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1. SCOPE

- 1.1. This Specification and Appendix covers Sapo's requirements for electrical motors and generators and must be read in conjunction with the main Specification.
- 1.2. All motors offered shall have performances and dimensions complying with SABS 948, VDE 0530, or BS 4999 and BS 5000 and other relevant standards.
- 1.3. Tenderers shall furnish detailed calculations including load cycle diagrams, max. torque/ RMS comparison, service conditions, derating factors, insulation, duty type and cyclic duration factors, etc. with their tenders, indicating how they arrive at the kW rating of all machines and to support their choice of each motor. All parameters and variables used in the calculations must be clearly defined.
- 1.4. The preferred nominal voltage for AC motors under 132kW shall be 400 V 3-phase, 50 Hz.
 - 1.4.1. Motors 132 kW and above must be supplied from 3.3 kV unless otherwise approved.
- 1.5. For variable frequency variable speed drives the motor shall be correctly rated for all speeds over which it is envisaged to run the motor, and power calculations shall show the torque and kilowatts required for each speed. The highest torque needed will be determined by the power of the motor selected. The torque/speed/power relationship must be observed. The variable frequency supply unit shall have at least twice motor full load current amperage capacity.
- 1.6. The full load efficiency of electrical motors and generators shall not be less than 80%, except for motors under 3 kW in which case not less than 60%.
- 1.7. All motors shall have a minimum degree of protection of IP 54 to IEC 144, except for motors which are installed in a clean and controlled environment for which the minimum protection is IP 23.
 - 1.7.1. Suitable drain holes shall be provided at the lowest points in the machines to allow condensed moisture to escape.
 - 1.7.2. Motor frames and endshields shall be cast iron unless otherwise approved.

- 1.8. All motors shall be equipped with parallel shafts to metric standards with keyways parallel to the axis and screwed ends.
- 1.9. All motors 18,5 kW and above and all motors which can become covered with product dust, shall be fitted with the following over temperature protection equipment:-
 - 1.9.1. Positive temperature coefficient thermister (PT100) type sensors fitted to the stator windings to trip the motor overloads when the temperature reaches the maximum stipulated for class B insulation at 45°C ambient temperature;
 - 1.9.2. Bearings are to be fitted with positive temperature coefficient RTD type sensors, embedded in the bearing housing of each bearing, set to trip according to the manufacturer's specification.
- 1.10. All DC Motors must be fitted with over speed trip devices on the motor shafts.
- 1.11. All motors shall be supplied with anti-condensation heaters (unless otherwise approved), terminated in a terminal box (No loose leads).
 - 1.11.1. Low voltage heating of the stator windings may be used on small motors.
- 1.12. The insulation of all motors shall be to at least class "F". Additional impregnation shall be used for the high relative humidity conditions. Temperature rise of motors on full load shall not exceed the temperature limits as laid down for class "B" insulation.
- 1.13. The material used in construction of sliprings and brush gear shall be corrosion resistant. The insulation shall be at least class "F" and non hygroscopic and specially designed to avoid tracking due to deposition of saline moisture.
 - 1.13.1. Sliprings shall be manufactured from electrical quality brass. Brush gear shall either be brass or stainless steel.
 - 1.13.2. Sliprings shall preferably be fitted with a brush lifting and short-circuiting device.
- 1.14. Provision shall be made for easy access to sliprings, brush gear and bearings.
- 1.15. Where an electrical motor needs to be braked a suitable method shall be used e.g. mechanical, reverse current, D.C. injection, thyristor controlled etc. (Preferably electrical to 10% of rated speed, then mechanical to hold load etc.)
- 1.16. In addition to the normal data, motor name plates shall show the

following information (where applicable):-

- 1.16.1. Bearing particulars;
- 1.16.2. Lubrication data;
- 1.16.3. Thermostat details;
- 1.16.4. Anti-condensation heater details;
- 1.16.5. Grade of brush for slip rings.

1.17. Suppliers must state the specifications to which all motors and generators are manufactured.

1.18. Motor Tests and Certificates:

- 1.18.1. Type test certificates in respect of the current design of each motor or generator shall be submitted in addition to routine test certificates. Motors or generators for which type test certificates are not available are not acceptable.
- 1.18.2. One motor of each size for all motors over 30 kW must be subjected to a type test as well as routine tests at the manufacturer's premises. Tenderers must include for these costs in their offer.

1.19. Motor Starters and Controllers:

- 1.19.1. Motor starters shall comply with BS 587 and/or BS 4941 Part 1 or other relevant standards.
- 1.19.2. All motor starters shall generally be provided with the following:
 - 1.19.2.1. Switch disconnectors;
 - 1.19.2.2. Fuses for short circuit protection;
 - 1.19.2.3. Contactors;
 - 1.19.2.4. Overload, phase imbalance and single phasing protection devices;
 - 1.19.2.5. Earth leakage protection;
 - 1.19.2.6. Control relays;
 - 1.19.2.7. Under voltage protection. (Contractors dropping out to disconnect the motor from the supply when the supply voltage falls below 65% of the nominal value are acceptable);

- 1.19.2.8. Emergency stop buttons;
- 1.19.2.9. Overspeed trip devices where applicable;
- 1.19.2.10. Voltmeter and ammeter connected to the incoming supply side of the main contactor;
- 1.19.2.11. All motors 55 kW and above shall be fitted with capacitors to correct their power factor to at least 0,97 lagging.
- 1.19.3. All starters and controllers must be marked designating the type of starter, rating etc.
- 1.19.4. A diagram of connections of each motor and schematic diagram of the control circuits in booklet form, size A4 shall be housed in the main panel.
- 1.19.5. The operating voltage of the motor starter shall be 231 V AC which shall be supplied by means of a 400/231V transformer (which has an earthed screen between the primary and the secondary windings) for each motor starter panel.
- 1.19.6. All equipment associated with a motor starter shall be housed in the same cubicle/enclosure and control buttons and selector switches shall be fitted on the cubicle door.
- 1.19.7. Where low voltage motor starters are a considerable distance away or not visible from the motor, a remote start/stop station with a lockable switch disconnecter must be provided at the motor for maintenance purposes.
- 1.19.8. The type of starter shall be (based on an expected voltage drop of $\pm 5\%$ of nominal supply voltage during starting).
 - 1.19.8.1. "Direct-on-line" for motors up to 30 kW.
 - 1.19.8.2. AC variable speed drives for motors of 30 to 132 kW.
 - 1.19.8.3. Motors over 132 kW will be supplied from 3.3 kV 3-phase AC and started direct-on-line unless otherwise specified.
- 1.19.9. Tenderers may alternatively tender for electronically controlled starters and solid state motor protection devices. Full details must be submitted.
- 1.19.10. All resistors used with rotor-resistance starters shall be adequately rated for normal operating duty of the machine and shall be of robust construction, suitably protected and

enclosed and not subject to fatigue or disintegration due heating or vibration.

1.19.11. Starters for medium voltage motors must comply with Specification HE8/2/11.

1.20. Over-load Protection:

1.20.1. Motor protection relays shall comply with BS 4941 Part 1, IEC 292-1, 1975, or other relevant standards.

1.20.2. Motor starters up to 30 kW shall have adjustable 3 phase electronic thermal overload relays with stalled overload protection, selectable tripping class, as well as ground fault protection.

1.20.2.1. Motor starters of 30 kW and larger shall be fitted with current-transformer operated solid state motor protection relays.

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END OF SPECIFICATION HE8/2/3 [VERSION 5]

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