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BUREAU OF INDIAN STANDARDS
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Draft Indian Standard

Guide for Testing Single-Phase AC and Universal Motors

(*First Revision of IS 7572*)

Rotating Machinery Sectional Committee, ETD 15

Last date for comments – **11/01/2025**

FOREWORD

(Formal clauses of the draft will be added later)

This standard was first published in 1974. This first revision has been brought out it in line with international practices to the extent possible.

The performance requirements of single-phase ac motors are covered by IS 996. This standard has been prepared to provide guidance on the test methods for conducting the tests for single-phase ac motors.

This guide covers methods for conducting the generally applicable tests to determine the performance characteristics of single-phase motors. It is not intended that the standard shall cover all possible tests used in production or tests of research nature. The guide shall not be deemed as making it obligatory to carry out any or all the tests specified in this standard.

In preparing this guide, assistance has been derived from the following publications:

IS 4029: 2010 Guide for testing three-phase induction motors.

AIEE Publication IEEE No, l14-2010 Test procedure for single-phase induction motors. The Institute of Electrical and Electronics Engineers, New York, USA.

IEC 60034-1-2021 Rotating electrical machines Part 1 Rating and performance

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2: 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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GUIDE FOR TESTING SINGLE-PHASE AC AND UNIVERSAL MOTORS

(First Revision)

1 SCOPE

This guide covers methods for conducting the tests for single-phase ac motors covered by IS 996.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 15999 (Part 1)/IEC 60034-1, IS 996, IS 1885 (Part 35) and IS 2993 (Part 1) shall apply.

4 MEASUREMENTS OF PARAMETERS

4.1 Instrument Selection

Calibrated, high-accuracy instrumentation and auxiliary equipment shall be used. Either analog or digital type instruments may be used in testing. Instruments with the following accuracy shall be used:

a) Error no greater than ± 0.2 percent of range/full scale for determination of efficiency. The instrument error for other motor performance testing shall not be greater than ± 0.5 percent of range/full scale.

b) The working range of instruments used shall be so selected as to give indication well up the scale; that is, where a fraction of division is easily estimated and where such a fraction is a small percentage of the value read. The range of the instrument chosen shall be as low as practical.

4.2 Instrument Transformer

When current and potential transformers are used, corrections shall be made for ratio errors in current and voltage measurements and for ratio and phase angle errors in power measurements. The use of instrument transformers shall be avoided if possible.

The accuracy class of the instrument transformers shall 0.2 class or better.

4.3 Voltage

The voltage shall be read at the motor terminals. The supply voltage shall closely approach sine-wave form.

4.4 Power

A suitable power analyser /wattmeter shall be used with basic accuracy of 0.2 percent.

4.5 Torque

Torque measuring instrument shall be accurate and error shall be within 0.25 percent of range.

4.6 Speed/Slip

Speed shall be measured by Tachometer (contact or photo type) or any suitable means having accuracy 0.1 percent of full scale.

5 QUANTITIES TO BE MEASURED

Table 1 gives information about the quantities that are to be measured by means of suitable tests for single-phase ac motors for the different types of motors.

Table 1 Quantities to be Measured for Single-Phase ac Motors

(Clause 5*)*

SL No.	TYPE OF MOTOR	LOCKED ROTOR CURRENT	LOCKED ROTOR TORQUE	PULL UP TORQUE	SWITCHING TORQUE	PULL OUT TORQUE	SPEED	POWER TORQUE	EFFICIENCY	TEMPERATURE RISE	CAPACITOR VOLTAGE AT NO LOAD
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
i)	Capacitor (permanent split)	X	X	X		X	X	X	X	X	X
ii)	Capacitor (two-value)	X	X	X	X	X	X	X	X	X	X
iii)	Split-phase (capacitor start)	X	X	X	X	X	X	X	X	X	X
iv)	Split-phase (resistance start)	X	X	X	X	X	X	X	X	X	
v)	Shaded pole	X	X	X		X	X	X	X	X	

6 INSULATION RESISTANCE TEST

6.1 Insulation resistance shall be measured between individual windings and frame (earth).

6.1.1 The insulation resistance, when the high voltage test is applied, shall be not less than the limit specified in IS 996. The insulation resistance shall be measured with a DC voltage of about 500 volts applied for a sufficient time for the reading of the indicator to become practically steady, such voltage being taken from an independent source or generated in the measuring instrument.

NOTE — When it is required to dry out windings at site to obtain the minimum value of insulation resistance, it is recommended that procedure for drying out as specified in IS 900 should be followed.

7 HIGH VOLTAGE TEST

7.1 A test voltage in accordance with Table 2 shall be applied between the windings and the frame of the motor, with the core connected to the frame and the windings not under test. The test voltage shall be applied once and only once to a new and completed motor in normal working condition, with all its parts in place, and the test shall he carried out together with the insulation resistance test at manufacturer's works.

7.2 Method of High Voltage Test

7.2.1 The test shall be made with alternating voltage of any convenient frequency, preferably between 40 and 60 Hz. The test voltage shall be of approximately sine-wave form and, during the application of voltage, the peak value, as would be determined by spark gap, by oscillography or by any other approved method, shall be not more than 1.45 times the rms value. The rms value of the applied voltage shall be measured by means of a volt- meter used with a suitable calibrated potential transformer or by means of voltmeter used in connection with a special calibrated voltmeter winding or testing transformers, or by any other suitable voltmeter connected to the output side of the testing transformer.

Table 2 High Voltage Test

(*Clauses* 7.1, 7.2.3)

SL No	RATED VOLTAGE OF MOTORS	TEST VOLTAGE (rms)
(1)	(2)	(3)
i)	50 volts for less	500
ii)	Above 50 volts up to and including 250 volts	1500

7.2.1.1 It is generally advisable that the high voltage test should not be applied if insulation resistance is less than that specified in the relevant equipment specification.

7.2.2 *Duration of High Voltage Test (Type Test)*

The test shall be commenced at a voltage of about one-third of the test voltage which shall be increased to the full test voltage in accordance with **7.1** as rapidly as is consistent with its value being indicated by the measuring instrument . The full test voltage shall be maintained for one minute. At the end of this period, the test voltage shall be rapidly diminished to one-third of its full value before switching off.

7.2.3 *Duration of the High Voltage Test (Flash Test) (Routine Test)*

As routine test, a test voltage equal to the one specified in Table 2 shall be applied between the windings and the frame of the motor, with the core connected to the frame and the windings not under test for 5 s.

7.2.4 *Supplementary High Voltage Test*

If, for any reason, it is desired to conduct additional high voltage tests on a motor which has already passed test in accordance with **7.1** and is installed on site, such additional high voltage tests shall be carried out in accordance with the requirements of **7.1** except that the test voltage shall be 80 percent of the value specified therein. Before applying the supplementary high voltage test, the windings shall be cleaned and the machine thoroughly dried out.

8 RESISTANCE MEASUREMENTS

8.1 General

The following methods to be used for the measurements of resistance.

a) The drop of potential or voltmeter-ammeter method, and
b) The bridge method in which the unknown resistance is compared with the known resistance by using a suitable bridge.

Note — Many test measurement instruments are available based on these methods.

8.1.1 Every possible precaution shall be taken to obtain the true temperature of the winding when measuring the cold resistance. The temperature of the surrounding air shall not be regarded as the temperature of the windings unless the motor has been standing idle under similar atmospheric temperature conditions for a considerable time.

8.1.2 If the resistance of copper is known at one temperature it may he calculated for any other temperature by using the following formula:

$$R_2 = \frac{(235 + t_2) \text{ x } R_1}{(235 + t_1)}$$

where

R_2 = unknown resistance at temperature t_2 °C.

R_1 = resistance measured at temperature t_1 °C.

NOTE — If R_1, R_2, and t_1 are known, t_2 may also be calculated from the above formula. Constant 235 is not recognized for all materials; for instant, for aluminum the constant is 225.

8.2 Drop of Potential or Voltmeter-Ammeter Method

In this method, a de ammeter and a voltmeter shall be used. Simultaneous readings of both voltage and current at motor terminals shall be taken when their values have become steady. The relationship between *R*, *V* and *I* is as follows:

$$R = \frac{V}{I}$$

where

R = resistance in ohms.
V = dc voltage in volts.
I = dc current in amperes.

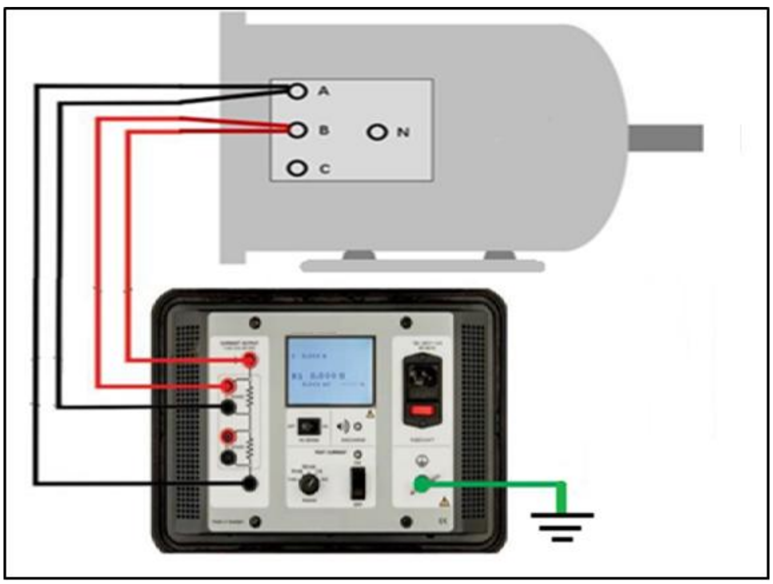


FIGURE 1 DROP OF POTENTIAL OR VOLTMETER-AMMETER METHOD

8.2.1 Suitable ranges of instruments shall be chosen so that errors of observations are reduced, to the minimum. For the measurement of potential drop of less than 0.5 volts, the use of a millivoltmeter is recommended.

8.2.2 The passage of high current may heat the windings appreciably and thus cause erroneous measurement. It is therefore, recommended that the current be limited to 50 percent of the rated current of the winding.

8.2.3 Care should be taken to compensate for the errors introduced in the measurements by the resistance of leads and contacts. Hence separate voltage measurement terminal to be used.

8.3 Bridge Method

The resistance above l ohm may be determined with sufficient accuracy if a wheatstone bridge is used. Resistance less than 1 ohm shall be measured by Kelvin double bridge, also known as Kelvin- Thompson double bridge.

8.3.1 *Wheatstone Bridge Method*

In using wheatstone bridge, the resistance of the ratio arms shall be so selected that the values used correspond as closely as possible to the resistance to be measured; the me of one ohm ratio coil should be avoided. The values of the resistance thus measured include the resistance of the connecting leads. Therefore, the resistance of the connecting leads shall be subtracted from the total measured resistance; otherwise, it shall be suitably compensated for.

8.3.2 *Kelvin- Thompson Double Bridge Method*

The double bridge compensates for resistance of the leads or other connections. It also enables low resistance to be compared accurately with a standard one of the same order.

9 PERFORMANCE CHARACTERISTICS

9.1 No-Load Test

9.1.1 This test is intended to find out the no-load current, core loss and friction and windage losses.

9.1.1.1 The motor is run at no-load with the running winding(s) excited at normal frequency and voltage until the power input is constant to assure that the temperature of the oil or grease and the bearings has become constant. Reading's arc taken of volts, amperes and watts input at rated frequency but with voltages ranging from 125 percent of rated voltage down to a point where further voltage reduction increases the current. The voltage adjustment is accomplished preferably by a variable-voltage transformer. Immediately following this test and before the temperatures may change sensibly, a reading or input power P_1 and input current I_A at 50 or 60 percent of rated voltage should be taken with the rotor locked and with only the main or running winding excited. This test should be followed immediately by a measurement of the resistance of the running winding R_l. If the input current at any voltage is Is, the total copper loss P_c in the machine at the same voltage is:

$$P_c = \frac{I_s^2}{2}\left(R_1 + \frac{P_1}{I_A^2}\right)$$

The copper loss so calculated should be subtracted from the total input power at the same voltage. The resultant values may then be plotted against applied voltage with an extrapolation to zero voltage where the intercept represents the friction and windage losses. Extrapolation of the curve is facilitated by plotting the input power minus the copper loss against voltage squared rather than against voltage.

For most practical purposes the friction can be measured with sufficient accuracy by reading simply the minimum power input as the voltage is reduced and then subtracting the copper loss as calculated by the formula.

9.1.1.2 The friction and windage losses as obtained in **9.1.1.1** shall be deducted from no-load power loss after deducting the copper loss P_c as calculated in **9.1.1.1** for any particular voltage to obtain core loss at the voltage.

NOTE — In the case of shaded pole, these include the losses in the shading coils.

9.2 Locked Rotor Test

9.2.1 It should be recognized that the testing of induction motors under locked rotor conditions involves unusual mechanical stresses and high rates of heating. Therefore, it is necessary that:

a) the mechanical means of locking the rotor be of adequate strength to prevent possible injury to personnel or damage to equipment,
b) the direction of rotation be determined prior to this test, and
c) the current and torque readings be taken a t approximately rated voltage and at rated frequency and that the motor be at approximately ambient temperature. The voltage shall be within 5 percent of rated voltage. The ammeter reading shall be corrected by multiplying it by the rated voltage and dividing the product by the voltage read when the ammeter was read. The ammeter shall be read after its pointer has stopped its periodic swinging but all readings shall be taken within 3 seconds after the line switch is closed. The temperature at the less than of every test shall he not less than 20 °C not more than 40 °C.

9.2.2 *Torque*

The rotating torque may be measured by dynamometer or in-line torque sensor and locked rotor torque may be measured by lever and force measuring device like load cells and weighing scales. All motors are subject to variations in locked rotor torque and these variations depend upon the angular position of the rotor with respect to the stator. The locked rotor torque is defined as the minimum torque developed at rest in the direction(s) of rotation specified and in any angular position(s) of the rotor with the entire motor at a temperature not less than 20 °C nor greater than 40 °C.

9.2.3 *Power*

Power may be measured with precise power meter/ analyser. The readings of power shall be taken simultaneously with those of current, torque and speed etc.

9.3 Tests for Speed-Torque and Speed-Current Curves

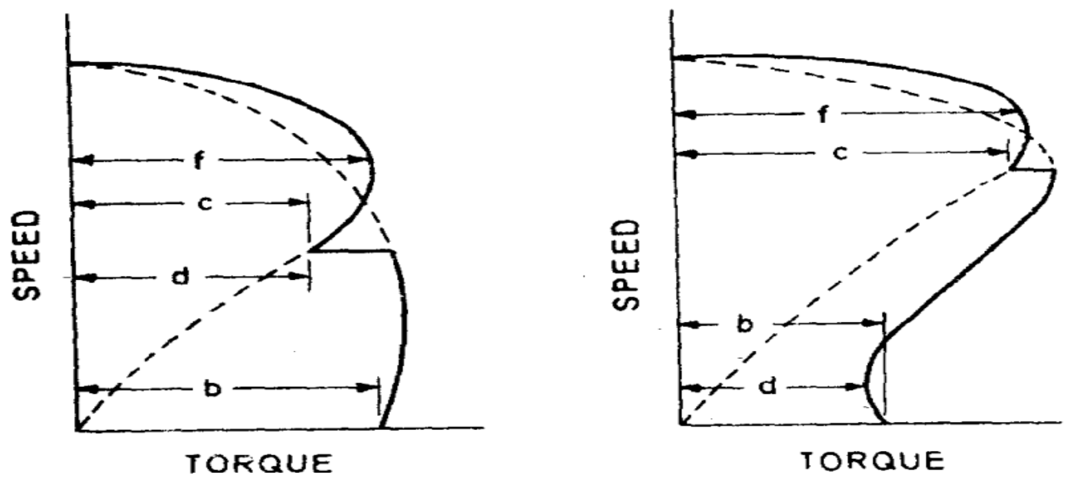
9.3.1 *General*

The speed-torque characteristic is the relation between torque and speed; embracing the range from zero to synchronous speed. This relation, when expressed as a curve, includes pull out (maximum running) torque, pull-up (minimum running) torque, and locked rotor torque of induction motors (*see* **Fig. 1**). The speed-current characteristic is the relation between current and speed. (This curve is generally plotted on the same sheet as the speed-torque curve, using a common speed scale for both curves.) The test should be carried out when temperature conditions are stabilized.

9.3.1.1 The speed-torque and speed-current tests may be made with a dynamometer or in line torque sensor mounted between motor and dynamometer. Measurements of current, voltage and speed shall be made. Data for these characteristics shall be taken at near rated voltage.

9.3.2 *Switching Torque*

The switching torque of a motor which has an automatic connection change at some instant in its starting interval is the minimum external torque developed by the motor as it accelerates through switch operating speed. It should be noted that if the torque on the starting connection is never less than the switching torque, the pull-up torque is identical with the switching torque.



b = Locked Rotor Torque

c = Switching Torque

d =Pull-up Torque

f = Breakdown Torque

FIGURE 2 TORQUE OF A SINGLE-PHASE INDUCTION MOTOR

However, if the torque on the starting connection falls below the switching torque at some speed below switch operating speed, the pull-up and switching torques are not identical. The difference between pull -up and switching torque is illustrated in **Fig. 1**.

9.3.2.1 The switching torque may be determined by the following procedure:

a) The motor is allowed to run at no load and the torque load is gradually increased until the speed falls off abruptly and the starting switch recloses. With this torque setting the motor may either fall off in speed or 'pump', that is, the speed may cycle between' the upper and lower speeds. In either case, the torque load should be reduced until the motor transfers and remains on the running connection.
b) An alternative method is to start the motor from rest with a heavy load and then gradually decrease the torque until the motor transfers and remains on the running connections.

9.3.3 *Pull- Out Torque*

This test may be made by allowing the motor to run light and then increasing the torque until the speed of the motor falls off abruptly. This test should be made as rapidly as is possible, consistent with accuracy, hut not so rapidly as to introduce inertia errors into the readings.

9.3.4 *Pull- Up Torque*

The pull-up torque of an alternating current motor is the minimum external torque developed by the motor during the period of acceleration from rest to the speed at which pull-out torque occurs. For motors which do not have a definite pull-out torque, the pull-up torque is the minimum torque developed up to rated speed.

The pull-up torque may be determined by dynamometer, or in line torque sensor mounted between motor and dynamometer (*see* **9.4.2**).

9.3.5 *Formula for Load Torque*

The load torque of any motor may be calculated from the following formula:

$$\text{Torque} = \frac{9\,554 \times P}{\text{rev/min}}\,\text{Nm}$$

where P is the rated output in kW.

9.4 Load Test

9.4.1 *General*

Load characteristics are obtained by testing a motor as in **9.3** except that the loading is done at least at five points spaced substantially equally from no load to full load and that additional reading of power input and power factor shall be taken to calculate efficiency. Readings beyond full load should be taken as far as possible in the same fashion. It should be ensured that the testing at overload shall not cause injury to the motor. This test shall be carried out at rated or mean voltage and rated frequency.

9.4.2 *Methods of Loading*

The following methods are recommended.

9.4.2.1 *Dynamometer method*

In this method, the motor is connected to a dynamometer usually by means of flexible coupling. The dynamometer is free to rotate and has a torque arm which rests on a scale. The torque output of the motor is a product of the scale reading and the distance from the center of the dynamometer to the point where the torque arm makes contact with the scale. A properly sized dynamometer should be used, such that the coupling, friction, and windage losses of the dynamometer measured at rated speed of the motor should not be greater than 15 percent of the rated output of the motor. The dynamometer should be sensitive to a change in torque of 0.1 percent of the rated torque. To obtain the mechanical power output of a motor by the dynamometer method, the following formula may be used:

$$\text{Power in } P = \frac{T \text{ X rev/min}}{9\,554}$$

where

P = rated output in kW, and

T = torque in Nm.

An in-line torque sensor can be used with dynamometer for torque measurement. Torque can be measured with dynamometer or torques sensor, using torque sensor is preferred. Dynamometer correction is required if a load cell and a torque arm is used in torque measurement. If a torque transducer is directly connected to the shaft of the test motor or the stator reaction torque is measured then the dynamometer correction is not required.

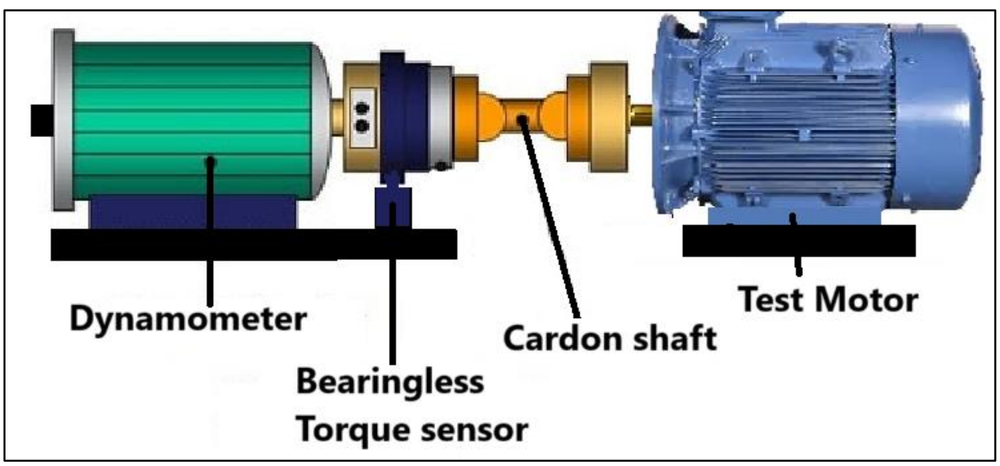


FIGURE 3 TEST SETUP FOR FULL LOAD TEST USING DYNAMOMETER LOADING

The dynamometer correction is a correction to the measured torque. In the case where dynamometer correction is required, the measured values of torque are corrected by adding a correction torque corresponding to the friction and windage loss associated with the dynamometer.

The correction is calculated from measurements of the input power and torque with the motor running unloaded and coupled to the dynamometer and the input power measurement with the motor uncoupled from the dynamometer.

The following procedure of dynamometer correction assumes a linear decrease in the torque with respect to input power, from the 25 percent load point to the minimum load point with a coupled but unloaded dynamometer. This line can be extrapolated to the no-load power point where the torque is expected to be zero. The difference can be considered as the error to be corrected with a dynamometer correction factor.

The slope of the line is calculated from below Equation:

$$slope = \frac{T_{LLP} - T_{NLC}}{P_{LLP} - P_{NLC}}$$

where

T_{LLP} = measured motor torque at 25% load test point, N - m
T_{NLC} = measured no-load motor torque with dynamometer coupled, N - m
P_{NLC} = measured no-load input power with dynamometer coupled, kW
P_{LLP} = measured motor input power at 25% load test point, kW
P_{NLU} = measured no-load input power with dynamometer un-coupled, kW

The dynamometer correction factor, in N - m, is given by:

$$T_W = slope \times (P_{NLC} - P_{NLU}) - T_{NLC}$$

9.4.2.2 *Calibrated machine*

If any of the methods given above is not available, the motor under test may be loaded on a calibrated generator. The efficiency curve of such a generator shall be available.

9.4.3 *Determination of Efficiency*

Efficiency is the ratio of output power to input power. Unless otherwise specified, the efficiency shall be determined at the rated voltage, frequency and after steady temperature has been attained at rated output.

9.4.3.1 *Input-output method*

Input-output tests arc carried out by the following four methods:

a) Dynamometer method (*see* **9.4.2.1**),
b) Any suitable loading method with in-line torque sensor, and
c) Calibrated machine (*see* **9.4.2.2**).

In Input output method where output is directly measured, the mechanical output power, P, is the product of torque, T and Speed. Refer **9.4.2.1**

The Input can be directly measured by power analyzer for getting efficiency.

9.4.3.2 *Segregated loss method*

Only applicable to induction run motors having no axially winding in picture during run. For motors with auxiliary windings such as permanent split capacitor motors and double capacitor motors this procedure is not applicable. Here output power is calculated by subtracting all power losses from the input power.

The losses shall include those listed below:

a) Stator I^2 R loss
b) Rotor I^2 R loss
c) Friction and windage loss
d) Core loss
e) Stray loss

NOTE —Input-output method is always preferred to segregated loss method.

Stator Resistive Loss: The resistive loss of a stator winding, P_{sl}, is given by Equation
$P_{sl} = I^2 R$

where

I is the measured stator winding current at a specified load (A);

R is the dc resistance between the line terminals. (Q). corrected to the specified temperature.

9.4.3.3 *Specified temperature for resistance corrections*

Class of insulation	Temperature (°C)
B	95
F	115
H	130

9.4.3.4 *Rotor resistive loss*

When slip can be accurately determined, the rotor resistive loss, *Prl*, should be determined from slip, *s*, is given by Equation:

$$P_{rl} = \left(P_0 - P_{sl} - P_{cl} - P_f \right) s$$

Where

P_o	is the measured stator input power (W):
P_{sl}	is the measured stator resistive loss (W);
P_{cl}	is the core loss (W);
P_f	is the friction and windage loss (W):
S	is the slip.

9.4.3.5 Friction and windage loss refer **9.1.1.1**

I addition to the method given in **9.1.1.1** the friction and windage loss can be obtained by using a primover motor. Here the test motor can be run without any excitation (open condition) by a primover motor and the additional power consumed by primover motor for driving the de-energized test motor is the friction and windage loss of test motor.

9.4.3.6 Core loss: refer **9.1.1.2**

9.4.3.7 *Assumed Stray-Load Loss*

If stray-load loss is not measured, and it is acceptable by applicable standards or by contract specification. The value of stray-load loss at rated load may be assumed to be 1.8 Percent of the rated output power.

For other than rated load, it shall be assumed that the stray-load loss, P_{sll}, is proportional to the ratio of ‘measured torque to rated torque squared, as shown in Equation:

$$P_{sll} = P_{sll} \left(\frac{T}{T_0} \right)^2$$

where

P_{sll}	is the assumed value of stray-load loss at rated load (W).
T	is the value of torque measured at the load point (Nm).
T_0	is the value of torque at rated load (Nm).

9.4.4 *Slip Measurement*

For the range of load for which the efficiency is determined, the measurement of slip is very important. The slip should be directly measured by one of the following methods:

a) Stroboscope,
b) Slip coil, and
c) Magnetic needle.

Methods (b) and (c) are suitable for machines having a slip of not more than 5 percent.

9.4.4.1 *Stroboscope method*

On one end of the motor shaft a single black radial line is painted upon a white background. The slip is readily measured by counting the apparent backward rotation of the black line over a given period of time.

9.4.4.2 *Slip-coil method*

A suitable slip-coil having approximately 700 turns of 1 mm diameter insulated wire is passed axially over the motor and its two ends are connected to center zero galvanometer. When the motor is running the galvanometer pointer will oscillate. The number of oscillations shall be counted only in one direction, that is, to the left or to the right for a period of, say, 20 s.

The following formula will give percentage slip:

$$S - \frac{n \times 100}{T \times f}$$

where

S = percentage slip
n = number of oscillations,
T= time in seconds required for n oscillation
f = and supply frequency.

9.4.4.3 *Magnetic needle method*

In this method a magnetic needle (suspended on a sharp point so that it can rotate freely) is placed on the body of motor in horizontal plane. The needle will oscillate and the number of oscillations shall be counted for a period of, say, 20 s. The percentage slip may be calculated by the formula given in **9.4.4.2**.

9.4.5 *Power Factor Measurement*

Power factor may be measured by one of the following two methods:

a) Watt to volt-ampere ratio.
b) Power-factor meter.

9.4.5.1 *Watt to volt-ampere ratio method*

Power factor is obtained by ratio of wattmeter readings to volt-ampere readings:

$$\text{Power factor} = \frac{\text{Watts}}{\text{Volts} \times \text{Amperes}}$$

9.4.5.2 *Power-factor meter method*

In this method, power factor meter is directly connected in the circuit and direct reading is obtained.

9.5 Temperature-Rise Test

Refer IS 15999 (Part 1)/IEC 60034-1 for temperature rise test and its limit.

10 Measurement of Noise

Refer IS 12065 for noise measurement and its limit.

11 Measurement of Vibration

Refer IS 12075 for Vibration measurement and its limit.

ANNEX A

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 900: 2019	Code of practice for Storage, installation and maintenance of induction motors (*third revision*)
IS 996: 2009	Single phase a.c. induction motors for general purpose (*third revision*)
IS 1885 (Part 35) : 2021	Electrotechnical vocabulary Part 35 Rotating machinery (*second revision*)
IS 4029 : 2010	Guide for testing three phase induction motors (*first revision*)
IS 2993 (Part 1) : 2024	a.c. Motor Capacitors Part 1 General - Performance, Testing and rating - Safety requirements — Guidance for installation and operation (*third revision*)
IS 12065: 1987	Permissible limits of noise levels for rotating electrical machines
IS 12075 : 2024	Mechanical vibration of rotating electrical machines with shaft heights 56 mm and higher — Measurement, evaluation and limits of vibration severity (*second revision*)
IS 15999 (Part 1)/IEC 60034-1	Rotating electrical machines Part 1 Rating and performance