



CONTRACTOR:
Petrochemical Industries
Design & Engineering Co.
PROJ. NO. : 1203

SABALAN METHANOL PROJECT

COVER SHEET



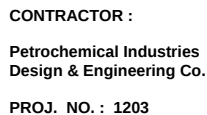
OWNER :
SABALAN PETROCHEMICAL
INDUSTRIES CO.
PROJ. NO. : 89/S-G/102

MATERIAL STANDARD SPECIFICATION FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS

DOCUMENT NO : **1203-00-EL-MSS-521**

TOTAL PAGES : **13** (Excluding Cover & Revision Index Sheets)

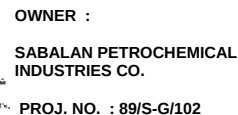
ED		EXT		CF		A	
Eng. Phase		Purpose Of Distribution (POD)		Purpose Of Issue (POI)		Owner's Action	
01	07.06.2011	Certified Final		A.Owji	M.Lotfi	M.Lotfi	N.Jafarpour
00	20.02.2011	Issued For Engineering		A.Owji	M.Lotfi	M.Lotfi	N.Jafarpour
Rev.	Date	Description		Prepared by	Checked by	Approved by	Project



MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS

DOC. NO. : 1203-00-EL-MSS-521

Rev.: 01



SHEET NO.	INTERNAL ISSUE	Change Index During formal issues						REMARKS
		First Issue	Second Issue	Third Issue	Fourth Issue	Fifth Issue	Sixth Issue	
	Rev. 0A	Rev.00	Rev.01	Rev.02	Rev.03	Rev.04	Rev.05	

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

Index:	Sheet
1. Scope	2
2. Standards & Codes	2
3. Responsibility	3
4. Design Requirements	3
4.1 General	3
4.2 Electrical Supply System	4
4.3 Enclosure and Protection	4
4.4 Methods of Cooling	4
4.5 Starting, Restarting	5
4.6 Vibration	5
4.7 Noise	6
5. General Construction Requirements	6
6. Condensation Protection	6
7. Windings	6
8. Terminals and Terminal Boxes	6
9. Bearings	7
9.1 General	7
9.2 Lubricants	8
9.3 Bearing Insulation	8
10. Rotor and Fans	8
11. Motors Operated with Variable Speed	9
12. Painting	9
13. Nameplate	10
14. Inspection and Tests	11
13.1 General	11
13.2 Performance Tests	11
13.3 Routine Tests	11
13.4 Test Reports	11
15. Information to be Supplied by the Vendor	11
16. Spare Parts	13
17. Special Tools and Spanners	13
18. Data Sheets	13
19. Preparation for Shipment	13

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

1. SCOPE

- 1.1 This standard specification covers the minimum technical requirements for design, manufacture, testing, inspection, packing and supply of low voltage, 3 phase squirrel cage induction electric motors for **Sabalan Methanol Plant in Bandar Assaluyeh-Iran.**
- 1.2 All electric motors supplied in accordance with this standard specification shall meet the requirements of the area classification in which it is to be installed as defined by the latest applicable sections of the herein mentioned standards and codes. Any special requirements will be indicated on the motor data sheets.
- 1.3 Compliance by the manufacturer with the provisions of this standard specification does not relieve him of the responsibility of furnishing unit of proper design, mechanically suited to meet operating guarantees at the specified operating conditions.
- 1.4 Deviations from this standard specification which the manufacturer may consider advisable, shall be submitted in writing to purchaser, together with his quotation. Afterward purchaser may approve or reject such deviations.

2. STANDARDS & CODES

- 2.1 All motors shall be constructed and tested in accordance with all applicable sections of the latest edition of the below listed standards and codes:

- IEC 60034 Rotating Electrical Machines
- IEC 60072 Dimensions and Output series for Rotating Electrical Machines
- IEC 60079 Electrical Apparatus for Explosive Gas Atmospheres
- IEC 60529 Degrees of protection provided by enclosures
- IEC 60085 Thermal evaluation and classification of electrical insulation
- ISO 281 Rolling Bearing-Dynamic Load Ratings and Life

The equipment as a whole may conform to the national standards of the country of manufacture, provided these standards are based on the IEC recommendations.

Vendor shall state in the quotation the standards to which the equipment conforms. If these are the national standards, then the vendor shall state in the quotation, the deviations (if any) from the relevant IEC recommendations.

2.2 UNITS

The international system of units (SI) shall be used for all drawings and documents. ISO Metric standard will be applied for threads and cable entries.

2.3 LANGUAGE

The English language shall be used for all correspondences, vendor documents, datasheets, catalogues, nameplates, etc.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

3. **RESPONSIBILITY**

- 3.1 The order of electric motor in accordance with this standard specification may be placed direct or through the manufacturer of the driven equipment with the manufacturer of electric motor approved by purchaser.
- 3.2 The motor and driven equipment may be assembled either at the factory of the manufacturer of the driven equipment or on site in the country of destination.
- 3.3 When motors are furnished with the driven equipment as a package, coordination for the torque-speed characteristics are the responsibility of the driven equipment vendor.
- 3.4 When motors are bought separately by the purchaser, the torque-speed characteristics of the driven equipment will be supplied with the "Inquiry" and "Purchase order". The offered electric motors shall be suitable for the load characteristic of the driven equipment.

4. **DESIGN REQUIREMENTS**

4.1 **GENERAL**

- 4.1.1 The motor and all individual items forming part of the motor shall have an expected life time of 20 years; this includes e.g. the lubricating system with piping, heaters, protective and monitoring systems, wiring, fixing materials, terminals, etc., with the exception of rolling element bearings.
- 4.1.2 Motors shall be sized taking into consideration of the followings:
- The motor shall be suitable for continuous operation at duty type S1 (continuous operation) for at least two years without maintenance requiring stopping of the motor. Lubrication, if required, shall be possible with the motor in operation.
 - Motors driving compressors and reciprocating pumps shall be sized so that the product of the motor nameplate rating and the motor service factor be at least 110% of the greatest output power required at any design operating condition.
 - Motors driving centrifugal pumps shall have output power rating at least equal to the following percentage of pump design point brake horse power.

<u>Motor output rating(KW)</u>	<u>Percent of pump BHP</u>
18.5 and less	125
Above 18.5 to 55	115
Above 55	110

- 4.1.3 The motors shall be earthquake proof in accordance with the local requirements as stated in requisition. Climate conditions, design temperature, relative humidity atmospheric details and altitude are specified in the mentioned document.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

4.2 ELECTRICAL SUPPLY SYSTEM

- 4.2.1 Unless otherwise specified in the data sheets, the motors shall meet the requirements tabulated below:

RATINGS	VOLTAGE (V)	PHASE	FREQUENCY (Hz)
Below 0.2 KW	230	1	50
0.2 KW up to 150 KW	400	3	50

- 4.4.2 The system voltage shall be assumed to be sinusoidal in accordance with IEC 60034-1, article 12.

4.3 ENCLOSURE AND PROTECTION

- 4.3.1 The degree of protection of the motors shall be at least:
- IP 54 for motor and auxiliaries.
 - IP 55 for the terminal boxes and bearing housings.
- 4.3.2 The enclosure of motor shall be equipped with a drain hole in accordance with IEC 60034-5 to IP44 to avoid accumulation of condensation within the motor (not applicable for EEx"d" motors).
- 4.3.3 The top bearing construction of vertical motors with upward extended shaft shall prevent water collection around the shaft protrusion and water penetration into the bearing.
- 4.3.4 Vertical motors with downward shafts shall be provided with fully covering rain canopies.
- 4.3.5 Horizontal motors used in vertical service, e.g. air coolers, shall be equipped with a shaft sealing device which will preclude entry of moisture. Adequate means of drainage through the lower end bell shall also be provided. Motors for such service will be identified by Purchaser.
- 4.3.6 Motors shall be of tropical type. The interior surfaces shall be protected against corrosion with synthetic varnish.
- 4.3.7 Type of protection of motors in relation to the area classification shall be as below and certified by a recognized and official testing laboratory:
- For zone 1 locations: EEx "d" with EEx "e" terminal boxes or EEx "e"
 - For zone 2 locations: EEx 'nA' or complying with requirements for zone 1.

Anyway risk assessment should be done for EEx "e" and EEx 'nA' Motors and in case that there is a need to an additional system like purging, the type of protection should be changed to EEx, "e" or EEx "d".

4.4 METHODS OF COOLING

The motor shall be totally enclosed fan cooled (IC 411, IC 511 or IC 611) as specified in the motor data sheets.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

4.5 STARTING, RESTARTING

4.5.1 General

Electric motors shall be suitable for direct on-line starting and re-acceleration at any voltage between 80% and 100% of the rated voltage at the terminals of the motor.

4.5.2 Number of Sequential Starts

Electric motors shall be suitable for:

- 3 consecutive starts when starting from Max .Ambient temperature (cold motor).
- 2 consecutive starts when starting at full load operating temperature (warm motor).

Motors for intermittent periodic duty shall permit the number of starts defined in the relevant motor data sheet, issued by the purchaser.

4.5.3 Number of Starts per Year

The electric motors shall be suitable for one of the duties listed below:

- Normal : maximum 1000 starts per year
- Heavy : maximum 3000 starts per year, e.g. conveyor systems, drain Pumps, etc.
- Extra Heavy: maximum 20,000 starts per year, e.g. hoisting equipment cranes, etc.

4.5.4 Starting Characteristic

- The torque-speed characteristics of the motor with rated frequency and 80% rated voltage applied to the motor terminals shall be adequate for starting the driven load under the most severe conditions e.g. pump with open discharge. Under these conditions the accelerating torque shall not be less than 10% of the full load torque at any point.
- The motors have to be capable to overcome the starting load inertia, as well as the reacceleration of the load to full speed at a voltage drop of 20%.
Motors shall be capable of reacceleration under full load condition following a power interruption not exceeding 0.2 second.
- The rated torque should not be affected by fluctuation of the frequency by -2%, +2% and also by voltage variation of $\pm 5\%$ of the nominal value.
- The locked rotor torque characteristic shall be sufficient to meet the specified requirements of the driven load.
- Starting current of motors with a rated output in excess of 55 KW shall not exceed 7 times the motor rated current.

4.6 VIBRATION

The motor vibration shall not exceed the limit specified in IEC 60034-14.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

4.7 NOISE

The mean sound pressure level measured in accordance with IEC 60034-9 shall in no case exceed 85 dB (A) at the distance of 1 meter from motor.

5. GENERAL CONSTRUCTION REQUIREMENTS

- 5.1 Generally motor frames and end shields shall be constructed of ferrous metals. For motors below 22kw or industrial type motors aluminum alloys may be used.
- 5.2 Motors heavier than 25 kg shall have eye bolts, lugs or extension pieces, clearly marked for "hoisting". Lifting points which are an integral part of the frame are preferred.
- 5.3 Motors weighting over 200 kg shall have jacking bolts or facilities to lift the motor with the aid of e.g. a hydraulic jack to facilitate lining-up of the motor with the driven equipment.
- 5.4 The materials shall be selected to prevent galvanic corrosion. All screws, bolts and nuts shall be corrosion-resistant. Self-tapping screws shall not be used.
- 5.5 The motors shall be provided with external earthing facilities by means of a suitable clamp or a bolt tapped into the frame on the side of the main cable connection box. The size of earthing conductor to be connected will be indicated in the data sheets.

6. CONDENSATION PROTECTION

Space heater should not be necessary for LV motors.

7. WINDINGS

- 7.1 All motors shall have class F insulation loaded to class B under design operating conditions
- 7.2 Stator windings shall be either star or delta connected. However star connection is preferred.

8. TERMINALS AND TERMINAL BOXES

- 8.1 All motors shall be supplied and equipped with terminals and terminal boxes. All terminal boxes shall preferably be positioned on the right hand side when looking at (facing) the driving end or on the top. The six terminals of motors shall be brought in the same terminal box with provisions for star point connection.
- 8.2 Terminal boxes shall be designed to rotate by 360° in 90° increments allowing cable termination in any of the four positions. Power cables shall enter horizontally from the non-drive end to terminal boxes.
- 8.3 Terminal boxes shall be made of cast iron or steel, except where aluminum frame is permitted.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

- 8.4 Terminal markings shall be U-V-W and provided in a clear and permanent manner.
- 8.5 Terminal connections shall be such that direct contact between bolts, nuts, screws and the **conductor** is avoided. Connections shall be secured against loosening and the arrangement shall be such that the contact pressure is maintained over the life of machine.
- 8.6 Terminal blocks shall be made of synthetic resin.
- 8.7 Motors, which are suitable for only one direction of rotation, shall have this direction of rotation clearly indicated on the motor together with the phase sequence to terminals associated with this rotation.
- 8.8 Cable entries shall have metric threads and shall be equipped with plugs to exclude moisture before installation.
- 8.9 The actual cable size, the number of cables and the gland size is as specified in "motor data sheet".

9. BEARINGS

9.1 GENERAL

- 9.1.1 Bearings sizes shall comply with the recommended dimensions of International Standard Organization (ISO), ISO 15, and ISO 1132.
- 9.1.2 All rolling element bearings shall have a metallic cage.
- 9.1.3 Vertical motors driving direct coupled pumps shall have the thrust bearing suitable for load imposed by the driven machinery.
- 9.1.4 If ball bearings are fitted at both driving and non-driving ends, a well proven method shall be employed at one end to permit differential expansion between shaft and frame.
- 9.1.5 Shaft axial expansion can take place towards the coupling end and this shall be stated, together with the estimated amount according to the temperature rise of the motor, so that due allowance can be made during alignment of the motor, coupling and driven unit.
- 9.1.6 It shall be possible to re-lubricate bearings in safety without stopping or dismantling the motor.
- 9.1.7 Unless agreed otherwise, the minimum re-lubrication interval for grease lubricated bearings, irrespective of actual running hours, shall be not less than 4000 hours for horizontal motors and 2000 hours for vertical motors.
- 9.1.8 Grease lubricated bearings shall have pressure relief devices which ensure that the new grease displaces the maximum amount of old grease and automatically ejects any surplus to the outside of the motor casing.
- 9.1.9 Pre-lubricated bearings may be considered for motors up to and including 37KW provided that the service life under the specified operating conditions is satisfactory and is agreed

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

by purchaser. An acceptable service life without re-greasing is considered to be not less than 40,000 hr.

- 9.1.10 The rated life of ball and roller bearings, when calculated in accordance with ISO recommendation 281-1 shall be in excess of 40,000 hr.
- 9.1.11 The motor's bearing arrangement shall be suitable for ball bearings with C3 radial internal clearance. Roller bearings may have a normal or C3 clearance.

9.2 LUBRICANTS

- 9.2.1 Lithium based greases shall be used in the bearings. Non compatible greases such as those based on polyurea are not acceptable.
- 9.2.2 Grease lubricated bearings shall be packed with the agreed lubricant before the motor is dispatched.

9.3 BEARING INSULATION

- 9.3.1 The shaft voltage shall not exceed 300mV RMS, unless bearings shall be fully insulated from the motor carcass and/or bedplate to prevent a flow of shaft current.
- 9.3.2 The method of insulation shall be permanent and non-deteriorating during assembly or disassembly of the bearing.
- 9.3.3 An earthing connection, which shall be removable for test purposes, shall be provided at the drive end bearing and care shall be taken not to bridge bearing insulation by any other connection.
- 9.3.4 Where bearing insulating is specified the manufacturer shall submit detail drawing for the proposed insulation arrangement.

10. ROTOR AND FANS

- 10.1 The rotor shall be free from excessive inherent axial thrust. It shall also be in good dynamic balance. Rotors shall be dynamically balanced to grade G2.5 as defined in ISO1940 with half depth keys or with the motor half-couplings keyed on the shaft.
- 10.2 After balancing, the vibration severity of the motor shall meet the criteria as specified in Clause 4.6 of this standard specification.
- 10.3 The rotor design shall allow for the addition of balancing weights, which shall not be of lead or similar unstable material.
- 10.4 Fans shall be inherently balanced and shall be located so that it is impossible to assemble them incorrectly. They shall force the cooling air in the direction of the driving end preferably be suitable for rotation in either direction.
- 10.5 In the case of motors supplied with unidirectional fans, it is essential that the manufacturers state this fact in their tender. In such cases, the direction of rotation for which the motor is arranged shall be clearly indicated by means of a permanent arrow on

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

the driving end, preferably on the stator body and not on a removable end shield. A painted arrow only is not acceptable.

- 10.6 The shaft ends shall be provided with a suitably threaded hole or holes to facilitate the putting on of couplings, etc.
- 10.7 The rotor cage construction shall ensure minimum noise from magnetic interaction.
- 10.8 Fans for motors should be of Brass, Bronze or Aluminum. Aluminum alloy fans should not contain more than 0.2% Copper and should be balanced before assembly on shaft. Fans shall be made of a corrosion resistant non-sparking metal.
- 10.9 Plastic, Fiberglass or other non-metallic fan housing are not acceptable.

11. MOTORS OPERATED WITH VARIABLE SPEED

The motors shall be sufficiently designed to accept harmonic voltages and corresponding harmonic currents generated by VSDs, which will flow continuously in the stator and rotor circuits.

Special attention shall be paid to speed torque curves because induction motors are self-ventilated motors and low speed will lower the cooling effect.

Generally the VSD motors shall comply with the specification for motors however the following additional special requirements shall also be considered.

- a) The motor shall be able to withstand the transient torques developed during short circuit conditions.
- b) The maximum operational speed of the motor shall be considered as the rated speed.
- c) On the test bed the unfiltered vibration severity of the electric motor shall not exceed of 2mm/s over the whole operational speed range.
- d) Every VSD motors shall have 2 embedded temperature detectors per phase in its stator windings. For motors at and above 30kW, the detectors shall be PT-100 platinum resistance elements to IEC 600751. The elements shall be wired to separate terminal box on the motor frame.
- e) For motors rated less than 30kW, the temperature detectors may be of the thermistor type (PTC).
- f) For motors rated less than 7.5kW, the terminals of the motor and of the temperature detectors may be mounted in one terminal box.

12. PAINTING

- 12.1 Prepared surfaces shall be free from rust, scale, sand, dust and grease before painting.
- 12.2 The painting shall be according to manufacturer's standard specification, provided that vendor painting procedure has been approved by purchaser. Finish color will be specified in the purchase order.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

- 12.3 For corrosive environments or areas subject to chemical spillage, painting shall be suitable for such environments.

13. NAMEPLATE

- 13.1 Nameplate shall be of stainless steel, brass or bronze. They shall be fixed to a non-removable part of the frame with the same material, and shall be according to manufacturer's standards. Minimum information on the nameplate includes:

- a) Maker's name
- b) Maker's frame size and serial number
- c) Voltage, phase, full load speed, frequency and full load current
- d) Class of rating: Continuous
- e) Class of insulation
- f) The degree of protection of the motor, its terminal boxes and bearing housings, in accordance with IEC 60034-5 and the certification No.
- g) Type of connection-star or delta
- h) kW output at full power at design temperature
- i) Efficiency and power factor at full load
- j) Type of enclosure, e.g. TEFC, and Hazardous area protection, etc.
- k) Type and size of bearing
- l) Class of lubrication
- m) Maximum temperature rise
- n) Starting current at full load
- o) Starting torque (% F.L.T)
- p) Net weight (If over 250 kg)
- q) Purchase order number

- 13.2 When special features are embodied, a plate showing appropriate instruction shall be affixed to each motor.

- 13.3 The motor identification tag plate shall be fixed to the motor frame.

- 13.4 A separate data plate shall be provided for frequency converter controlled variable speed motors. This data plate shall comprise all data pertaining to motor operation with frequency converter and different from those when operated at fixed speed.

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

14. INSPECTION AND TESTS

14.1 GENERAL

- 14.1.1 During the production of the motor and before leaving the manufacturer's works, each motor shall be tested and the results recorded in test reports. Motors offered for inspection shall be complete and ready for shipment.
- 14.1.2 Tests shall be carried out in accordance with this standard and the IEC and ISO recommendations, unless otherwise specified.
- 14.1.3 If the manufacturer's test arrangements are not adequate or he is not capable of carrying out the specified test, this shall be clearly stated in the quotation. Application of alternative tests shall be approved by the **purchaser** before the order is placed, e.g. 60 Hz machines to be tested at 50 Hz or vice versa, tests under reduced load conditions, heat run carried out by two frequency methods.



14.2 PERFORMANCE TESTS

Type test reports of identical machines are acceptable.

14.3 ROUTINE TESTS

A routine test shall be carried out on every motor.
Unless otherwise specified in the requisition, the routine tests shall at least include the following tests:

- Measurement of winding resistance (cold)
- Measurement of no-load losses and current
- High voltage test plus insulation resistance test
- Inspection (at no load) of bearings and mechanical operation of the motor
- Dimensional check
- f)
- Nameplate check

14.4 TEST REPORTS

The manufacturer shall provide test reports with the results of all tests.

15. INFORMATION TO BE SUPPLIED BY THE VENDOR

Information to be supplied by the vendor for electric motors shall be as follows:

- Rated KW (continuous duty)
- Line voltage
- Frequency
- Number of poles
- Number of phases

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

- Direction of rotation, if unidirectional
- Vendor's standards indication of:
 - a) Make
 - b) Type of mounting and enclosure
 - c) Frame size
 - d) Cooling
- Applicable National Standard
- Maximum rated operating temperature
- Star or Delta Wound
- Rated current at FL
- Starting torque, % FLT
- Starting current, % FLC
- Minimum run up torque, % FLT
- Stalling torque, % FLT
- Starting time, uncoupled at full voltage
- Efficiency and power Factor at:
 - a) Full Load
 - b) 3/4 Loads
 - c) 1/2 Loads
- RPM at full load
- Class of insulation
- Bearings:
 - a) Type
 - b) Make and size
 - c) Method of lubrication
 - d) Grease lubrication interval
- Heaters supply voltage. (if applicable)
- Sound pressure at no load
- Vibration severity at full load
- Speed torque characteristic:
 - a) At 100% Rated Voltage
 - b) At 80% Rated Voltage
- Type of protection class, apparatus group or subgroup and temperature classification
- Copy of certificate issued by the Certifying Authority
- Estimated run up time of the motor at rated voltage:
 - a) When uncoupled
 - b) When coupled to rated load
- Allowable run-up time
- Confirmation that the machine complies in all respects with this standard or details of any deviations
- Ex Certificates for Ex motors
- Outline drawings showing main dimensions, arrangement of components, terminal boxes, and foundation loadings
- Terminal box arrangement and cable gland details
- Torque-Speed and Current-Speed and Current-Time curves
- Approximate weight
- Specific/Recommended commissioning spares
- Specific/Recommended spare parts list, for 2 years normal operation

 CONTRACTOR: Petrochemical Industries Design & Engineering Co. PROJ. NO. : 1203	SABALAN METHANOL PROJECT		 OWNER : SABALAN PETROCHEMICAL INDUSTRIES CO. PROJ. NO. : 89/S-G/102
	MSS FOR LOW VOLTAGE INDUCTION ELECTRIC MOTORS		
	DOC. NO. : 1203-00-EL-MSS-521	Rev.: 01	

16. **SPARE PARTS**

Spare parts shall be interchangeable as far as possible between motors and be suitable for use in place of the original parts fitted and comply with the same specification and tests. They shall be marked and numbered for easy identification, and preserved to prevent deterioration during transport and/or storage in a damp or humid, tropical atmosphere.

Vendor shall guarantee supply of spare parts for minimum 10 years.

17. **SPECIAL TOOLS AND SPANNERS**

Each motor shall be provided with a set of spanners and special tools required for dismantling and maintenance of the motor. Triangular spanners required for explosion proof or increased safety motors are considered as special tools.

18. **DATA SHEETS**

Data sheets shall be completed by vendor and be submitted with quotations and final documentation respectively in due time according to the agreed time schedule.

19. **PREPARATION FOR SHIPMENT**

Preparation for shipment shall be in accordance with manufacturer's standards, unless otherwise noted on the "Material Requisition". The manufacturer shall be solely responsible for the adequacy of the preparation for shipment employed with respect to materials and application, and provide materials to their destination in, ex-works condition when handled by commercial carrier system.