OGDCL PAKISTAN:
OIL & GAS DEVELOPMENT
COMPANY LIMITED

NASHPA COMPRESSION PROJECT (PHASE-II)

ISSUED FOR TENDER

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ENAR

ENAR Petrotech Services (Pvt.) Limited ,
7-B , Sector 7-A , Korangi Industrial Area ,
Karachi Pakistan

TITLE:

SPECIFICATION FOR LV A.C INDUCTION MOTOR

CONTRACT NO.
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CLIENT : OIL & GAS DEVELOPMENT COMPANY LTD. (OGDCL)

PROJECT: NASHPA COMPRESSION PROJECT (PHASE-II)

SPECIFICATION FOR LV A.C INDUCTION MOTOR

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1. PURPOSE

This specification supplements the General Specification for Electrical Installation and covers the minimum requirements for the 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 sheets 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 Contractor.

IEC 60034	Rotating electrical machines (Part1 to Part15)
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-70 / National Electric Code
- API Recommend Practice 505
- 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 (IEEE)
- Electricity Act. (up –to-date) Govt. of Pakistan
- Oil & Gas (Safety in Drilling and Production) Regulation (up –to-date), Govt. of Pakistan.

3. SERVICE CONDITIONS

Electrical design shall be based on the following:

Temperature:	Maximum	115 °F
	Minimum	35 °F
Humidity:	Maximum	70%
	Minimum	10%
Elevation		2700 Feet

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 (directly mounted on the motor shaft) 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 with protective shelter.

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. For pumping duty they shall provide for permanent spare capacities in accordance with API 610.

Motors shall be suitable for required service as per project requirement, refer "Doc. no. 0193-DS-1702".

Motors installed in hazardous area shall comply with IEC 60079 and shall be labelled or listed or certified by one of the third party as listed in Table-1; (*where required*).

The degree of protection shall be IP 42 for motors indoor in non-hazardous area and IP 55 for motors outdoor & 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.

Energy efficient motors are required for continuous duty application. The motor shall have power factor of not less than 0.90 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:

Voltage	400 V ± 10% (*)
Phase	3
Frequency	50 Hz. ± 2%
Neutral System	Solidly Earthed
RMS Asymmetrical Current	120 kA (1 Sec)

(*)Motors shall be designed for reduced voltage star delta 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 shall be continuously rated, and starting method shall be suitable as given below:

(a) Motors below 37kW shall be DOL starting.

(b) Motors between 37kW and 100kW shall have Star/Delta starter.

(c) Motor above 100kW shall have Soft starters / VFD.

When variable frequency drive (VFD) is used for motor control, motors shall be suitable for VFD starting. Refer a.c induction motor data sheet "Doc. No. 0193-ELA-6505" for motor starting selection.

Motors to be installed within a hazardous area shall be certified in accordance with NEC/IEC 79 recommendations, by an approved testing authority. The motors shall be of the following types of construction depending upon the classifications of the hazardous locations in which they are to be installed:

Zone-1:	Flame proof enclosure ''d'' Increased safety ''e'' Intrinsically safe ''ib''
Zone-2:	Motors for Zone 1 or type ''n''as per NEC/IEC 79-15.

For motors to be installed in hazardous areas, all auxiliary electrical equipment mounted on the motor shall be certified for use in hazardous areas.

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.

The Contractor shall be completely responsible for the correct combined performance of the motor and its driven equipment package after installation.

If the Contractor 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 nonhygroscopic 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 40º 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 Contractor's Manufacturer 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 ¼'' 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 5º 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 0º 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.
- Oil flow rate (gpm, for flood lubricated bearings)
- Hazardous Area Classification / IP Classification for weather protected motors.

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 Contractor 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 Contractor shall make all necessary alterations, repairs and replacements of defective equipment / components, at his own cost including transportation, installation and testing.

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, Contractor'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 ¼, ½, ¾, 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.

8. TABLE-1

Belgium	Institute National des Industries Extractives (INIEX)	Certified
France	Laboratoire Central des Industries Electriques (LCIE)	Certified
Germany	Physikalisch Technische Bundesanstalt (PTB)	Certified
Italy	Centro Elettrotechnico Sperimentale Italiano (CESI)	Certified
Netherlands	KEMA Nederland B.V. (KEMA)	Certified
USA	Underwriters Laboratories, Inc. (UL)	Labeled or listed
USA	Factory Mutual Research Corp. (FM)	Certified
Canada	Canadian Standards Association (CSA)	Certified
UK	ATEX	Certified