INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR TESTING/INSPECTION OF ROTATING ELECTRICAL MACHINES** (*First Revision*)	**IPSS:1-03-025-07**
	Based on IS 325, IS 4029 IS 4722 & IS 9320	Formerly: IPSS:1-03-025-97

0. FOREWORD

0.1 This Interplant Standard has been prepared by the Standards Committee on Rotating Electrical Machinery, IPSS 1:3 with the active participation of representatives of steel plants, reputed consulting organizations and established manufacturers of electric motors and was adopted in July 2007.

0.2 Primarily IPSS Standards are prepared to achieve rationalization and unification of parts and assemblies used in steel plant equipment and accessories with specific constructional requirements. Hence more detailed constructional features are specified in IPSS Standards for motors.

0.3 At present, for testing electrical machines, reference was made to national and other national standards available for testing of rotating electrical machines. These standards deal more in detail about performance tests (Electrical tests).

0.4 In order to ascertain these constructional features which are specific for steel industry application, a need was felt to provide guidelines and check-points for inspecting/testing machines for acceptance.

0.5 While preparing this standard, assistance has been derived from :

IS 325:1996 `Specification for three-phase induction motors (fifth revision)'
IS 4029:1967`Guide for testing three phase induction motors
IS 4722:2001 `Specification for rotating electrical machines (second revision)'
IS 9320:1979 `Guide for testing of direct current (dc) machines

0.6 This IPSS has been published after updating the relevant things.

1. SCOPE

1.1 This standard prescribes guidelines/check-points for testing/inspection of rotating machines covered by the following IPSS Standards :

a) IPSS:1-03-001-05 Specification for General purpose squirrel cage induction motors (fourth revision)

b) IPSS:1-03-002-08 Specification for dc mill/crane duty motors (800 series) (fourth revision)

c) IPSS:1-03-003-08 Specification for ac mill/crane duty slipring induction motors (third revision)

d) IPSS:1-03-004-05 Specification for ac crane (Hoist & Winches) duty squirrel cage induction motors (third revision)

1.2 This standard outlines guidelines / check-points for constructional and electrical requirements, which can be verified without dis-assembling the machines.

1.3 Requirements specified in this standard are examples for guidelines. For actual compliance, reference to relevant standards / AT specifications may be made to.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IPSS:1-03-001, IPSS:1-03-002, IPSS:1-03-003 & IPSS:1-03-004 shall apply.

2.2 **Glossary of Terms** – Glossary of Terms are given in **Annexure-I**.

3. PHYSICAL CHECKS

3.1 Rating Plate (NOTE: **Annexure-II** may be referred)

3.1.1 All the machines shall have rating plate/name plate made out of non-rusting metal and shall carry relevant information pertaining to machine indelibly marked on it and shall be fixed to stator body.

3.1.2 The rating plate shall be fixed on the body of stator and shall carry the following information:

i) Reference to IPSS standard

ii) Type of motor (e.g. slipring, squirrel cage or dc)

iii) Name of manufacturer

iv) Manufacturer's serial number and frame reference

For dc machines, the manufacturer's serial number shall be embossed on the armature shaft (preferably in the keyway) also. For ac machines in frames 315 and above, the manufacturer's serial number shall be embossed on rotor shaft also.

v) Type of duty e.g. S_1, S_2-30 mt, S_4-40%, S_5-40% etc.

vi) Class of insulation e.g. F, H, B etc for stator and rotor.

vii) Frequency – 50 Hz (only for ac machines)

viii) Rated output expressed in kW at 40^oC

ix) Number of phases – 3 (for ac machines only)

x) Rated voltage and winding connection

Rated voltage expressed in Volts

415 V for all ac machines
230 V or 460 V for dc machines

Winding connection star ( ) or delta (Δ) (applicable for ac machines only)

xi) Input current in Amps at rated output

xii) Speed – expressed in revolutions / minute

xiii) Rotor voltage in volts]
] (applicable for ac slipring machines only)
xiv) Rotor current in Amps]

xv) Ambient temperature expressed in ^oC e.g. 40^oC

xvi) Designation of motor as per IPSS, wherever applicable

xvii) No load current at rated voltage expressed in Amps

xviii) Bearing designation (for both drive end and non-drive end)

xix) Lubrication details (type, qty, frequency, etc)

xx) Weight of motor in kg

xxi) Year of manufacture

xxii) Excitation voltage (expressed in volts), type of excitation e.g. Straight, shunt, stabilized shunt, compound, series etc (applicable for dc machines only)

xxiii) No. of starts per hour e.g. 6, 150 or 300

xxiv) Moment of Inertia (GD^2) expressed in $kgfm^2$

xxv) Degree of protection e.g. IP 22, IP 54 etc

xxvi) Method of cooling e.g. IC 0141 or IC 01 etc

xxvii) Enclosure e.g. TEFC, TENV etc

xxviii) Efficiency

xxix) Power factor (for ac machines only)

xxx) Type of mounting

3.1.3 An additional rating plate / name plate may be used to accommodate the information.

3.2 Dimensions

3.2.1 Dimensions of squirrel cage induction motors shall be in accordance with IS 1231:1974 `Dimensions of three phase foot mounted induction motors (third revision}', IS 2223:1983 `Dimensions of flange mounted ac induction motors (first revision) and IS 2254:1985 `Dimensions of vertical shaft motors for pumps (second revision) respectively.

3.2.2 Dimensions of slipring induction motors shall be as specified in Tables-4 and 5 of IPSS:1-03-003.

3.2.3 Dimensions of dc machines shall be as specified in Table-2 of IPSS:1-03-002.

3.2.4 Dimensions of machines shall be in general conforming to IPSS standards, but deviations in respect of dimensions shall be as per the drawings approved by the purchaser / indentor.

3.2.5 Manufacturer's certificate as evidence of compliance of the motor with the dimensional requirement shall be accepted, unless otherwise specifically requisitioned at the time of inviting tender.

3.3 Earthing

3.3.1 All the machines shall have two distinctive earthing terminals of proper size suitable to receive galvanized iron conductor on the bottom half of the motor body. In addition, machines shall have one more earthing terminal inside the terminal box. The earth terminal shall be identified by the symbol ….size of the terminal shall conform to the clause 12.2.2 of IS 3043:1987 `Code of practice for earthing (first revision)'.

3.4 Lifting Hooks

3.4.1 All machines shall have screwed eyebolts or lifting lugs provided on the motor frame. Motor in frame sizes 280 and above shall have two eye bolts / lifting lugs. The threaded hole for the hook shall be blind and shall not be through.

3.5 Terminal Box

3.5.1 Squirrel cage induction motors shall have a terminal box (TB) for terminating the supply lines. The terminal box may be located either on left or right side of the body when viewed from the drive end. Terminal box on the top is also acceptable. Actual location for particular machine shall be as specified in A/T by purchaser / tenderer.

3.5.2 Slipring induction motors shall have terminal box for rotor and stator separately for motors in 315frames and above. Motors of frames less than 315 may have either separate or single terminal box as specified when common terminal box is used for rotor and stator terminals, rotor and stator terminals shall be clearly identified and phase segregated with an insulating partition between rotor and stator terminals.

NOTE: Top terminal box for stator and side entry for rotor leads may also be provided for slipring motors when specifically requested by the purchaser / indentor.

3.5.3 dc machines shall have their terminal leads of approximate length 300 mm brought out to left when viewed from commutator end. All leads shall be fitted with suitable lugs. Leads shall be of copper.

3.5.4 Separate terminal boxes shall be used for thermistors, when provided with the machine. Thermistors are use to protect the machine against over temperature, which may result due to loss of phase and supply under or over voltage, stalled rotor, severe starting duty, faulty cooling system, increased ambient temperature etc. Normally 6 thermistors, 2 number per phase, are embedded in the core portion. A set of 3 thermistors, one from each phase is connected in series and two such sets are formed. One set is used for alarm and the other for tripping the machine. (Thermistors are temperature sensitive resistance devices).

3.5.5 **RTD (Resistance Temperature Detector), BTD (Bearing Temperature Detector)** – These are temperature sensitive resistance device. These are used to provide over temperature protection to machines. 6 Nos. RTDs, 2 Nos. per phase are used for winding temperature measurement. The are embedded in the stator winding, one in the top layer, other in the bottom layer. One BTD each for drive end and non-drive end bearings are used for bearing temperature

measurement. Terminals of both RTDs and BTDs are to be terminated to separate individual terminal boxes.

3.5.6 All terminal boxes shall have suitable cable glands adequate to receive aluminium cables. Degree of protection provided for the TB shall be same as that of the machine.

3.6 Inspection Cover

3.6.1 Inspection cover fitted on the motors shall be of hinged type with gasket to ensure proper sealing to prevent dust and water entry.

3.7 Slipring Assembly

3.7.1 Slipring unit of slipring induction motors in frames 225 and above shall be of fabricated design (built up construction). Slipring units of motors in frames smaller than 225 may have moulded slipring design.

3.8 Brush Gear

3.8.1 Brush holder arms of slipring induction motors shall have square cross section. Alternatively, two stud design may also be employed.

3.8.2 Rocker rings (where brush holder arms are fixed) of dc machines shall not rotate freely and shall have locking arrangement.

3.8.3 It shall be possible to access brush holders freely through the inspection window.

3.9 End Shields and Cooling Fans

3.9.1 End shields of induction motors in frames 280 and above shall have two diametrically opposite tapped (threaded) holes for jacking arrangement.

3.9.2 Cooling fans shall be made of either fibre cast iron or cast aluminium with a fibre steel or cast iron hub. A position locking arrangement shall exist to prevent fan movement on shaft in radial as well as axial directions. Hub shall have two diametrically tapped (threaded) holes for easy removal of fan.

3.10 Greasing Facility

3.10.1 Motors of 280 frame and above shall have grease nipples of adequate size. Also suitable collectors or drain plugs shall be provided for excess grease removal.

3.11 Commutator

3.11.1 dc machines shall have fabricated commutator with rigid or flexible risers. Commutators shall have means for fixing balancing weights (e.g. a tapered groove may be provided on the collar of front mica cone). Commutators assembled in moulded / cast design are not acceptable.

3.12 Winding Connections & Connection Diagram

3.12.1 Interpole coil and compensating winding connections of dc machines shall be by means of nut bold arrangement with at least two connecting screws / bolts to prevent rotation.

3.12.2 Connection diagram of machines shall be clearly marked on inside of the terminal box cover. Terminal marking shall be as per IS 4728:1975 `Terminal marking and direction of rotation for rotating electrical machines (first revision)'.

3.12.3 Neutral position of the brushgear assembly of the dc motor shall be clearly marked on the body.

3.13 General

3.13.1 All the threaded fasteners used, shall be of ISO metric series with hexagonal head of standard size. Screws and bolts of allenkey type are not acceptable.

3.13.2 Tapped holes (threaded) shall be provided on the foundation legs for finer alignment, in case of machines of larger frame i.e. 400 and above.

4. ELECTRICAL TESTS

4.1 The tests specified in this clause shall normally be carried out at the manufacturers' works.

4.2 Test Certificates

4.2.1 Unless otherwise specified when inviting tenders by the purchaser, manufacturer's certificates as evidence of the compliance of the motors with requirements of relevant IPSS standards shall be acceptable when furnished along with a type test certificate on a motor identical in essential details with one purchased, together with a routine test certificate on each individual motor.

4.2.2 In case when a batch of 20 or more similar motors are supplied in one order, type tests as specified shall be made on one of these motors, in addition to the other certificates if desired at the time of inviting tender.

4.2.3 Certificates of routine tests shall show that motor purchased has been run and has been found to be electrically and mechanically sound and in working order in all particulars.

4.2.4 Certificates of all type tests together with a record of any alterations, whether essential or not, which have been made to the motor since the type tests were carried out, shall be kept available by the manufacturer for inspection.

4.2.5 Torque speed / current time curve shall be supplied along with each motor.

4.3 Classification of Tests

4.3.1 **Type Test** – The following are the type tests:

i) Measurement of winding resistance

ii) No load running of motor (for induction motors)

iii) Open circuit voltage ratio on slipring induction motors

iv) Reduced voltage run up test for squirrel cage induction motors

v) Locked rotor test (for induction motors)

vi) Load test (for induction motors / dc motors)

vii) Regulation test (dc machines)

viii) Temperature rise test

ix) Insulation resistance test (both before and after high voltage test)

x) High voltage test

xi) Over speed test

xii) Efficiency test

xiii) Commutation test (for dc machines)

NOTE: When type tests are to be carried out, all or some of the tests mentioned above may be performed as agreed between purchaser and manufacturer.

4.3.2 Routine Tests – The following are routine tests:

i) Measurement of winding resistance (for dc machines)

ii) Insulation resistance test

iii) High voltage test

iv) No load run up test (for induction motors)

v) Locked rotor test (for induction motors)

vi) Reduced voltage run up test (for squirrel cage motors)

vii) Open circuit voltage ratio for slipring induction motors

viii) Commutation test (for dc machines)

5. TESTING METHODS

5.1 The test methods for electrical tests of motors mentioned in clause 16 are briefly described in the following clauses. Actual test procedure may be followed as given in relevant Indian Standards (refer **Annexure-III**).

5.2 The indication instruments used in electrical measurements shall conform to IS 1248:2003 `Direct acting indicating analogue electrical measuring instruments and their accessories'. Instruments with the following accuracies shall be used:

a) for routine tests, instruments of clause 2.5

b) for type tests, instruments of class 0.5

c) The calibration certificate used for the electrical measuring instruments shall be made available if asked for.

6. WINDING RESISTANCE

6.1 The following two methods may be used for measurement of resistance:

a) The drop of potential or voltmeter-ammeter method. In this method, a dc ammeter and voltmeter shall be used with current in the windings limited to 50% of rated current.

b) Bridge Method – In this method, the unknown resistance is compared with a known resistance by using a suitable bridge. For winding resistance above 1 ohm, Wheatstone bridge shall be used, for winding resistance less than 1 ohm, Kelvin double bridge (Kelvin-Thompson bridge) shall be used.

6.2 In both the methods, care shall be taken to account for lead resistance.

6.3 The rotor winding resistance shall be measured at the point of connection of rotor windings to sliprings so that slipring resistance is eliminated.

6.4 The variation of resistance between phases may be accepted to an extent of 5%.

7. NO LOAD TEST

7.1 This test is intended to find out the no load current, core loss and friction and windage losses. In this test, motor is run at no load at rated frequency and voltage until watts input is constant. The test shall preferably be carried immediately after temperature rise test.

8. OPEN CIRCUIT TEST

8.1 On wound-rotor motors (slipring induction motors), the voltage between all rotor terminals shall be measured with the rotor locked, if necessary and its winding on open circuit. If any rotor unbalance is observed, readings may be taken at several positions of rotor.

9. REDUCED VOLTAGE RUN UP TEST FOR SQUIRREL CAGE MOTORS

9.1 The test is intended to check the ability of the motor to run up to full speed on no load. For motors up to 37 kW, $1/\sqrt{3}$ times rated line voltage shall be applied in each direction of rotation. For motors of capacity above 37 kW, the value of reduced voltage shall be $1/\sqrt{3}$ of rated line voltage or less but only in the specified direction of rotation.

10. LOCKED ROTOR TEST

10.1 This test is carried out to determine the soundness of rotors, in the case of squirrel cage motors (of ratings up to 37 kW) and their starting current, power factor, starting torque and impedance. This test may be carried out at reduced voltage. One method being to apply a voltage which will produce rated current by measuring the current at the stator terminals. Only locked rotor current is measured for slipring motors (up to ratings of 37 kW).

10.2 As the winding gets heated very rapidly, the test voltage shall be applied as quickly as possible, ensuring that the winding temperature does not exceed the value permissible for the class of insulation used. The readings shall be taken within 6 seconds for motors of output 7.5 kW and below and 10 seconds for motors of output above 7.5 kW.

10.3 Either Dynamometer, or Rope and pulley or brake or beam clamped rigidly to motor shaft may be employed for measurement of torque. The torque shall be measured with the rotor in various positions and minimum value shall be taken as starting torque.

10.4 When the test is carried out at reduced voltage, the starting torque and current shall be extrapolated. For extrapolation, readings shall be taken at least at three different test voltages.

11. LOAD TEST

11.1 This test is carried out on motors to determine performance such as efficiency, power factor, speed and temperature rises. Any of the following loading methods may be used:

a) Brake method
b) Dynamometer method
c) Calibrated machine (a calibrated generator)
d) Uncalibrated machine

12. TEMPERATURE RISE

12.1 This test is primarily intended to determine the temperature rise on different parts of the motor while running at load.

12.2 Temperature rise test for machines with maximum continuous rating (duty type S_1) shall be continued until thermal equilibrium is reached. Equilibrium is deemed to be reached when the temperature difference between two successive readings is 1^oC or less.

12.3 Temperature rise test shall be continued upto the actual rating specified for short time rated motors (duty type S_2).

12.4 For intermittent loads (duty type S_3 to S_8), the load cycle specified shall be applied until practically identical temperature cycles are obtained. The criterion for this is that a straight line between the corresponding points of duty cycles has a gradient of less than 2^oC per hour. Where testing at exact duty cycle is not feasible, test may be carried out at equivalent continuous rating.

12.5 Winding temperature rise shall be measured by resistance method.

Temperature rise of other parts which are not in contact with winding permanently, short-circuited uninsulated windings, shall in no case reach such as a value that risk of injury to any insulation or other material adjacent to parts or to the item itself. For more details Table-1, 2 & 3 of IS 12802:1989 `Temperature rise measurement of rotating electrical machines' may be referred to.

12.6 The limits of temperature rise in case of machines assigned with short time rating, shall not exceed by 10^oC over the temperature rise limits specified in Tables of IS 12802:1989.

12.7 Method of bearing temperature measurement.

12.7.1 For measuring bearing temperatures, the thermometer method or embedded temperature detector is used. The measuring point of the determination of the temperature of bearings shall be located as nearly as possible to the locations specified in clause 5.8 of IS 12802:1989. The temperature of the bearings shall not exceed 80^{o}C.

13. INSULATION RESISTANCE

13.1 The insulation resistance shall be measured between windings and frame. A dc voltage of 500 V shall be applied for sufficient time for the reading of the indicator to become practically steady. An instrument like hand-operated insulation resistance tester having a dc voltage of 500 V may be used.

13.2 Polarization Index is defined as the ratio of the values of 60 seconds to 15 seconds insulation resistance. The recommended minimum polarization index for all class of insulation is 1.3.

14. HIGH VOLTAGE TEST

14.1 The high voltage test shall be applied between the windings and the frame with the core connected to the frame and to the windings not under test and shall be applied only to a new and completed motor with all its parts in place under conditions equivalent to normal working conditions. The test shall be carried out at the maker's works at the conclusion of temperature rise test, where such test is carried out.

14.2 The test voltage shall be of power frequency and shall be as near as possible to sine wave form. The test voltage shall be commenced at half of the full test voltage and increased steadily at the increment of 5% of full test value in 10 seconds. The full test voltage shall be maintained for one minute.

14.3 During routine testing of machines of less than 5 kW, the one minute test may be replaced by a test voltage equal to recommended test voltage for 5 seconds or 120% of recommended test voltage for 1 second, the test voltage being supplied by means of prods.

14.4 The test made on windings on acceptance shall not be repeated as far as possible. When such test is conducted, it shall be after further drying if considered necessary and the voltage being applied equal to 80% of the recommended value.

14.5 The recommended test voltages are:

Induction Motors	1000 V + twice the rated voltage with a minimum

(stator windings)	of 1500 V
Rotor Windings (non-reversible motors)	1000 + 2 x open circuit stand still voltage as measured between slipring with full voltage applied to stator.

15. OVER SPEED TEST

15.1 An over speed test is not normally considered necessary but can be performed when this is specified and has been agreed between the manufacturer and the purchaser.

15.2 An over speed test shall be considered as satisfactory if no permanent abnormal deformation is apparent subsequently and no other weakness detected which would prevent the machine from operating normally, and provided rotor windings after the test comply with the required dielectric test (H V test). The duration of any over speed test shall be 2 minutes.

15.3 Due to settling of laminated rotor rims, laminated poles held by wedges or by bolts etc, a minute permanent increase in the diameter is natural and not to be considered as an abnormal deformation indicating that the machine is not suitable for normal operation.

15.4 Recommended over speeds for different machines shall be:

i)	Squirrel cage general purpose induction motors	-	1.2 times the max rated speed
ii)	Crane duty induction motors	-	2.5 times the max rated speed
iii)	dc crane duty motors	-	Shall be in accordance with Table-1 of IPSS:1-03-002

16. REGULATION TEST

16.1 Regulation characteristics of a dc motor represents the dependence of speed of motor on the load current at constant excitation and shall be determined at temperature approximately equal to working temperature. The regulation shall be:

Base Speed %	Regulation (%, max)
100	15
200	20
300	25

17. COMMUTATION TEST

17.1 The machine shall work with fixed brush setting from no load to full load to momentary overload (if specified) without injurious sparking or injury to the commutator or brushes. The commutation test shall be carried out immediately after temperature rise test, if any such test is conducted.

18. VIBRATION TEST

18.1 Vibration test shall be carried out in accordance with IS 12075:1987 `Mechanical vibration of rotating electrical machines with shaft heights 56 mm and higher measurement evaluation and limits of vibration severity (superseding IS 4729:1968)' and shall be within the norms specified therein.

19. NOISE TEST

19.1 Noise test shall be carried out in accordance with IS 12065:1987 `Permissible limits of noise level for rotating electrical machines' and shall be within the norms specified therein.

ANNEXURE-I

(Clause 2.2)

GLOSSARY OF TERMS (Reference IS 4722:2001)

1. **Rating** – The whole of the numerical values of the electrical and mechanical quantities with their durations and sequence assigned to the machine and stated on the rating plate, the machine complying with the specified conditions.

2. **Rated Value** – The numerical value of a quantity included in the rating.

3. **Rated Output** – The numerical value of the output included in the rating.

4. **Load** – All the numerical values of the electrical and mechanical quantities that signify the demand to be made on a rotating machine by an electrical circuit or a mechanism at the given instant.

5. **No-Load** – The state of a machine rotating with zero output power (but under otherwise normal operating conditions).

6. **Full Load** – The highest value of load specified for a machine operating at rated output.

7. **Full Load Power** – The highest value of power specified for machine operating at rated output.

   Note: This concept also applies to torque, current, speed, etc.

8. **Rest and De-energized** – The complete absence of all movement and of all electrical supply or mechanical drive.

9. **Duty** – The statement of the loads to which the machine is subjected, including, if applicable, starting, electric braking, no load and rest and de-energized periods and including their duration and sequence in time.

10. **Duty Type** – A continuous short time or periodic duty, comprising one or more loads remaining constant for the duration specified, or a non-periodic duty in which generally load and speed vary within the permissible operating range.

11. **Thermal Equilibrium** – The state reached when temperature rise of the several parts of the machines do not vary by more than 2K over a period of I hour.

    Note: $0^{o}C = 273^{o}K$ (Kelvin)

12. **Cyclic Duration Factor** – The ratio between the period of loading including starting and electric braking and the duration of duty cycle, expressed as a percentage.

13. **Locked Rotor Torque** – The minimum measured torque which the motor develops with the rotor locked and rated voltage applied at rated frequency.

14. **Locked Rotor Current** – The measured steady state root mean square current taken from the line with rotor locked with rated voltage and frequency applied.

15. **Pull Up Torque (for ac Motors)** – The smallest torque which the motor develops between zero speed and the speed corresponding to break down torque when the motor is supplied at the rated voltage and frequency.

16. **Breakdown Torque** – The maximum torque which the motor develops with rated voltage and frequency applied at operating temperature without an abrupt drop in speed.

17. **Moment of Inertia** – The (dynamic) moment of inertia of a body about an axis is the sum (integral) of the products of its mass element and the square of their distances (radii) from the axis.

18. **Maximum Continuous Rating** – The statement of the load and conditions assigned to the machine at which the machine may be operated for an unlimited period.

19. **Short Time Rating** – The statement of the load time and conditions assigned to the machine at which the machine may be operated for a limited period, starting at the ambient temperature.

20. **Equivalent Continuous Rating** – The statement of the load and conditions assigned to the machine for test purpose, at which the machine may be operated until thermal equilibrium is reached and which is considered to be equivalent to periodic duty assigned for the machine.

21. **Periodic Duty Type Rating** – The statement of the loads and conditions, assigned to the machine at which the machine may be operated on duty cycles. The time for a duty cycle shall be 10 minutes and the cyclic duration factor shall be one of the following:

    15, 25, 40 and 60%

22. **Non Periodic Duty Type Rating** – The statement of the varying loads over varying speed and conditions, including over loads assigned to the machine at which the machine may be operated non-periodically.

23. **Type Tests** – Tests carried out to prove conformity with the requirements of the standards. These are intended to prove the general qualities and design of a given type of machine.

24. **Routine Tests** – Tests carried out on each machine to check the essential requirements which are likely to vary during production.

ANNEXURE-II
(Clause 3.1)

PREFERREDUTY RATINGS & RELEVANT I.S. REFERENCE

Sl. No.	IPSS No.	IS No.	Preferred Duty	Class of Insulation	Temp. Limit
1.	1-03-001-05 Specification for General purpose squirrel cage induction motors (fourth revision)	325:1996	S_1 – 100%	F (both stator & rotor)	Limited to B
2.	1-03-002-08 Specification for dc mill / crane duty motors (800 series) (fourth revision)	4722:1992	S_1 – 100% S_2 – 60 minutes S_2 – 30 minutes S_3 –30%	H (Armature & Field)	Limited to F
3.	1-03-003-08 Specification for ac mill / crane duty slipring induction motors (third revision)	325:1996	S_3 – 25% S_3 – 40% S_3 – 60% S_3 –100% S_4 – 25% S_4 – 40% S_4 – 60% S_5 – 25% S_5 – 40% S_5 – 60%	F (both stator & rotor)	Limited to B
4.	1-03-004-05 Specification for ac crane (Hoist & Winches) duty squirrel cage induction motors (third revision)	325:1996	S_4 – 25% S_4 – 40% S_4 – 60% S_5 – 25% S_5 – 40% S_5 – 60%	F (both stator & rotor)	Limited to B

ANNEXURE-III
(Clause5.1)

TEST METHOD & I.S. REFERENCE

Sl. No.	Test	IS No.
1.	Measurement of winding resistance	4029:1967
2.	No load running up of motor	4029:1967
3.	Open circuit voltage ratio of slipring motors	4029:1967
4.	Reduced voltage run up test	325:1996
5.	Locked rotor test	4029:1967
6.	Load test	4029:1967
7.	Temperature rise test	12802:1989
8.	Insulation resistance test	4722:1992
9.	High voltage test	
	ac Machines	4029:1967
	dc Machines	4722:1992
10.	Over speed test	
	ac Machines]] dc Machines]	4722:1992
11.	Efficiency test	4889:1968
12.	Commutation test	4722:1992
13.	Regulation test	9320:1979
14.	Vibrant test	12075:1987
15.	Noise test	12065:1987

TITLES OF ISs REFERRED ABOVE	IS NO.
1. Guide for testing three phase induction motors	4029:1967
2. Temperature rise measurement of rotating electrical machines	12802:1989
3. Specification for three phase induction motors (fifth revision)	325:1996
4. Specification for rotating electrical machines (first revision)	4722:1992
5. Guide for testing direct current (dc) machines	9320:1979
6. Mechanical vibration of rotating electrical machines with shaft heights 56 mm and higher-measurement, evaluation and limits of vibration severity (superseding IS 4729:1968)	12075:1987
7. Permissible limits of noise level for rotating electrical machines	12065:1987
8. Method of determination of efficiency of rotating Machines	4889:1968

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