistant.

For fractional capacity motors, totally enclosed natural-ventilated (TENV) type enclosures are also acceptable.

Enclosures shall completely enclose the motors. Designs in which the stator laminations form a part of the enclosure or in which the stator laminations are otherwise exposed to external cooling air are not acceptable.

Casting shall be sound and free from shrink holes, cracks, scale, blisters or other similar injurious defects. Surface of castings shall be cleaned by sandblasting, shot blasting, pickling or any other standard method. All mold-parting fins and remains of gates and risers shall be chipped, filed, or ground flush.

Totally enclosed motors in frames 254 and larger shall be equipped with an approved Stainless Steel drain at the lowest point of the frame.

Major parts such as frame components and bearing housings shall be designed and manufactured to ensure accurate alignment on re-assembly.

The frame shall be of cast iron or welded steel plate construction with removable end bells or end plates to permit removal of the rotor and facilitate replacement of stator coils. The frame shall be free from structural resonance within the applicable speed range.

The stress values used in the design of the frame shall not exceed the maximum allowable stress criteria specified in ASME Section VIII, for the material used.

Conditions evaluated should include short circuits, thrust, handling and specified seismic loading.



The motor frame, including bearing supports, shall be designed to have sufficient strength and rigidity to limit changes of alignment caused by the worst combination of torque reaction, conduit / piping stress, magnetic imbalance and thermal distortion at the coupling flange and to permit the machine to be moved by using the lateral, axial and vertical jackscrews appropriately located to facilitate alignment.

Mounting plates shall be furnished, if required by the motor design, fitted with horizontal and vertical jackscrews of the same size.

The motor frame support or supports shall be provided with suitable number pilot holes for dowels. The holes shall be as near the vertical as possible and shall be located to provide adequate space for field drilling, reaming and placement of dowels.

Alignment dowels or rabbit fits shall be provided to facilitate disassembly and re-assembly of end bells or plates, bearing housing mounting plates and bearing housings. When jackscrews are used as a means of parting contacting faces, one of the faces shall be counter-bored or recessed to prevent a leaking joint or improper fit caused by marring.

The Supplier shall determine jointly with the driven equipment manufacturer the common base frame and / or the alignment system of the motor on the base frame.

Tapped openings not connected to piping shall be plugged with solid corrosion resistant steel plugs furnished in accordance with ANSI B16.11. Threads shall be lubricated. Tape shall not be applied to threads of plugs inserted into oil passages.

Fan covers shall also be made of cast iron or cast steel and shall have a minimum rigidity equivalent to 3.18 mm steel plate. The air-intake opening shall be guarded by either a grill or by a metal screen made of Series 300 Stainless Steel with 1/4" mesh. The screen holders shall be designed for easy removal and replacement of the screens while the motor is running.

Air deflectors shall be made of corrosion-resistant material or have corrosion-resistant plating or treatment.

Motor shall have adequate lifting and hoisting provisions.

All bolts, studs and other fastening devices of the enclosure shall be made of Series 300 Stainless Steel. Internal fastening devices shall use locking nuts, lock-washers, or locking compound. Threads of bolts shall conform to ANSI B1.1.



The design of the enclosure and arrangement of the equipment, including terminal housings, auxiliaries, etc., shall provide adequate clearance areas and safe access for installation, operation, rapid and economical maintenance, cleaning and painting of the motor interior.

4.2.3. Rotating Elements

The rotating element shall be designed and constructed to withstand the starting duties specified.

The shaft shall be one-piece, heat-treated forged steel, suitably ground. Suitable fillets shall be provided at all changes in shaft diameters and in keyways.

Welding of / or to shafts is not acceptable on two-pole motors, on shafting for balancing purposes, or on finished shafting. Any shafting and / or spiders subjected to welding must be post-weld stress relieved prior to finish machining.

Rotor laminations shall have no burrs in excess of 0.075 mm and shall be rotated when stacked to prevent uneven built up and to evenly distribute magnetic properties in grain orientation. The method of assembly shall prevent shaft surface scoring, assure positive positioning and minimise bowing.

Fabricated bar rotors shall be furnished with copper / copper alloy bars and end rings, replaceable without damage to air passages or laminations, maintained tight in the slot to limit vibration and fatigue. The rotor cage shall be maintained centre locked (swedged, centred, pinned). End rings shall be without circumferential joints.

Inert gas welding or induction brazing is preferred for the attachment of bars to the current carrying end rings. Butt type joints are not acceptable. The bars shall be radially supported as necessary in the current carrying end rings. The metal joining material shall be phosphorus free. Outward bending of rotor bar ends and shorting ring articulation shall be limited by design or material selection.

Rotors shall be dynamically precision balanced for the whole revolving mass, i.e., rotor, fan and half coupling sleeve supplied by the manufacturer of the driven equipment, in two or more planes. Final balance shall be performed after heat treating and / or baking. When a keyway is provided for a coupling hub, the rotor shall be balanced with the keyway fitted with a crowned half key to fill the useable length of the shaft keyway.

Shaft extension including keys and keyways shall be in accordance with IEC 72.

Balance weights added to the final assembly shall be Series 300 Stainless Steel. The use of solder or similar deposits for balancing purposes is not acceptable. If parent material is to be removed to



achieve dynamic or static balance, it is to be drilled out in a manner that will maintain the structural integrity of the rotor and will not cause harmful or distortive hot spots in operation. Chiselling, sawing or torch burning is not permitted.

Motors shall be fan-ventilated type to meet the requirements of IEC 34 Part 6 to IC 0151.

Fans shall be of non-sparking corrosion resistant material and shall force the cooling air from non-driving end toward the driving end. Air inlet and discharge openings shall be arranged to prevent re-circulation of cooling air through the motor.

Fans for motor frames 445 or smaller shall be suitable for rotation in either direction.

If used, sheet metal covers or wrappers used to form air passages over the motor enclosure shall have a minimum rigidity equivalent to 3.18 mm steel plate

Fans shall be permanently indexed angularly and axially and shall be mounted by either Split hub or Shrink-fit on shaft methods. Split fans secured only with set-screws to the shaft are not acceptable.

After final balance of the two-pole main rotors, the fans shall be installed and balanced. Removal and reassembly of the fans to the rotor shall not change the rotor balance outside the allowable residual unbalance limits.

The direction of rotation for which motor is arranged shall be clearly indicated by means of an arrow on the non-driving end and shall be Series 300 Stainless Steel or nickel-copper alloy, whichever suitable, securely fastened by pins of suitable material and shall be located of easy visibility. A paint arrow only is not sufficient.

Air to air exchanger tubes (if used), shall be made of copper, copper alloy, stainless steel or an aluminium alloy not more than 0.2% copper. Material selection shall be suitable for the specified environment.

4.2.4. Bearings and Lubrication

Sealed pre-lubricated ball and roller bearings are preferred for small motors (Frame size 180 or less) to provide a trouble free service of 3 to 5 years without the necessity of relubrication.

Ball and roller bearings shall be of reputable manufacturer and of a type interchangeable with other makes, preferably in cartridge type housing.

Grease or lubricated bearings shall be used for motors bearing housings for grease lubricated bearings shall be provided with exterior fill and release plugs in taped holes. Grease fittings are



not acceptable release plugs must be large enough to relieve bearings without grease getting in to motor. Sealed pre lubricated ball bearings are acceptable only for small motors (frame size 180 or less)

It is the responsibility of the motor manufacturer to provide correct bearing for the application, in accordance with relevant Codes & Standards. However, for special drives with high radial forces the application of roller bearings or a combination of ball and roller bearings at the drive-end side may be necessary. Bearings shall be protected to eliminate contamination, loss of lubricant and to prevent intrusion of fine dust and sand particles.

For motors with rated outputs exceeding 250kW the MANUFACTURER shall provide data and drawings regarding the bearing arrangement. These data shall include but not be limited to:

- Bearing data, e.g. type, size, clearance
- Housing fit with tolerances
- Shaft fit with tolerances
- Installation instructions

Half-couplings shall be mounted on motor shafts with either a taper or cylindrical fit and shall be keyed. Cylindrical fits shall be in accordance with ANSI B4.1, Class FN1.

Vertical motors driving direct coupled pumps shall have the thrust bearing at the non- drive end (NDE). The rating plates shall be fixed to a non-removable part of the frame. Information provided on the rating plates shall be in accordance with IEC 60034-1

4.3. ACCESSORIES

4.3.1. Terminal Boxes and Terminals

Motors shall be equipped with a main terminal box for motor supply cables and auxiliary terminal boxes for anti-condensation heater, winding temperature detectors, where applicable.

Main terminal boxes on the horizontal motors shall be on the right side, whereas, auxiliary terminal boxes shall be on the left side when facing the non-drive-end (shaft extension).

All terminal boxes shall be made of cast iron or steel, unless otherwise specified, with a minimum rigidity equivalent to 3.18 mm steel plate. Minimum dimensions and useable volumes shall not be less than those given in ANSI C50.41.22. When required, larger boxes shall be provided for special cable terminations and / or additional devices. Terminal boxes and auxiliary equipment enclosures shall be suitable for the conductor entry, as required, and shall be furnished with compression type cable glands (ISO metric), water tight and fully gasketed.



The terminal boxes and gland plates shall be so arranged as to allow for the disconnection and removal of the incoming cable(s) without disturbing the motor windings terminations or the seal between the motor frame and terminal box.

Each terminal box other than explosion proof shall have a bolted, gasketed cover fully accessible from the front and arranged for convenient access. Gasketing material shall be non-sticking, non-hygroscopic, re-usable, shall not require grease or other applicable compound and shall be impervious to oil attack.

Terminals, leads and associated fittings shall be able to withstand conditions of a through fault when connected to the plant electrical system.

Motor terminals shall be clearly and permanently marked with reference letters in accordance with applicable standards.

The choice of direction or its modification shall be possible on the work site by means of standard tools.

4.3.2. Space Heater

Motors anti-condensation heater shall be as per manufacturer recommendation in view of ambient condition (refer sec.3) and motor winding life. However; motor equal and larger than 55 kW shall be provided with anti-condensation heaters irrespective of manufacturer recommendation. The space heaters shall be energised while the motors are stopped and shall be arranged to provide uniform heating of the stator windings. The heaters shall maintain the temperature of the motor windings approximately 5° C above ambient temperature. The surface temperature of the heater elements shall be in accordance with the requirements of area classification.

The space heater leads shall be brought out into a separate terminal box from the motor main terminal box.

The space heaters shall be rated 230 V, single phase, 50 Hz.

4.3.3. Grounding Terminals

Each motor shall be provided with two external grounding terminals on the motor frame and an internal grounding terminal inside each terminal box. The grounding terminal and wiring shall be clearly and permanently identified.

The screw, stud or bolt intended for the termination of a grounding conductor shall be of a suitable size for the attachment and shall have equivalent fault current ampacity of a copper grounding conductor required per motor full load current. External tooth lock washers, serrated



screw heads, or the equivalent shall not be furnished for a screw, bolt, or stud intended as a grounding conductor termination.

The terminals shall be solder less type and shall be on a part of the machine not normally disassembled during operation or servicing.

4.3.4. Winding Temperature Detectors

For motor larger than 185 kW, winding temperature detection shall be provided by temperature detectors embedded in the hottest spot of the stator windings wired to a auxiliary terminal box common for winding and bearing temperature detectors. A minimum of six (06) elements shall be installed, installed two per phase distributed around the circumference, located between coils sides, & in positions having normally the highest temperature along the length of the slot. Elements shall be platinum wire, with a resistance of 100 ohms at 0° C, NEC type, TFE-insulated, 22 AWG (minimum size) stranded, tinned copper wire leads.

4.3.5. Nameplates

The nameplate shall be Series 300 Stainless Steel securely fastened by pins of similar material and shall be located for easy visibility.

The rated conditions and other data, as below, shall be clearly stamped on the nameplates:

- Manufacturer's name.
- Serial number.
- Motor Item Number.
- Model Number.
- Duty Type.
- Design Class
- Enclosure type.
- Frame Size
- Horsepower and kW rating.
- Voltages.
- Phases.
- Frequency.
- Efficiency.
- Power Factor.
- Full Load Amperes(FLA)
- Locked-Rotor Amperes (LRA)
- Full Load Speed (RPM)
- Service factor.



- Temperature Class.
- Direction of Rotation
- Bearing Nos. and Manufacturer.

Separate connection diagrams or data nameplates shall be located near the appropriate connection box for the following:

- Motors having more than three power leads.
- Space heaters (Operating voltage and wattage).
- Winding Temperature Detectors.
- Vibration detectors (Vendor and Model).
- Connections of proper rotation.
- Instruction for lubrication, with bearing numbers.

4.3.6. Finish

The exterior shall be thoroughly cleaned, scraped and wire brushed to remove all rust, grease and dirt. Immediately after preparation the exterior shall be primed and painted as per painting specification.

4.4. TEST AND INSPECTION

Manufacturer shall submit the following data available for examination by the Owner or his representative during inspection at the Manufacturer's works:

- All necessary certification of materials such as mill test reports on shafting, forging and major castings.
- Test data to verify that the requirements of the specification have been met.
- Results of all quality control tests and inspections.

The motors shall be factory tested as per the requirements of Codes and Standards mentioned above.

Each motor shall be given a routine test to demonstrate that it is free from mechanical and electrical defects. This test shall be conducted in accordance with the applicable portions of Codes and Standards mentioned above.

This test shall include, but not limited to the following:

- Measurement of no-load current (each phase).
- Measurement of nominal no-load speed.
- A determination of locked-rotor current.
- Stator and Rotor copper and core losses.



- A high-potential test.
- An insulation resistance test by megohmmeter.
- Measurement of winding resistance (Wheatstone bridge method).
- Measurement of Polarization index.
- Measurement of vibration.
- Measurement of noise.
- Air gap measurements.

When specified, surge comparison tests shall be made of turn insulation in the fully wound stator just prior to making up connections. Peak voltage shall equal motor rated voltage.

The following basic requirements shall be met for all running tests:

- Tests shall be made on the fully assembled motor including contract components, accessories, etc.
- If applicable, all oil pressures, viscosities and temperatures shall be at the same operating values recommended in the Manufacturer's operating instructions for the specific unit under test. Oil flow rates for bearing housings shall be determined.
- All warning, protective and control devices shall be checked and adjustments made as required.

During the running test, the mechanical operation of all equipment being tested and test instrumentation shall be satisfactory. Unfiltered radial and axial vibration measurements shall not exceed the limits specified and shall be recorded throughout the speed range.

When radial vibration readings are taken directly on the bearing caps or shaft with hand-held instruments, they shall be taken in both the X and Y planes at 30-minute intervals. During the final set of readings, the reading at each position shall be recorded or continuously observed for a period of at least 10 minutes. If the vibration modulates or pulsates, the high and low values of vibration and the modulation frequency shall be recorded.

If replacement or modification of bearings or dismantling of the motor to replace or modify other parts is required for improvement of mechanical or performance deficiencies, a bearing heat run shall be conducted after such replacements or correction are made. During this run, no-load current, wattage and vibration shall be measured to confirm the correction.

Facilities to ensure against entrance of oil into the motor shall be in operation throughout the test.

The Manufacturer shall maintain a complete, detailed log and plot of all final tests and shall submit the required number of copies to the Owner, including data for rotor balancing and



vibration measurements taken over the operating speed range and the non synchronous sweep. A description of the test methods and instrumentation and certified copies of the instrument calibrations shall also be provided along with the above mentioned for the Owner's review.

5. GUARANTEE

The Supplier shall guarantee that the equipment furnished is free from fault in design, workmanship, is of adequate size and capacity, and of proper material to satisfactorily fulfil the operating conditions specified. Should any defect in design, material, workmanship or operating characteristics develop during the first year of operation, the Supplier shall make all necessary alterations, repairs and replacements of defective equipment / components, at his own cost.

6. SHIPPING

Motors shall be suitably prepared for the type and mode of shipment such that these arrive at their destination in undamaged condition.

7. DOCUMENTS

For each motor, Supplier's Manufacturer shall complete and submit motor data sheets at the time of bidding. Required number of copies of the vendor's design drawings and As-built information shall be submitted per API Std. 541, which shall include, but not limited to the following:

- Certified copies of shop test data.
- Motor torque versus speed at rated voltage and at 80% of rated voltage.
- Motor current versus speed at rated voltage, at 90% of rated voltage and at the anticipated starting voltage.
- Rotor Balance report.
- Estimated times for acceleration at rated voltage, at 90% of rated voltage and the anticipated starting voltage.
- Standard and Maximum available efficiencies at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and full load and the service factor.
- Power factors at the same loads as required above for both standard efficiencies and maximum available efficiencies.
- Lubrication oil required, including the quantity of lubricating oil required at supply pressure and the heat load to be removed by the oil. Approximate data shall be defined clearly as such.
- Net weights and maximum erection weights with identification of the item. These data shall be stated individually where separate shipments, packages or assemblies are involved.
- List of all vendor drawings.
- Dimensional outline drawings showing the location of inlet and discharge connections and the direction of rotation when the motor is viewed from the non drive end.
- Schematic diagrams of the lube-oil system.



- Bills of material for all auxiliary systems within the scope of supply, including control systems and dimensional outline drawings for accessories and instruments. Bills of material shall include and identify all components by make, type, size, capacity rating, materials and other data as applicable.
- Cross-sectional drawings and literature to fully describe the details of the offering(s) showing shaft sealing details, shaft dimensions, bearing details, internal construction, rotor construction and the method of attaching the rotor bar to the shorting ring.
- Erection / assembly drawings.
- Recommended spare parts list (Start up and 2-year maintenance).
- An itemised list of any special tools included in the offering(s).
- Installation, operation and maintenance manuals.
- Technical Specification
- Motor performance Curves
- Installation Drawings
- Test Certificates
- Motor connection details
- WK2 (moment of inertia) of the motor rotor
- WK2 of the driven equipment, referenced to the same rpm as the motor rotor

The drawings furnished shall contain sufficient information; the size, type, location and identification of all auxiliary or other equipment, rigging provisions and connections, including power, control, and instrument wiring, supply and drain details for lubricating oil and inlet and discharge details for cooling air, as well as frame vents and drains including manufacturer plugged connections, so that when they are combined with the manuals, as above, the ordered equipment shall be properly installed, operated and maintained.



*Specification for Fire Water Jockey Pump
Integrity Assessment And Reliability Check Of Dakhni Plant*

Site Environment and Utility Design Data



Job No. 14 - 4908

Spec. No. 4908-A-1001

Page 1 of 11

Rev. 3

PROJECT DESIGN DATA

Project: **Dakhni Expansion Project**

Client: **Oil & Gas Development Company Limited**

Prepared by: AH/mpm
Checked by: TH
Approved by: NS
Revised by: AH

3	REVISED FOR REFRIGERATION PACKAGE TENDER	24/11/2009	5
2	REVISED FOR MDEA TENDER	15/04/2005	8,9
1	GENERAL REVISION	05/5/2003	
0	ISSUED FOR BID	29/1/2003	
Rev.	Description of Revision	Date	Revised Page Nos.



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4.0	FOUNDATIONS & STRUCTURES	7
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1.0 DESCRIPTION OF PROJECT

Balancing, modification and Expansion of the existing gas processing plant comprising of Gas Gathering Facilities, Gas/Oil Separators, Amine Sweetening Unit, Glycol Dehydration Unit, Crude Stabilization Unit, HC Dew Point Control/LPG Recovery Unit, Sulfur Recovery Plant, Utilities and Offsite.



2.0 GENERAL SITE DATA

- A. Elevation: 1100 ft. above mean sea level.
- B. Location 120kms West of Islamabad
Latitude N 71° 56'
Longitude E 33° 24'
- C. Trace Hydrogen Sulphide in Atmosphere

3.0 METEOROLOGICAL DATA

A.	Average Barometric Pressure	14.3 psia
B.	Design Barometric Pressure for Air Compressor Suctions	14.1 psia
C.	Air Temperature for Design of Heating, Cooling, Ventilating and Protective Heating	
	– Design dry bulb temperature	115°F
	– Minimum dry bulb temperature	32°F
	– Maximum dry bulb temperature	122°F
	– Design dry bulb temperature for equipment (electric motor etc.)	120°F
D.	Relative Humidity	
	– Design	75%
E.	Air Temperature/Humidity for Design of Cooling Towers	Wet bulb 83°F Dry bulb 115°F Relative Humidity 75%
Note:	The above conditions are not coincident	
F.	Air Coolers	Dry bulb 122 °F Relative Humidity 75%
G.	Wind Speed for Structural Design	100 mph
H.	Wind Speed Normal	5 – 10 mph
I.	Direction of Prevailing Wind	Wind direction varies from SW to NE and SE to NW. Still conditions are encountered during mid July to mid September. During Winter wind direction is from NW to SE.



PROJECT DESIGN DATA

J.	Design Rainfall	2 inch/hour for 2 hours (max. intensity)
K.	Dust Storms	Occasional



4.0 FOUNDATIONS & STRUCTURES

4.1 Earthquake

Design Zone 2, Uniform Bldg., Code (S). Ground Acceleration 0.15g.

5.0 UTILITIESA. Electrical Power

Name Plate Voltage	Phase	Frequency Hz	Service/Motor Size, KW
6000	3	50	In-house power generation
6000	3	50	Above 150 kW to 3730 kW
380	3	50	0.37 kW to 150 kW
380	3	50	Less than 0.37 kW (Essential drives)
220	1	50	Less than 0.37 kW (non-essential drives)
220	1	50	Instruments
220	1	50	Lighting

B. Electrical Hazardous Area Classification

In accordance with API RP 500A.

C. Cooling Water

Re-circulation system with cooling tower:

	(psig)	(°F)
- Supply	100 - 110	95
- Return	18 - 20	115
- Max. Outlet	-	120

D. Water Supply

From Rasi Nullah bed (sub-terrainian) about 3km from plant site. Storage capacity 5 days normal requirements plus firewater requirements.

- Temperature: 45 – 98 ° F



<u>E. Raw Water Analysis</u>	<u>Typical Analysis</u>
Total hardness (as CaCO ₃) ppm	72.00
Calcium (as CaCO ₃) ppm	42.00
Magnesium (as CaCO ₃) ppm	30.00
Sodium (as CaCO ₃) ppm	337.00
Bicarbonate (as CaCO ₃) ppm	76.00
Carbonate (as CaCO ₃) ppm	08.00
Sulphate (as CaCO ₃) ppm	46.00
Chloride (as CaCO ₃) ppm	10 - 18
'M' Alkalinity (as CaCO ₃) ppm	98.00
'P' Alkalinity (as CaCO ₃) ppm	07.00
Total Dissolved Solids (TDS)	189.00
pH	8.00
Dissolved Silica ppm	2.00
Iron	Nil
Organic Matter	Nil
Oxygen dissolved	Nil
Turbidity	4.5 (ASTM-D-1889)
Residual Chlorine	Nil
Conductivity (Ms/cm)	270

F. Air

- Instrument & plant air headers normal conditions:
 - Normal Pressure: 105 psig (at process area battery limits)
 - Minimum Pressure: 65 psig (for actuator sizing)
 - Temperature: 140°F (max.)

- Instrument & plant air system mechanical design conditions:
 - Design Pressure: 150 psig (RV set)
 - Design Temperature 170°F

- Instrument air dew point -40° F

G. **Fuel Gas**

– Typical Gas Analysis

	Mole % Sour Gas	Mole % Sweet Gas
H ₂ O	0.40	Trace
N ₂	0.33	0.31
CO ₂	4.16	1.80
H ₂ S	9.5	Trace
C ₁	81.20	90.73
C ₂	3.14	3.51
C ₃	1.10	1.23
C ₄ +	1.80	2.01
Temperature, °F	136	105
Pressure, psig	45	45

H. **Demineralized Water**

Conductivity	1.0 micromhos
TDS	1.0 ppm
TSS	0.5 ppm
Total Silica	0.2 ppm as SiO ₂
Total Iron	0.01 ppm
Total Copper	0.02 ppm
CO ₂	0.1 ppm
Chlorides	0.01 ppm
Organics	0.01 ppm

Note:

It is intended to run the gas turbines, gas engines burners and other consumers initially on the sour gas and switch to sweet dry gas when the sweetening and drying systems are operational.



*Specification for Fire Water Jockey Pump
Integrity Assessment And Reliability Check Of Dakhni Plant*

Specification for Painting



Job No. 01 - 4908

Spec. No. 4908-GS-9502

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Rev. 1

GENERAL SPECIFICATION FOR PAINTING & COATING

Project: Dakhni Expansion Project

Owner: Oil & Gas Development Co. Ltd.

Prepared by: IAS
 Checked by: MAT
 Approved by: TH
 Revised by: -

Rev.	Description of Revision	Date	Revised Page Nos.
1	RE-ISSUED FOR BID	07/04/2009	
0	ISSUED FOR BID	06/03/2009	



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1.0 SCOPE

This specification covers the minimum requirements for the supply of painting materials, application of painting materials on vessels, piping, structure, platforms and other equipments located at plant for Dakhni Expansion Project during fabrication & construction. However it is responsibility of contractor to provide most suitable & economical painting material for service condition.

- 1.1 The painting works to be performed by the Contractor shall include all necessary steps like supply of material, surface preparation, protection of the other works, application of primer, intermediate and top (finish) coats, cleaning of the working area as well as all intermediate and final inspection works.

1.2 Terminology

The following terminology will be applied throughout this specification.

Plant	Dakhni
Company	Oil and Gas Development Company Limited
Company Representative	A Company designated Personnel, Party/Parties duly authorized by the company to act on behalf of the company with whom the Supplier shall consult at all reasonable times and whose instructions, request and decision shall be binding on Supplier.
Supplier	Entity with whom the Company will execute a Contract for supply of equipment/material as per this document
Project	Dakhni Expansion Project
Application Contractor	As appropriate; the suppliers of equipment and the contractors engaged for the application of



blast cleaning and painting of skids and off site-mounted equipment.

- 1.3 In the case of equipment suppliers the complete painting works shall be performed by the Supplier as per this specification and term "Application Contractor" shall be considered as same as "Supplier" defined above. At site "Application Contractor" is an entity engaged by Company.
- 1.4 All deviations to this Specification, other related specifications or attachments shall be brought to the knowledge of the Company. All deviations made during the procurement, design, manufacturing, testing and inspection shall be with written approval of the Company prior to execution of Work. Such deviations shall be shown in the documentation prepared by the Contractor.
- 1.5 In the event of any conflict, inconsistency or ambiguity between the Contract scope of work, this Specification, National Codes & Standards, referenced in the Project Specification or any other documents, the Contractor shall refer to the Company whose decision shall prevail.
- 1.6 Company reserves the right to revise any or some clauses of this specification or may give additional requirement if deemed at any stage of design/ fabrication/ construction and shall not be liable for extra cost.



2.0 CODES AND STANDARDS

2.1 Codes, Standards and Regulations

The surface preparation and coatings shall be in accordance with this Statutory Regulations (where applicable):

“Steel Structures Painting Manual Vol. 1” “Good Painting Practice” Steel Structures Painting Council 4440 Fifth-Avenue, Pittsburgh, PA 15212, U.S.A.

“Steel Structures Painting Manual Vol. 2” “System and Specifications” Steel Structures Painting Council 4440 Fifth- Avenue, Pittsburgh, PA 15212, U.S.A.

“Echelle European de Degrees D’ Enrouillement Pour Peintures Antirouille” (“European Scale of Rusting for Anticorrosive Paints”) European Committee of Paint and Printing Ink manufacturers Association obtainable from: Paint Manufacturers Assn. of Great Britain, Alembic House, Albert Embankment, London

ASTM. A123 “Zinc (Hot Galvanized) Coatings on Products from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip”. American Society for Testing & Materials 1916 Race Street Philadelphia, PA 19103 U.S.A.

Surface preparation of all steel surfaces shall be done by one of the following methods described in the following specifications publishing specifications published by the steel structures Painting council, 4400 Fifth Avenue, Pittsburgh, Pa. 15213, or Swedish Standards.

SSPC <u>Specification No.</u>	<u>Swedish Standard</u>	SSPC <u>Specification Title</u>
SSPC-SP-63		Solvent Cleaning
SSPC-SP2-63		Hand Cleaning
SSPC-SP3-63		Power Tool Cleaning
SSPC-SP4-63		Flame Cleaning of New Steel
SSPC-SP5-63	Sa3	Blast Cleaning to “White” Metal



SSPC-SP6-63	Sa2	Commercial Blast Cleaning
SSPC-SP7-63		Brush-off Blast Cleaning
SSPC-SP8-63		Pickling
SSPC-SP10-63T	Sa2 1/2	Blast Cleaning to "Near-White" Metal

Painting and coating shall be carried out according to the relevant Standard of Steel Painting Council (SSPC). The acceptable standard for surface preparation of storage tanks, vessels, piping and structures shall be SSPC-SP10, "near white metal".

Any deviation from this specification shall be approved in writing by Engineering Contractor/Owner.

2.2. **Order of Precedence**

In case of conflict between this specification and its associated specifications and the above codes and standards, the Application Contractor shall bring the matter to the contractor's attention for resolution and approval in writing. In all cases the most stringent requirement shall apply.

Should any conflict occur as a result of applying paint manufacturers data sheets and specifications, the order of precedence shall be as follows:

- Data Sheets
- This specification
- Other referenced Project Specifications
- Codes and Standards referred to within this specification and its attachments.



3.0 SCOPE OF SUPPLY

3.1 General

The overall scope of supply for the preparation and painting shall be as indicated within this specification.

3.2 Scope of Supply

The Application Contractor appointed to carry out surface preparation and painting shall provide the following as a minimum:

- Supply all labor sufficient to complete the work
- Supply all equipment, special tools and power
- Supply suitable grit/sand
- Supply all coating materials
- Responsibility for safe storage of consumable/Non consumable materials
- Provision of daily accurate records of plant consumable materials and ambient conditions during operations.
- Inspection and testing in accordance with this specification and its attachments.
- All documentation as required by this specification and its attachments.



4.0 MATERIALS

- 4.1 Painting and finishing products for all work shall be best grade produced for each particular kind of material.

Above Ground Piping

Uninsulated above ground piping operating b/w -18°C and 93°C shall be shop primed and field finish coated unless otherwise specified in the applicable purchase document.

Insulated above ground piping operating b/w -1°C and 93°C shall be shop primed, unless otherwise specified in the applicable purchase document

Uninsulated, above ground piping operating b/w 93°C and 482°C shall be shop primed and field finish coated unless otherwise specified in the Applicable Purchase Document.

Underground Piping And Equipment

Underground uninsulated piping and equipment having temperature b/w -25°C and 93°C , when specified to be painted, shall be coated with two coats of coal tar epoxy, with both primer and finish coat applied either in shop or field.

Each coat of coal tar epoxy shall measure approximately 200 micrometers dry film thickness.

4.2 Approved Paint Manufacturers

Coating systems listed in this Specification are to be applied with suitable materials from the owner approved paint manufacturers available in Pakistan, i.e., ICI etc.

Any deviation from above shall be subjected to prior approval by the Purchaser or Contractor.

Before supply, the Contractor will provide samples and specifications of primer and paints for Engineering Contractor's/Owner's approval.



- 4.3 Material for primers and paints will be supplied in 20-liter containers. It should be clearly marked on each container that "Specially Manufactured for Engineering Contractor/Owner".
- 4.4 Materials for primer and succeeding coats shall preferably be the products of the same manufacturer. Compatibility of primer and succeeding coats shall be checked before execution of work.
- 4.5 The storage and preparation of paints and other coating materials shall be in accordance with the manufacturers' instructions.



5.0 ENVIRONMENTAL DESIGN CRITERIA

5.1 General

Unless otherwise stated on the data sheets, all equipments and structures will be located in an open exposed area.

5.2 Site Environmental Data

Environmental conditions for all equipments and structures covered by this specification will be listed in the Project Specification on Site Data and Utilities.



6.0 APPLICATION PROCEDURE

6.1 General

6.1.1 Manufacturer's Representative/Guarantee

The Application Contractor shall arrange for the services of a technical representative of the selected coating manufacturer to visit the work site before the beginning of cleaning and coating operations to advise the Application Contractors personnel regarding proper equipment, surface preparation and coating procedures. The technical representative shall thereafter make periodic visits to assist the Application Contractor in applying and curing the products and systems as recommended by film thickness.

Coating Manufacturer and Application Contractor shall give a joint 5-year guarantee as follows:

- All coatings will be 'sound' and give a 'degree of paint protection efficiency' similar to scale 8 of the European Scale of Degree of Rusting for Anti Corrosive Paints"- for a period of five years.
- The guarantee period will start from the provisional acceptance of the completed work.

6.1.2 Inspection

The Contractor's representatives and the Paint manufacturer's representative shall have access to the Application Contractors worksites at all times during blasting and coating application and shall be permitted to inspect the work at will. Both representatives shall be given at least two days' notice prior to initial starting of any work covered by the specification. The Contractor's representatives shall have the authority to reject any work that does not conform to the specification.

6.1.3 Contractor's Personnel

The Application Contractor shall select only competent and fully skilled personnel and shall keep an experienced foreman on the job at all times when work is in progress. Any instructions or notices given to the Contractor's site representative by the Contractor's representatives shall be deemed to be given to the Application Contractor.



6.1.4 Site Preparation

Prior to the commencement of the work, Contractor shall submit for Engineering Contractor/Owner review a blast cleaning procedure, details of equipment and personnel assigned to the blast cleaning operation. Blast cleaning shall be done in case of storage tanks & vessels while the remaining piping and structure shall be cleaned by mechanical means or as desired by Engineering Contractor/Owner.

6.2 Surface Application – General

6.2.1 Cleaning

All steel surfaces to be coated shall be cleaned by abrasive blasting.

Abrasive material for blast cleaning shall be of a particle size to achieve the anchor profile/surface cleanliness detailed below:

- Blasting abrasives shall be dry, clean and free from contaminations.
- Blasted surfaces shall conform to SA 2.5 by visual comparison with the Swedish Standard SIS 05 59 00.
- An average surface amplitude of 50 microns peak height shall be obtained (± 25 microns), every hour and tested every hour with a Testex Press-O-Film and retained with the inspection records.

Preliminary blasting may be done at night with the prior consent of the Contractor's representatives provided that all surfaces blasted shall again be blasted to within the specified tolerances before any coating materials are applied.

Final blast cleaning shall be permitted only during daylight hours but when the surfaces show traces of condensation and if the relative humidity of the ambient air is higher than 80 to 85% the work shall be interrupted in the presence of the Contractor's representative.

All metal parts, which show traces of oxidation after cleaning and before painting shall be cleaned again, Greasy substances on surfaces to be re-cleaned, shall be removed through solvent scrubbing before re-cleaning.



All tools shall be used so as not to leave rough or sharp surfaces. No cuts shall be made on steel surface.

For storage tank, plates after beveling, rolling and cleaning should be transferred to a shot-blasting area remote from other cleaning or coating operations.

During transportation and coating care shall be taken to avoid damage to bevels, and the steel surface.

All blast-cleaned surfaces shall be coated with the specific primer within four hours after blasting, prior to sundown on the same day before rusting occurs. All dust and abrasive shall be thoroughly removed from surfaces before the application of any coating. A minimum of 50mm around the edges of blast cleaned surfaces shall be left uncoated unless joining a coated surface. No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after they are blasted. This includes inhibitive washes intended to prevent rusting.

Blast cleaning shall not be done on surfaces that are moist or that may become moist before the application primer.

All NDT of components and surfaces to be coated must be ascertained to have been completed prior to preparation and coating. Any steel not primed on the same day as it was blasted or any steel wet by rain or moisture shall be re-blasted.

No blasting shall be permitted when metal surface temperatures are less than 30°C above the dew point, or when the relative humidity of the air is greater than 80%. Temperatures and humidity shall be recorded twice a day.

Blast cleaning shall not be done in proximity to surface coating operations or near other surfaces susceptible to dust and particle contamination.

Any portion of the fabrication to be blast cleaned, including the drilling of both holes, shall be complete and in final condition before blasting is started, unless otherwise authorized by the contractor. All welded areas shall be given special attention for removal of weld flux stag, weld heat oxides, weld flux fumes, slivers and other foreign objects before blasting. Any oil or grease contamination shall be removed by



solvent cleaning and the area re-blasted. Only approved safety solvents, which do not leave a residue shall be used. Pipes, which have been subjected to salt spray in transportation shall be water washed and dried. Blasting shall continue a minimum of 20mm into adjacent coated surfaces.

6.3 Blast Cleaning Requirements

6.3.1 As a minimum, all cleaning shall be to a NEAR-WHITE-BLAST CLEANING in accordance with and as illustrated by Swedish Standard SIS 05 5900 Grade SA 2 ½

A Near-White-Blast Cleaned Surface Finish is defined as one free from all oil, grease, dirt, mill scale, rust. Corrosion products, oxides, paint and other foreign matter have been completely removed from the surface except for the very light shadows, very slight streaks, or slight discolorations caused by rust stain, mill scale oxides, or slight residues of paint or coating that may remain. At least 95 percent of each 5cm², of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Size of abrasive particles shall be such that anchor profile achieved is maximum 50 microns unless otherwise approved by Contractor. The abrasive selected for use, which will be angular in nature, shall be in accordance with the recommendations of the coating manufacturer. The anchor profile shall be measured and recorded or replicated with:

- The "Testex Press-O-Film" system or equivalent
- The "Rugotest LCA-CFA No. 3" or equivalent

Sand blasting equipment is to be inspected with respect of discharge rate and pressure, hose sizes and air-drying.

Sand/grit is to be stored under cover and shall be "DRY" for feeding into the spray hopper.

After blasting, all grit/sand shall be removed by dry air blowing or vacuum.



6.4 Coating

6.4.1 Supply of Materials

All coating materials and thinners shall be furnished by the Application Contractor in original, unopened containers bearing the manufacturer label and instructions. For materials having a limited shelf life, the date of manufacture and the length of life and the quantity shall be shown.

6.4.2 Preparation of Materials

All coating materials shall be stirred in a pot with a power mixer before use to thoroughly mix the pigments and thinners. Only thinners specified by the coating manufacturer shall be used. Mixing and thinning directions as furnished by the coating manufacturer shall be followed.

6.4.3 Use of Materials

If the coating material requires the addition of a catalyst, the pot life under application conditions shall be clearly stated on the container label and this pot life shall not be exceeded. When the pot life limit is reached, the spray pot shall be emptied, remaining material discarded, the equipment cleaned and new material catalyzed.

Coating materials which have livered, gelled or otherwise deteriorated during storage shall not be used. Thixotropic materials which may be stirred to obtain normal consistency are not subjected to this restriction.

Depending upon location, the Application Contractor shall employ the suitable system as listed in this Specification

Coating systems shall be supplied by one manufacturer who shall assure the Application Contractor that the various components of the coating system are compatible.

6.5 Coating Application

6.5.1 Surface Defects

All surface defects including cracks, surface laminations and deep pitting, likely to be detrimental to the protective painting system shall be removed in accordance with the



relevant equipment, vessel, piping or structural code or specification covering surface defects. All fins at saw cuts; barbs and sharp edges shall be similarly removed. Where extensive grinding has been necessary, the dressed areas shall be re-blasted to remove all rust and provide an adequate paint key.

6.5.2 **Weather**

No coating shall be applied during fog, mist, rain, frost, or when (the metal surface temperatures are less than 3°C above the air dew point or when the relative humidity of the air is greater than 85% (95% for application of inorganic zinc Silicate paints). The Contractor or his representative may suspend application of coating when in their opinion damage to the coating may result from actual or impending weather conditions.

6.5.3 **Coating**

Each coat shall be applied uniformly over the entire surface. Skips, runs, sags and drips shall be avoided. When these occur they shall be brushed out immediately or the material shall be removed and the surface recoated. On beams and irregular surfaces, edges shall be coated first and an extra pass made later.

Each coat shall be allowed to dry for the time specified by the coating manufacturer. Paint rollers shall not be used.

6.5.4 **Film Thickness**

Specified film thickness for coating materials shall be strictly observed. Film thickness shall be checked with appropriate film thickness gauges furnished by the Application Contractor. The Application Contractor shall calibrate gauges for the thickness range to be checked, over the type of surface to be coated. When dry film thicknesses are less than those specified, additional coats shall be applied as required at no additional cost to the Contractor.

6.5.5 **Integrity of Coating**

Coating shall be free from pinholes, voids, bubbles and other discontinuities. Any such defects shall be repaired at the Application Contractor's expense. Prior to the application of a coating, any damage to the previous coating shall be repaired with the



specified material. Upon completion, any damage or fault to the coating system shall be repaired to the satisfaction of the Contractor at no additional cost.

6.5.6 Contaminations

Precautions shall be taken to prevent the deposition of dust, moisture or other foreign matters on the surface after coating. Any coated surface that becomes contaminated with dirt etc., shall be air-blasted or washed down and allowed to dry. If the contamination still exists the affected surfaces shall be re-blasted.

6.5.7 Spray Application

The Contractor reserves the right to inspect all equipment for spray application prior to commencement of spraying. Spray guns, lines and pressure pots shall be cleaned before adding new material. An adequate moisture trap shall be installed between the air supply and each pressure pot. Suitable pressure regulators and gauges shall be provided for both the air supply to the pressure pot and the air supply to the spray gun. Spray equipment and operating pressure shall comply with the recommendations of the coating manufacturer.

The length of the material hose between pressure pot and spray gun shall not exceed 15 meters. Pressure pot, material hose and spray gun shall all be kept at as nearly the same elevation as possible. The spray gun shall be held at right angles to the surface and each pass shall overlap the previous pass by 50%.

Large surfaces shall receive two passes (except when applying solvent based inorganic zinc) at right angles to each other (crosshatched). Spray shall be applied in a heavy, wet coat. Coating materials containing heavy or metallic pigments that have a tendency to settle shall be kept in suspension in the pressure pot by a power driven continuous agitator. Other coating materials shall be agitated as frequently as workability requires.

The Application Contractor shall follow the paint manufacturer's recommendation in his selection and use of paint spray equipment, and any specific instructions for application.

6.5.8 Brush Application

When coatings are to be applied by brushing, brushes shall be of a style and quality that will permit proper application of material. Round or oval brushes are generally



most suitable for bolts, irregular surfaces and rough or pitted steel. Flat brushes are suitable for flat area. Flat brushes shall not be more than 100mm wide. No extending handles shall be used on brushes. Brushing shall be done so that a smooth coat, as nearly uniform in thickness as possible, is obtained. There shall be no detrimental brush marks. Paint shall be worked into all corners and crevices. When applying solvent type coatings, care shall be taken to prevent lifting of previous coats.

Adhesion tests shall be made at the discretion of the Contractor or his representative.

6.6 Protection

The Application Contractor shall protect buildings, structures and equipment from droppings and spray, and shall be solely responsible for all damages to other equipments and facilities as a result of coating operations.

6.7 Field Welds

No coating shall be placed on edges or surfaces prepared for field welds or within 50mm of these areas.

6.8 Bolt Holes

Care should be taken to ensure that bolt holes receive the required coatings.



7.0 GALVANIZING

7.1 General

All grating, and other items so specified on the Project Drawings, shall be hot-dipped galvanized in accordance with ASTM A-123.

7.2 Repair of Galvanized Surfaces

All galvanized surfaces that require welding, cutting, drilling or other preparation and any galvanized surface that has been damaged shall be repaired with the specified coating repair system.

Before application of repair coating, surface shall be washed with fresh water; rust and other deposits shall be removed by power sanding and the area thoroughly cleaned with solvent and/or grease removing agent. Coating material shall be applied immediately after completion of surface preparation.



8.0 PREPARATION OF NON-FERROUS SURFACES

8.1 General

Prior to applying coating material, surfaces shall be degreased using an emulsifying agent and then washed thoroughly in fresh water and allowed to dry. All surfaces shall be given a 'sweet blast' immediately before coating.

8.2 Stainless Steel Parts

Stainless steel parts shall not be painted.



9.0 SURFACES NOT TO BE COATED

Equipment and component drawings will indicate areas that do not require coatings, which will generally include:

- Flanged faces
- Tapped holes
- Machined parts
- Stainless steel parts
- Plastic or PVC based materials
- Cupro-nickel parts

Grit or sand blasting is NOT to be carried out local to:

- Machined surfaces
- Running bushes or bearings
- Instrument glasses
- Cables
- Or any other items of equipment that will incur damage without adequate covering or protection

All openings in mechanical equipment and process piping are to be adequately plugged or covered prior to blasting to prevent the ingress of sand or grit.

Any coatings, drips, runs or streaks that go accidentally onto the above listed surfaces, are to be removed without the use of power tools.

All tapped holes are to be re-tapped after painting of equipment.

Nameplates and "Tag" identifications shall not be painted so obliterating markings thereon.

Prefabricated parts that require welding shall not be painted local to the weld preparation.

A strip 50mm wide from the weld bevel is to be left unpainted.



10.0 DEVIATIONS

"Small" items of proprietary equipment can be supplied with a preparation and protective coating system and finish to the equipment Contractors "own standard"; provided that the Contractor conforms to the Contractor or his representative, in writing, that the Contractor's "own standard" is "as good as" or "better than" the preparation and finish as required by this Specification inclusive of the "five year" guarantee specified in para. 5.1.1 of this specification.

Upon request the Contractor will be supplied with details of climatic and environmental conditions applicable.

Contractors who 'choose' the above deviation are required to provide:

- A written data sheet of "own standard" paint system and topcoat color, to be included in the Contractors data book or installation/maintenance manual.
- A written data sheet of a "Repair Procedure" for the paint system, to be included in the Contractors data book or installation/maintenance manual.
- Quantity of 'primer - tie coat' and 'topcoat" (matching color), for making good by others. The paint is to be included as part of the equipment.

NOTE: THE CONTRACTOR'S PAINT SYSTEM MUST BE COMPATIBLE WITH THE PAINT SYSTEMS (FOR SPECIFIC AREAS) AS LISTED IN THIS SPECIFICATION.



11.0 COATINGS REPAIR PROCEDURE

When the surfaces show traces of condensation and if the relative humidity of the ambient air is higher than 80 to 85% the work shall be interrupted.

11.1 General

This Repair Procedure is to be used (or repairing 'small' areas of coating damage incurred:

- During fabrication in equipment Contractors work's
- During fabrication/construction of steelwork
- During hook-up work
- During pre-commissioning and start up
- During full on stream operation, up to a five year period from start up.

11.2 Exclusions

This Repair Procedure does not cover:

- Major or extensive areas of repair
- Major or extensive repair/maintenance of areas after startup

In such cases, the remaining 'undamaged' coatings are to be removed back to base metal, and the applicable preparation and coating system is to be applied a new.

The Contractor or his representative is to be informed of any major damage to coatings during stages of fabrication and/or construction.

11.3 Small Areas

Repairs to 'small' areas of coatings will apply to two separate standards:

11.3.1 The Standard Coating Systems as listed in this Specification.

11.3.2 The Standard Coaling System as used by a Contractor of some small items of equipment.

Repairs covered by (10.3.1) are to be as per systems shown.



Repairs covered by (10.3.2) are to be as per the specific 'Coatings Repair Procedure', which will be located within the equipment Contractors installation/maintenance manual, for the item of equipment requiring repair. The Contractor will have also included for quantities of 'primer' 'tie coat' of mating color in his 'spares' supply.

11.4 **Dressing Back**

For all small repairs, the damaged coating is to be removed back to base metal and to an area that overlaps into 'sound' undamaged coating. Damaged areas of coatings are to be removed with hand tools or power tools and not by 'grit or sand blasting'. The preparation (prior to coating) shall be as per this Specification (10.3.1) or Contractors specification (10.3.2) whichever is applicable.



12.0 PAINT SYSTEMS

12.1 Key List

Code	Work Location	
1A	Shop or Field	Surface preparation - Blast clean SA 3
1B	Shop or Field	Surface preparation - Blast clean SA 2
2	Field	Surface preparation - needle gun, water wash and scrub, power tool clean ST 3
5	Shop	Primer - 75 microns DFT zinc phosphate (high build)
8	Shop or Field	Prime 40 microns DFT urethane zinc rich (moisture tolerant)
9	Shop or Field	Prime 50 microns DFT urethane pitch rich (moisture tolerant)
10	Field	Intermediate - 75 microns DFT urethane M10 (moisture tolerant)
11	Shop or Field	Top Coat - 75 microns DFT modified Alkyd gloss (high build)
12	Shop or Field	Top Coat - 150 microns DFT urethane pitch (moisture tolerant)
13	Shop or Field	Top Coat - microns 50 DFT urethane, gloss (moisture tolerant)
14	Shop or Field	Undercoat - 30 microns DFT urethane undercoat (moisture tolerant)



15	Shop	Primer - Inorganic zinc silicate 75 microns DFT
16	Field	Top Coat - Aluminum silicone 25 microns DFT
17	Field	Touch up - Inorganic zinc silicate 75 microns DFT
18	Field	Coal tar Epoxy (CS 200) – Special Grade Coal tar pitch and Epoxy-resin 125 microns DFT.

12.2 Application

Details of paint systems and the applications are listed below:

- System 1 - Structural steel for Buildings
- System 2 - Structural supports, tank internals
- System 3 - External roofs, tank externals
- System 4 - Structural steel, piping and vessels below 100° C
- System 5 - Piping and Vessels above 100°C
- System 6 - Buried Piping - (In plant)

	System-1	System-2	System-3	System-4	System-5	System-6
Surface Preparation	1B	1B	1B	1A	1A	1A
Primer	5-AS	9-AS	8-AS	5-AS	15-B	5-AS
Undercoat	14-AS	10-AS	10-AS	14-AS	-	18 AS
Top Coat	13-AS	12-AS	13-B	13-AS	16-AS	18 AS
TOUCH UP	13-Brush	12-Brush	13-Brush	13-Brush	17-Brush	18-Brush
Minimum DFT (microns)	150	250	130	150	90	325
Maximum DFT (microns)	170	280	160	170	100	350

Legend: AS - Airless spray application
B - Brush application



12.3 Pumps, Machinery and Electrical Equipment

12.3.1 Surface Preparation and Painting at manufacturer's Works for Equipment Installed Outside Buildings.

Manufacturers shall specify their standard painting system (for the site conditions, and shall Specify surface preparation, type of coating, number of coats, dry film thickness and color. Should this system be unacceptable to the Purchaser, the requirements of this specification shall govern.

- **Painting at Site**
- No painting is permitted but the shop finish shall be made good if damaged.
- Color matching
- If required by the Purchaser, finish painted items shall be painted for color matching.

12.4 Instruments, Instrument Panels, Consoles and Cabinets

12.4.1 Surface Preparation and Painting at Manufacturer's Works for Equipment Installed Inside Fully Enclosed Buildings.

This equipment shall have its surface prepared, primed and finished in accordance with Manufacturer's standards. In general this shall consist of:

- One coat of primer and
- Two coats of enamel

12.4.2 Surface Preparation and Painting at Manufacturer's Works for Equipment Installed Outside Buildings

This equipment manufacturer shall specify their standard system (or the site conditions and shall specify surface preparation, type of coating, number of coats, dry film thickness and color. Should this system be unacceptable to the Purchaser, the requirements of this specification shall govern.



Painting at Site

No painting is permitted but the shop finish shall be made good if damaged.

Color Matching

If required by the Purchaser, finish painted items shall be painted for color matching.

12.5 Protective Coatings for Valves

12.5.1 Scope

This specification covers the preparation and external coating requirements for assembled valves.

12.5.2 Surface Preparation and Application

Following complete assembly of valves, all oil and grease shall be completely removed and surface thoroughly wire brushed to remove all loose and friable material.

Apply one coat of System No. 2 (a Zinc Dust Filled Primer) to a dry film thickness of 75 microns. All valve stems and stuffing box guides shall be suitably protected with grease after coating has been completed.

This does not apply if the Contractor's standard practice of preparation is by grit or shot blasting either before assembly or, with proper masking precautions, after assembly. If abrasive blasting is carried out, the use of an inorganic primer (System No. 1) is to be applied.



13.0 COLOR CODING

Firewater piping shall be painted solid red in a suitable weather resistant paint available in Pakistan.

Pipe work shall generally be painted silver with color-coding as below.

Color-coding of pipe work shall be as per the Piping Service Designations. Each pipe shall be color coded with three painted bands (with the exception of Fire Water piping) identifying

- Product Medium
- ANSI Piping Class
- Piping Material

Color-coding shall be prepared by Contractor and agreed by Engineering Contractor/Owner from the appropriate range of suitable paints available in Pakistan.



*Specification for Fire Water Jockey Pump
Integrity Assessment And Reliability Check Of Dakhni Plant*

Specification for Steel Structure



Job No. 14 - 4908

Spec. No. 4908-STA-4003

Sheet 1 of 14

Rev. 1

SPECIFICATION FOR SUPPLY & INSTALLATION OF STEEL STRUCTURE

Project: **Dakhni Expansion Project**

Client: **Oil & Gas Development Co. Ltd**

Prepared by: IAS
Checked by: MAT
Approved by: TH
Revised by: -

Rev.	Description of Revision	Date	Revised Page Nos.
1	RE-ISSUED FOR BID	07/04/2009	
0	ISSUED FOR BID	06/03/2009	



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1.0 SCOPE

This specification defines the supply, fabrication and erection procedures for structural steel frame buildings, equipment supports, access platforms, pipe supports and all other miscellaneous steel structure works.



2.0 CODES & STANDARDS

All structural steelwork, as a minimum shall comply with the requirements of this specification and the latest editions of the following codes, standards and regulations (where applicable).

BS 499: Part 1	Welding Terms & Symbols
BS 639	Specification for Covered Carbon & Carbon Manganese Steel Electrodes for Manual Metal Arc Welding.
BS 709	Methods of Destructive Testing of Fusion Welded Joints & Weld Metal in Steel.
BS 729	Specification for Hot Dip Galvanized Coatings on Iron & Steel Articles
BS 1706	Specification for Electroplated Coatings of Cadmium & Zinc on Iron & Steel
BS 2853	Specification for the Design & Testing of Steel Overhead Runway Beams
BS 2997	Aluminum Rainwater Goods
BS 4190	Specification for ISO Metric Black Hexagon Bolts Screws & Nuts



3.0 **MATERIALS**

3.1 **Structural Steel**

Structural steel shall comply with BS EN 10 025. Grade Fe 430 C (EN 10 025 Fe 580 C) or equivalent. All steel shall be from a source/material approved by the OGDCL/Engineering Consultant.

3.2 **Bolts**

High tensile structural bolts and nuts shall comply with BS 3692 Strength Grade 8.8.

ISO Metric black bolts; screws and nuts shall comply with BS 4190.

Bolts and washers shall be zinc plated in accordance with BS 1706 Class Zn2. Nuts may also be plated to the same specification, or may, alternatively, be supplied with a cadmium finish in accordance with BS 1706 Class Cd 2 in order to facilitate tightening.

Holding down bolts shall normally be supplied black with a light coating of oil. Each bolt shall be supplied with hexagonal nut(s) and washer.

3.3 **Steel Flooring**

The steel used for steel flooring and stair treads shall conform to BS EN 10 025 Grade Fe 430 C, or equivalent.

3.4 **Roof & Wall Cladding**

Roof and wall cladding shall be profiled as sheeting as defined in BS 5427 and shall be either aluminum to BS 4868 or steel.

Steel sheeting shall be in accordance with the structural design rules of BS5950 Part6.

Aluminum sheeting shall not be less than 1.2mm (18 SWG) thick unless otherwise directed or approved by the OGDCL/Engineering Consultant.

Cladding shall be supplied complete with all necessary purpose made accessories including rigid pieces, aprons, flashings and filler pieces, brackets and fixings.



The complete roof and wall cladding system and accessories shall be from one manufacturer and the approval of the OGDCL/Engineering Consultant.



4.0 WELDING

4.1 Quality

Welding shall be carried out only under the direction of an experienced and competent supervisor. Unless otherwise agreed by the OGDCL/Engineering Consultant a record shall be kept to enable major welds to be identified with the welders responsibility for the work.

Electrodes and fluxes shall be used in accordance with the manufacturer's instructions and shall be so chosen that the properties of the deposited metal are not inferior to those of the parent metal.

The use of welding processes other than those covered by BS 5135 shall be subject to the approval of the OGDCL/Engineering Consultant.

The general welding program for shop and site welds, including particulars of the preparation of fusion faces, the method of preheating where required, the methods of making the welds, and the type of electrodes shall be submitted to the OGDCL/Engineering Consultant for their approval.

The position of welds required for temporary fabrication attachments shall be subjected to approval by the OGDCL/Engineering Consultant.

4.2 Qualifications of Welders

Welders shall be suitably qualified and evidence shall be furnished of their satisfactorily completed appropriate tests as laid down in BS 4872: Part 1.



5.0 ERECTION

5.1 Erection Generally

Erection on concrete foundations shall not commence unless the concrete has acquired sufficient strength.

The Contractor shall properly align each part of the structure before making field connections. The steel frames shall be true and plumbed. Temporary bracing shall be introduced to prevent instability due to lateral loads acting on the structure during construction, including loading from erection or operating of equipment.

Minor misfits which can be rectified by a moderate amount of reaming and slight cutting and chipping may be corrected by the Contractor when in the OGDCL/Engineering Consultant opinion it will not be detrimental to the strength or appearance of the structure.

All errors shall be reported without any delay to the OGDCL/Engineering Consultant.

Fitting-up bolts and drift pins shall not be used to bring improperly fabricated members and parts into place, thus causing a strain on bolts in finished work. Drift pins shall not be driven with such force as to damage adjacent metal.

No packing, shimming or wedging will be permitted to correct imperfect work unless specifically approved by the OGDCL/Engineering Consultant. No welded connection shall be made until the member or structure has been properly aligned.

All members in completed frames shall be true to line and free from bends, twists and open joints.

Field connections shall be welded or bolted as shown on the drawings. Permanently bolted connections of primary construction members shall be made with the use of bolts as shown on the drawings and in conformity with all Local, National, Provincial and Municipal Laws and Regulations and the OGDCL/Engineering Consultant safety ordinances.



Holes, cutouts, etc., shall be provided only where indicated on the drawings and any additional holes, cutouts, etc., made at site will require prior approval from the OGDCL/Engineering Consultant. Bolt holes shall only be drilled.

Any damage to materials on the site due to inadequate precautions being taken during the erection of the steel work shall be made to the good satisfaction of the OGDCL/Engineering Consultant at the Contractor's expense.

For major structures, the Contractor shall submit to the OGDCL/Engineering Consultant an erection plan complete with data on heaviest lift, weights and calculations involved. Approval of this erection plan by the OGDCL/Engineering Consultant shall not relieve the Contractor of his responsibility for the erection of the structure.

Before setting bases and bearing plates for structural steel, concrete surfaces to receive grout shall be chipped to a minimum depth of 6mm to remove laitance and to expose aggregate. Bottom surface of base and bearing plates shall be then cleaned and supported on steel wedges, shims, or other adjustable devices.

After the supporting members have been properly positioned and plumbed, the holding down bolts shall be tightened. The entire bearing area under the base or bearing plate shall be packed with grout. The grout shall be thoroughly worked to eliminate voids and provide a uniform bearing surface. After the grout has cured for 72 hours, the shims and wedges shall be removed, the voids packed with grout, and the holding down bolts re tightened.

After erection, the various members forming part of a completed frame or structure shall be aligned and adjusted before being permanently fastened. The finished structure shall conform to the lines and elevations shown on the drawings.

Splicing of structural members where not detailed on the drawings is not permitted, without prior approval of the OGDCL/Engineering Consultant as to the location and type of splice to be used.



5.2 **Erection Tolerance**

Erection tolerances shall generally be in accordance with BS 5950: Part 2.

- **Beams**

The maximum tolerance for level and alignment shall be ± 5 mm across any particular floor of the structure. Maximum differential between connecting beams or adjacent beams shall not exceed 2 mm.

- **Stanchions**

Plan Position

The distance between the centers of adjacent stanchions at any one-floor level shall not exceed ± 5 mm.

The cumulative tolerances over three or more bays shall not exceed the following:

Upto and including 30m	± 10 mm
Over 30m	± 15 mm



6.0 PROTECTION OF STEEL SURFACES

6.1 Equipment & Materials

All the necessary materials and equipments shall be supplied by the Contractor unless stated otherwise in the Contract.

All paint shall be supplied in unopened original containers clearly showing expiry date and manufacturing date. All paint shall be stored in accordance with manufacturer's directions. No paint is to be used within 3 months of the expiry date.

6.2 Surface Preparation & Painting

6.2.1 The Contractor shall paint all new equipment, materials and piping, as appropriate, together with any existing paint work, damaged during execution of the Works in accordance with this Specification.

6.2.2 All new steel surfaces required to be painted shall be grit blasted.

If heavy scale is present it must be removed by hammering or scraping. Any heavy scale contaminated by oil must be removed using non-sparking tools. Grease or oil shall be removed by swabbing the affected surface area with a solvent or cleaning agent specified by the OGDCL/Engineering Consultant, and dried using clean cloths.

Any seams, welds, sharp edges and laminations shall be ground smooth prior to blasting. Any area not requiring to be blasted shall be masked with suitable masking material.

The surface shall be blasted to Swedish Standard SIS 055900, Grade S.A. 2.5 using commercially available grit (type to be approved by the OGDCL/Engineering Consultant and a source of dry compressed air at a minimum of 250 cfm at 100 psi. Pitted areas shall be blasted such that there remains no residual scale at the bottom of the pits. On certain occasions other forms of surface preparation may be accepted at the discretion of the OGDCL/Engineering Consultant.

Blasting must not be carried out if the relative humidity is greater than 80% or the temperature of the steel is within 2°C or Dew Point. Care should be taken to ensure that no water contacts the blasted surface.



After blasting, the surface should be "blown down" with compressed air to enable an inspection to be made; unsatisfactory areas are to be marked with chalk and re blasted. When the surface preparation has been approved by the OGDCL/Engineering Consultant all surfaces should be cleaned of residual dust by thorough "blowing down" or brushing with clean nylon brushes or preferably with an industrial vacuum cleaner. Grit blasting shall be removed and disposed of by the OGDCL/Engineering Consultant.

- 6.2.3 The paint manufacturer's mixing and application instructions (refer to the paint manufacturer's own technical data sheets) should be adhered to and taken care of to achieve an even coating of the correct film thickness as recommended by the manufacturer, upto a DFT as specified.
- 6.2.4 Airless spray (using correctly sized spray nozzles) is the preferred method of application. Application by brush and/or roller may be acceptable after the approval of OGDCL/Engg. Consultant. In all cases the minimum film thickness specified for each individual paint coat must be achieved prior to final approval of the coating. Over coating intervals recommended by the paint manufacturer must be adhered to unless the OGDCL/Engineering Consultant advises otherwise.
- 6.2.5 When over coating, the relative humidity must be less than 80% and comply with paint manufacturer's data sheets. The steel temperature must not be within 2°C of the Dew Point. The previously applied paint coating must be free of any grease or oil, dust or water before over coating and each coat must be inspected and approved by the OGDCL/Engineering Consultant before over coating is permitted.
- 6.2.6 Final color shall be specified later stage on the drawings; or Particular Specification; or as determined by the chemistry of the paint system specified.
- 6.2.7 All seams welds and sharp edges shall be stripe coated before commencing of spray.
- 6.2.8 Painting shall only be undertaken upon satisfactory completion of all NDT and hydro tests.



6.3 **Coating System**

6.3.1 **Surface Preparation**

First cleaning with proprietary degreasing agent then flushing with fresh (sweet) water and then drying shall be done. Grit blasting with one way abrasive to SiS Grade Sa 2.5 (SIS refers to Swedish International Specification 05-59-00) shall be done where required.

6.3.2 **Primer Coat**

1 coat, 2Component Epoxy Polyamide build to DFT 50 pm.

Color - as specified by OGDCL/Engineering Consultant.

6.3.3 **Intermediate Coat**

2 coats, 2 component Epoxy Polyamide high build to 100 pm DFT.



7.0 RUNWAY BEAMS

The testing of all runway beams shall be carried out in accordance with BS 2853 and such statutory requirements as may be specified.

Runway beams shall be erected free from twist.