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Low-voltage three-phase
squirrel-cage induction motors—
Low-voltage top runner motor

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by The Japan Electrical Manufacturers' Association (JEMA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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Low-voltage three-phase squirrel-cage induction motors—Low-voltage top runner motor

Introduction

This Japanese Industrial Standard has been prepared based on the twelfth edition of **IEC 60034-1** published in 2010, the third edition of **IEC 60034-8** published in 2007, Edition 4.1 of **IEC 60034-9** published in 2007, Edition 2.1 of **IEC 60034-12** published in 2007 and the sixth edition of **IEC 60072-1** published in 1991 with some modifications of the technical contents such as the deletion of the specifications relating to inapplicable items.

The portions given sidelines or dotted underlines are the matters in which the contents of the corresponding International Standards have been modified. A list of modifications with the explanations is given in Annex JB. The matters contained in Annex JA are unique contents of **JIS** that are not given in the corresponding International Standards.

1 Scope

This Standard specifies the low-voltage top runner motors (hereafter referred to as motors) among the low-voltage three-phase 50 Hz and/or 60 Hz squirrel-cage induction motors shown below. This Standard covers the motors having the ratings of two or more voltages and/or frequencies.

- Rated voltage 600 V or under
- Rated output 0.75 kW or over up to and including 375 kW
- 2, 4 or 6 poles
- Duty type S1 (continuous running duty) or S3 (intermittent periodic duty) having 80 % or more cyclic duration factor
- Commercial power source driven type
- Motors suitable for conditions of installation site specified in clause 6

This Standard also covers the following motors.

- Motors having flange, foot or shaft of special dimensions
- Motors incorporated in geared motors and brake motors irrespective of the shapes of shafts and/or flanges

This Standard does not cover the following motors.

- Motors that are driven exclusively by inverter.
- Motors which are completely integrated into a machine (for example, pump, fan and compressor) therefore which cannot be tested separately from the machine

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 60034-1:2010 *Rotating electrical machines—Part 1: Rating and performance*

IEC 60034-8:2007 *Rotating electrical machines—Part 8: Terminal markings and direction of rotation*

IEC 60034-9:2007 *Rotating electrical machines—Part 9: Noise limits*

IEC 60034-12:2007 *Rotating electrical machines—Part 12: Starting performance of single-speed three-phase cage induction motors*

IEC 60072-1:1991 *Dimensions and output series for rotating electrical machines—Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1 080* (Overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21-1.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards indicated below, only the editions of the indicated year shall be applied and any revisions (including amendments) made thereafter shall not be applied.

JIS B 0401-1:1998 *ISO system of limits and fits—Part 1: Bases of tolerances, deviations and fits*

NOTE : Corresponding International Standard: ISO 286-1:1988 *Geometrical product specifications (GPS)—ISO code system for tolerances on linear sizes—Part 1: Basis of tolerances, deviations and fits* (IDT)

JIS B 0401-2:1998 *ISO system of limits and fits—Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

NOTE : Corresponding International Standard: ISO 286-2:1988 *Geometrical product specifications (GPS)—ISO code system for tolerances on linear sizes—Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts* (IDT)

JIS B 0902:2001 *Driving and driven machines—Shaft heights*

NOTE : Corresponding International Standard: ISO 496:1973 *Driving and driven machines—Shaft heights* (IDT)

JIS B 1001:1985 *Diameter of clearance holes and counterbores for bolts and screws*

NOTE : Corresponding International Standard: ISO 273:1979 *Fasteners—Clearance holes for bolts and screws* (MOD)

JIS B 1301:1996 *Keys and their corresponding keyways*

NOTE : Corresponding International Standard: ISO 3912:1977 *Woodruff keys and keyways* (MOD)

JIS B 9960-1:2008 *Safety of machinery—Electrical equipment of machines—Part 1: General requirements*

NOTE : Corresponding International Standard: IEC 60204-1:2005 *Safety of machinery—Electrical equipment of machines—Part 1: General requirements* (MOD)

JIS C 1509-1:2005 *Electroacoustics—Sound level meters—Part 1: Specifications*

NOTE : Corresponding International Standard: IEC 61672-1:2002 *Electroacoustics—Sound level meters—Part 1: Specifications* (IDT)

JIS C 1514:2002 *Electroacoustics—Octave-band and fractional-octave-band filters*

JIS C 4034-2-1:2011 *Rotating electrical machines—Part 2-1: Methods for determining losses and efficiency from tests of single-speed, three-phase, cage-induction motors*

NOTE : Corresponding International Standard: IEC 60034-2-1:2007 *Rotating electrical machines—Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)* (MOD)

JIS C 4034-5:1999 *Rotating electrical machines—Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)*

NOTE : Corresponding International Standard: IEC 60034-5:1991 *Rotating electrical machines—Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)* (IDT)

JIS C 4034-30:2011 *Rotating electrical machines—Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)*

NOTE : Corresponding International Standard: IEC 60034-30:2008 *Rotating electrical machines—Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)* (IDT)

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS C 4034-2-1:2011** and **JIS C 4034-30:2011**, and the following apply.

The symbols and abbreviations shall be as specified in clause 4 of **JIS C 4034-2-1:2011**.

3.1 low-voltage top runner motor

low-voltage three-phase squirrel-cage induction motor among the specific appliances conforming to the top runner standard which is stipulated in “Act on the Rational Use of Energy (Energy Saving Act)”

3.2 duty

the statement of the load(s) to which the machine is subjected, including, if applicable, starting, electric braking, no-load and rest and de-energized periods, and including their durations and sequence in time (**IEV 411-51-06**)

3.3 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 (IEV 411-51-13)

3.4 load

all the values of the electrical and mechanical quantities that signify the demand made on the motor by an electrical circuit or a mechanism at a given instant (IEV 411-51-01 modified)

3.5 cyclic duration factor

the ratio between the period of loading, including starting and electric braking, and the duration of the duty cycle, expressed as a percentage (IEV 411-51-09)

3.6 thermal equilibrium

the state reached when the temperature rises of the several parts of the motor do not vary by more than a gradient of 2 K per hour (IEV 411-51-08 modified)

3.7 starting

the state of a motor in the moment it starts rotating from the state of rest (IEV 411-52-01)

NOTE : It also means a process in which a motor at rest is accelerated up to a steady-state speed.

3.8 rated value

a quantity value assigned, generally by a manufacturer, for a specified operating condition of the motor (IEV 411-51-23 modified)

3.9 rating

the set of rated values and operating conditions of the motor (IEV 411-51-24 modified)

3.10 rated output

the value of the output included in the rating

3.11 rated voltage

line voltage at the terminal of a motor at the rated output

3.12 rated frequency

frequency of the power supplied to a motor at the rated output

3.13 ambient temperature

temperature of air surrounding a motor at the site where the motor is operated

3.14 coolant

a medium, liquid or gas, by means of which heat generated in the motor is transferred (IEV 411-44-02 modified)

3.15 primary coolant

a medium, liquid or gas, which, being at a lower temperature than a part of the motor and in contact with it, removes heat from that part (IEV 411-44-03 modified)

3.16 secondary coolant

a medium, liquid or gas, which, being at a lower temperature than the primary coolant, removes the heat given up by this primary coolant by means of a heat exchanger or through the external surface of the motor (IEV 411-44-04 modified)

3.17 direct cooled (inner cooled) winding

a winding mainly cooled by coolant flowing in direct contact with the cooled part through hollow conductors, tubes, ducts or channels which, regardless of their orientation, form an integral part of the winding inside the main insulation (IEV 411-44-08)

3.18 indirect cooled winding

any winding other than a direct cooled winding (IEV 411-44-09)

4 Duty

4.1 Duty

It is the responsibility of the purchaser to declare the duty. The purchaser may describe the duty by one of the following:

- a) numerically, where the load does not vary or where it varies in a known manner;
- b) as a time sequence graph of the variable quantities such as a load, loss and temperature;
- c) by selecting the duty type either S1 or S3 that is no less onerous than the expected duty.

The duty type shall be designated by the appropriate abbreviation, specified in 4.2, written after the value of the load.

An expression for the cyclic duration factor is given in the relevant duty type figure.

Where the purchaser does not declare a duty, the manufacturer shall assume that duty type S1 (continuous running duty) applies.

4.2 Duty types

4.2.1 Duty type S1 (continuous running duty)

The continuous running duty means the operation at a constant load maintained for sufficient time to allow the motor to reach thermal equilibrium (see Figure 1).

The abbreviation is S1.

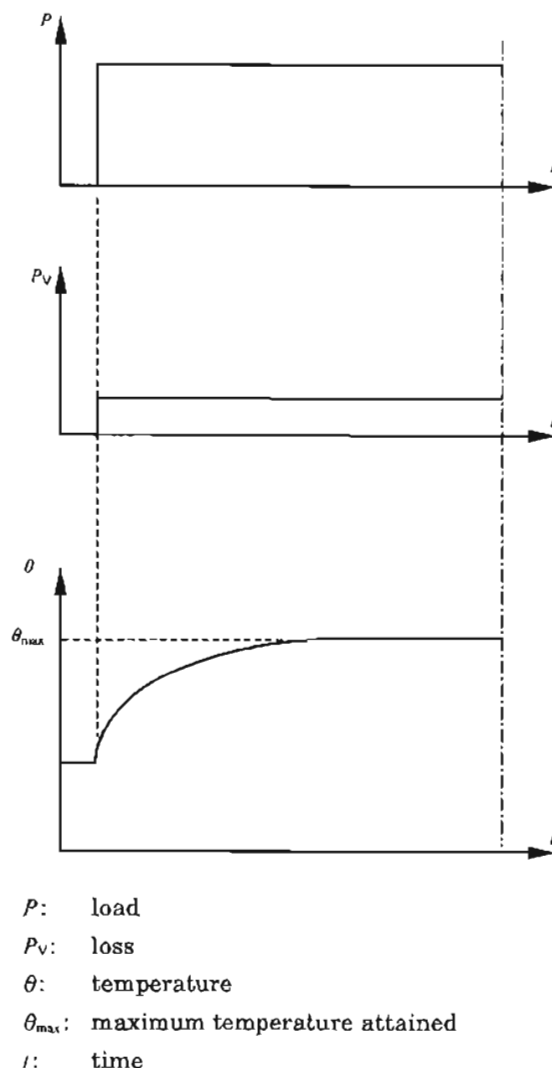


Figure 1 Continuous running duty S1

4.2.2 Duty type S3 (intermittent periodic duty)

The intermittent periodic duty means a sequence of identical duty cycles, each including an operation time at constant load and a time de-energized and at rest. In this duty, without the electric braking, the cycle is such that the starting current does not significantly affect the temperature rise (see Figure 2). The abbreviation is S3 followed by the cyclic duration factor. The cyclic duration factor, %ED, shall be calculated according to the following formula.

$$\%ED = \frac{\Delta t_p}{T_c} \times 100 \%$$

where, Δt_p : operation time at constant load
 T_c : time of one load cycle

Example : S3 80 %

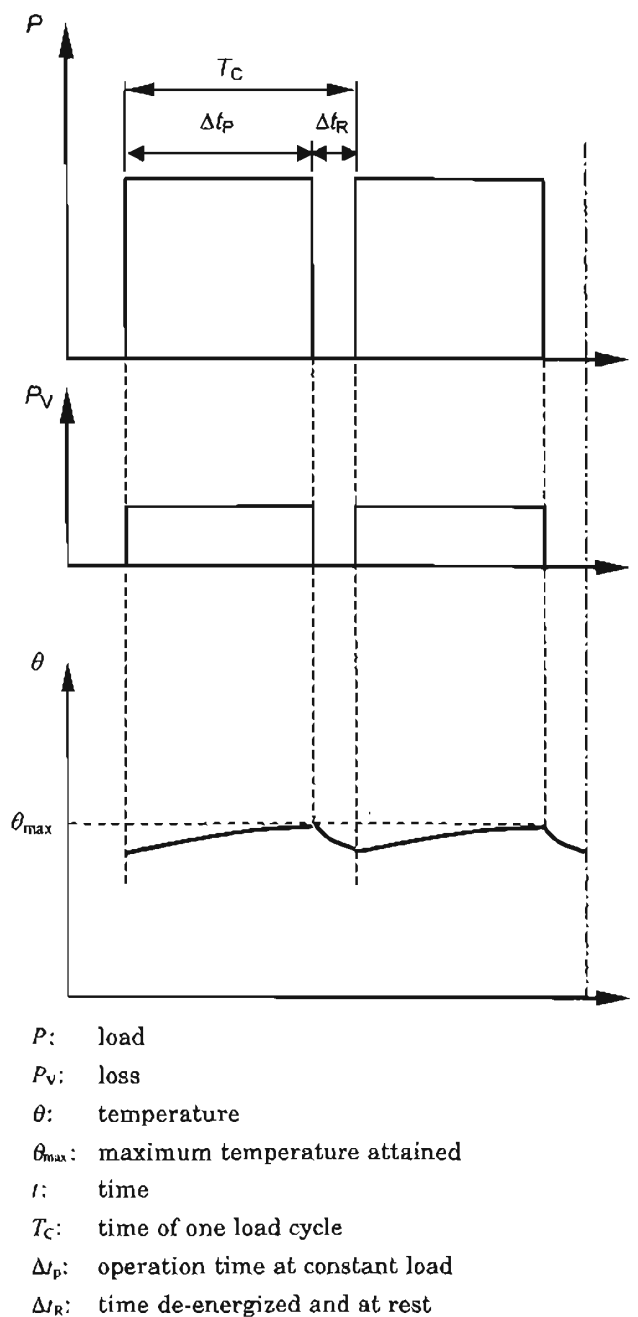


Figure 2 Intermittent periodic duty S3

5 Rating

5.1 Rated voltage

The rated voltage shall be 600 V or under.

5.2 Rated frequency

The rated frequency shall be 50 Hz and/or 60 Hz.

5.3 Rated output

The rated output is a mechanical output available at a shaft, expressed in kilowatt (kW), and is 0.75 kW to 375 kW. Recommended values are given in Table 1.

Table 1 Recommended values of rated output

Unit: kW

Rated output
0.75, 1.1, 1.5, 2.2, 3, 3.7, 4, 5.5, 7.5, 11, 15, 18.5, 22, 30, 37, 45, 55, 75, 90, 110, 132, 150, 160, 185, 200, 220, 250, 280, 300, 315, 355, 375

6 Conditions for installation site

6.1 General matters

Unless otherwise specified, the installation site of motor shall conform to all the conditions of 6.2 to 6.6. For the installation site conditions deviating from those values, the adjustment to limit of temperature rise shall be as given in Table 3 and Table 5.

6.2 Altitude

The altitude shall not exceed 1 000 m.

6.3 Maximum ambient temperature

The ambient temperature shall be 40 °C or under.

6.4 Minimum ambient temperature

The ambient temperature shall be -20 °C or higher. The ambient temperature shall be 0 °C or higher for motors using sleeve bearing and motors using water as a primary coolant or secondary coolant.

6.5 Water coolant temperature

The temperature of reference water coolant shall be as given in Table 6. Other water coolant temperatures shall be adjusted as given in Table 3. The water coolant temperature shall be +5 °C or higher.

6.6 Storage and transport

When temperatures lower than specified in 6.4 are expected during transportation, storage, or after installation, the purchaser shall inform the manufacturer and specify the expected minimum temperature.

7 Performances

7.1 Temperature rise

The limits of temperature rise of indirect cooled winding by air coolant shall not exceed the values given in Table 2 when tested according to 10.5.

The limits of temperature rise when conditions of **6.2** to **6.5** are not satisfied shall be adjusted as given in Table 3 (the assumed maximum ambient temperature specified by the altitude in item 3 given in Table 3 shall be as given in Table 4.).

When applying the thermometer method specified in **10.5.2.2 c)**, the limits of temperature rise shall be as given in Table 2.

The limits of temperature rise of indirect cooled winding by air coolant when the condition of the test site differs from that of the installation site shall be adjusted as given in Table 5. If the adjusted limits given in Table 5 lead to the permissible temperatures at the test site which the manufacturer considers to be excessive, the testing procedure and the limits shall be determined as agreed between the parties concerned with delivery.

Table 2 Limits of temperature rise of indirect cooled winding by air coolant

Unit: K

Item	Part of motor	Thermal class								
		120 (E)			130 (B)			155 (F)		
		Thermometer method	Resistance method	Embedded temperature detector method	Thermometer method	Resistance method	Embedded temperature detector method	Thermometer method	Resistance method	Embedded temperature detector method
1a	Stator windings of motor whose output is over 200 kW up to and incl. 375 kW	—	75	80	—	80	90	—	105	115
1b	Stator windings of motor other than item 1c whose output is 200 kW or under ^{a)}	— ^{b)}	75	—	— ^{b)}	80	—	— ^{b)}	105	—
1c	Self-cooled (IC40)/moulded insulated winding without cooling fan ^{a)}	—	75	—	—	85	—	—	110	—
2	Squirrel-cage conductor	The temperature rise and the temperature of this portion shall not have deleterious effects on the function of insulating materials of this portion and nearby materials.								
3	Iron cores and all structural formations (except bearings) irrespective of contact with insulating materials.	The temperature rise and the temperature of this portion shall not have deleterious effects on the function of insulating materials of this portion and nearby materials.								
Notes ^{a)}		With the application of the superposition test method to windings of motors rated at 200 kW or under, the limits of temperature rise given for the resistance method may be exceeded by 5 K.								
^{b)}		When agreed between the parties concerned with delivery, the thermometer method may be used.								

Table 3 Adjustment to limits of temperature rise at installation site of indirect cooled windings to take account of operating conditions other than 6.2 to 6.5

Item	Operating condition		Adjustment to limit of temperature rise in Table 2 ($\Delta\theta$)
1a	Maximum ambient temperature or maximum coolant temperature at inlet to motor (θ_c)	$0\text{ }^{\circ}\text{C} \leq \theta_c \leq 40\text{ }^{\circ}\text{C}$, difference between thermal class θ_{ch} and $(40\text{ }^{\circ}\text{C} + \Delta\theta)^{b)}$ is 5 K or under, and thermal class 130 (B) or 155 (F).	Increased by the difference between maximum coolant temperature (θ_c) and $40\text{ }^{\circ}\text{C}^{a)}$.
1b	Altitude under 1 000 m	$0\text{ }^{\circ}\text{C} \leq \theta_c \leq 40\text{ }^{\circ}\text{C}$, difference between thermal class θ_{ch} and $(40\text{ }^{\circ}\text{C} + \Delta\theta)^{b)}$ is over 5 K, and thermal class 130 (B) or 155 (F).	Increased by the difference between maximum coolant temperature (θ_c) and $40\text{ }^{\circ}\text{C}$, multiplied by the factor $\left[1 - \frac{\theta_{ch} - (40\text{ }^{\circ}\text{C} + \Delta\theta)}{80\text{ K}} \right]^{a)}$ θ_{ch} is permissible maximum temperature of thermal class, and $\Delta\theta$ is limit of temperature rise specified in Table 2.
1c		$0\text{ }^{\circ}\text{C} < \theta_c \leq 40\text{ }^{\circ}\text{C}$, and thermal class 120 (E).	Increased by the difference between maximum coolant temperature (θ_c) and $40\text{ }^{\circ}\text{C}$ taking the maximum as 30 K, as agreed between the parties concerned with delivery.
1d		$40\text{ }^{\circ}\text{C} < \theta_c \leq 60\text{ }^{\circ}\text{C}$	Reduced by the amount by which coolant temperature exceeds $40\text{ }^{\circ}\text{C}$.
1e		$\theta_c < 0\text{ }^{\circ}\text{C}$ or $\theta_c > 60\text{ }^{\circ}\text{C}$	As agreed between the parties concerned with delivery.
2	Maximum water temperature of at inlet to water-cooled heat exchanger (θ_w)	$5\text{ }^{\circ}\text{C} \leq \theta_w \leq 25\text{ }^{\circ}\text{C}$	Increased by 15 K and by the difference between $25\text{ }^{\circ}\text{C}$ and maximum water temperature θ_w .
		$\theta_w > 25\text{ }^{\circ}\text{C}$	Increased by 15 K and reduced by the difference between $25\text{ }^{\circ}\text{C}$ and maximum water temperature θ_w .
3	Altitude (H)	1 000 m $< H \leq 4\text{ }000\text{ m}$, and maximum ambient temperature is not specified.	No adjustment. It shall be assumed that the reduced cooling resulting from altitude is compensated by a reduction of maximum ambient temperature below $40\text{ }^{\circ}\text{C}$ and that the total temperature will therefore not exceed $40\text{ }^{\circ}\text{C}$ plus the Table 2 temperature rises $c)$.
		$H > 4\text{ }000\text{ m}$	As agreed between the parties concerned with delivery.

- Notes ^{a)} It is the value obtained by adjusting the difference between the maximum coolant temperature and the reference value of coolant temperature $40\text{ }^{\circ}\text{C}$ by considering the properties of temperature measurement method so as to be not more than the permissible maximum temperature of a thermal class.
- ^{b)} $(40\text{ }^{\circ}\text{C} + \Delta\theta)$ is the sum of the reference value of coolant temperature ($40\text{ }^{\circ}\text{C}$) and the limit of temperature rise $\Delta\theta$ specified in Table 2, which is the value obtained by adjusting the permissible maximum temperature of each thermal class by considering the properties of temperature measurement method.
- ^{c)} When assuming that the reduction of ambient temperature is 1 % of the limit of temperature rise of items 1a and 1b specified in Table 2 for every 100 m increase in altitude in case of exceeding 1 000 m, and the highest ambient temperature at an altitude of 1 000 m or under is $40\text{ }^{\circ}\text{C}$, the assumed maximum ambient temperature at the installation site becomes as given in Table 4.

Table 4 Assumed maximum ambient temperature

Altitude m	Thermal class		
	120 (E)	130 (B)	155 (F)
	Temperature °C		
1 000	40	40	40
2 000	33	32	30
3 000	26	24	19
4 000	19	16	9

Table 5 Adjustment to limits of temperature rise at operating site of indirect cooled windings by air to take account of test site conditions ($\Delta\theta_T$)

Item	Test condition		Adjusted limit temperature at test site $\Delta\theta_1$
1	Temperature difference of reference coolant between test site (θ_{CT}) and operation site (θ_C)	Absolute value of $(\theta_C - \theta_{CT}) \leq 30$ K	$\Delta\theta_T = \Delta\theta$
		Absolute value of $(\theta_C - \theta_{CT}) > 30$ K	As agreed between the parties concerned with delivery.
2	Altitude difference between test site (H_T) and operation site (H)	$1\,000\text{ m} < H \leq 4\,000\text{ m}$ $H_T < 1\,000\text{ m}$	$\Delta\theta_T = \Delta\theta \left[1 - \frac{H - 1\,000\text{ m}}{10\,000\text{ m}} \right]$
		$H < 1\,000\text{ m}$ $1\,000\text{ m} < H_T \leq 4\,000\text{ m}$	$\Delta\theta_T = \Delta\theta \left[1 + \frac{H_T - 1\,000\text{ m}}{10\,000\text{ m}} \right]$
		$1\,000\text{ m} < H \leq 4\,000\text{ m}$ $1\,000\text{ m} < H_T \leq 4\,000\text{ m}$	$\Delta\theta_T = \Delta\theta \left[1 + \frac{H_T - H}{10\,000\text{ m}} \right]$
		$H > 4\,000\text{ m}$ or $H_T > 4\,000\text{ m}$	As agreed between the parties concerned with delivery.
NOTE: The limits of temperature rise before $\Delta\theta$, are given in Table 2 and adjusted, if necessary, as given in Table 3.			

7.2 Reference coolant

The reference coolant for the given cooling method of machine shall be as given in Table 6. If a third coolant is used, the temperature rise shall be measured above the temperature of the primary coolant or the secondary coolant as specified in Table 6.

NOTE : A machine may be so arranged and cooled that more than one item of Table 6 applies, in which case different reference coolants may apply for different windings.

Table 6 Reference coolant temperature (see also Table 4)

Item	Primary coolant	Cooling system	Secondary coolant	Table number	Limit specified by table shown in left column	Reference coolant and reference coolant temperature
1	Air	Indirect	None	Table 2	Temperature rise	Ambient air
2	Air	Indirect	Air	Table 2		Reference temperature: 40 °C
3	Air	Indirect	Water	Table 2		Coolant at inlet to machine or ambient water Reference coolant temperature of air at inlet of appliance: 40 °C Reference temperature of ambient water: 25 °C ^{a)}
Note ^{a)} A machine with indirect cooled winding and water-cooled heat exchanger may be rated using either the primary coolant or the secondary coolant as the reference coolant (see clause 12 for information to be given on the rating plate). A submersible machine with surface cooling or a machine with water jacket cooling should be rated using the secondary coolant as the reference coolant.						

7.3 Efficiency

The efficiency at the rated output of motor shall be determined according to the test method of 10.6, and shall be the premium efficiency (IE3) specified in **JIS C 4034-30:2011**. For the motor having three or six ratings, the efficiency at 200 V-60 Hz or 400 V-60 Hz shall be as given in Table 10.

The rating combination in three or six ratings shall be as follows.

- Three ratings: 200 V-50 Hz/200 V-60 Hz/220 V-60 Hz or 400 V-50 Hz/400 V-60 Hz/440 V-60 Hz
- Six ratings: 200 V-50 Hz/200 V-60 Hz/220 V-60 Hz/400 V-50 Hz/400 V-60 Hz/440 V-60 Hz

NOTE 1 Table 7 and Table 8 in **JIS C 4034-30:2011** are listed as Table 8 and Table 9 respectively, for reference in this Standard. The nominal efficiency at 3.7 kW in rated output, which is not specified in Table 7 of **JIS C 4034-30:2011**, is specified in Table 8 of this Standard according to the correction coefficient.

The efficiency in the rated output specified in this Standard shall be the nominal value.

NOTE 2 Even for the motors by single design, the efficiency varies due to the variation in materials, manufacturing processes and tests. The efficiency in the rated output of two or more motors by single design serves as a value with a width instead of only one numerical value.

The efficiency which the manufacturer marks on a rating plate shall be the rated efficiency, and shall be not less than the nominal efficiency required by Table 8 (Table 7 of **JIS C 4034-30:2011**), Table 9 (Table 8 of **JIS C 4034-30:2011**) and Table 10.

When the test is performed at the rated voltage and the rated frequency, the tolerances of the rated efficiency in accordance with clause 11 shall be applied to the efficiency by the total load measured in each motor.

NOTE 3 The rated efficiency has tolerances, but the nominal efficiency is a single number without tolerances.

Table 8 gives a nominal efficiency at 50 Hz. In the rated output range of 0.75 kW to 200 kW in Table 8, the nominal efficiency at 50 Hz of the rated output other than that in Table 8 shall be calculated according to Formula (1). The nominal efficiency η_n (%) determined shall be rounded to the first decimal place, to be expressed with xx.x %.

$$\eta_n = A \times \left[\log_{10} \left(\frac{P_N}{P_c} \right) \right]^3 + B \times \left[\log_{10} \left(\frac{P_N}{P_c} \right) \right]^2 + C \times \log_{10} \left(\frac{P_N}{P_c} \right) + D \dots\dots\dots (1)$$

where, A , B , C and D : interpolation coefficient (see Table 7)

P_c : 1 (kW)

NOTE 4 Formula (1) and the interpolation coefficient are mathematically derived in order to obtain the optimal approximate curve for the nominal efficiency in Table 8.

NOTE 5 In order to make P_N (kW) dimensionless, it is divided by 1 (kW).

NOTE 6 In the output range of 200 kW to 375 kW, since the nominal efficiency has a constant value, the interpolation according to Formula (1) is unnecessary.

Table 7 Interpolation coefficient for motor of 50 Hz

Efficiency class (IE code)	Interpolation coefficient	50 Hz, 0.75 kW to 200 kW		
		2-pole	4-pole	6-pole
IE3	A	0.356 9	0.077 3	0.125 2
	B	-3.307 6	-1.895 1	-2.613 0
	C	11.610 8	9.298 4	11.996 3
	D	82.250 3	83.702 5	80.476 9

The nominal efficiency at 60 Hz shall be as given in Table 9, and the nominal efficiency at 200 V-60 Hz or 400 V-60 Hz in the motor with three ratings or six ratings shall be as given in Table 10. The nominal efficiency at the rated output other than those in Table 9 and Table 10 shall be as follows.

- For the nominal efficiency at the rated output of not less than the middle-point between two continuous output ratings, the higher efficiency of the two ratings shall be applied.
- For the nominal efficiency at the rated output of under the middle-point between two continuous output ratings, the lower efficiency of the two ratings shall be applied.

**Table 8 (informative) Nominal efficiency limits (%) for 50 Hz IE3
(Table 7 in JIS C 4034-30)**

Unit: %

Rated output P_N (kW)	Number of poles		
	2	4	6
0.75	80.7	82.5	78.9
1.1	82.7	84.1	81.0
1.5	84.2	85.3	82.5
2.2	85.9	86.7	84.3
3	87.1	87.7	85.6
3.7	87.8	88.4	86.5
4	88.1	88.6	86.8
5.5	89.2	89.6	88.0
7.5	90.1	90.4	89.1
11	91.2	91.4	90.3
15	91.9	92.1	91.2
18.5	92.4	92.6	91.7
22	92.7	93.0	92.2
30	93.3	93.6	92.9
37	93.7	93.9	93.3
45	94.0	94.2	93.7
55	94.3	94.6	94.1
75	94.7	95.0	94.6
90	95.0	95.2	94.9
110	95.2	95.4	95.1
132	95.4	95.6	95.4
160	95.6	95.8	95.6
200 to 375	95.8	96.0	95.8

**Table 9 (informative) Nominal efficiency limits (%) for 60 Hz IE3
(Table 8 in JIS C 4034-30)**

Unit: %

Rated output P_N (kW)	Number of poles		
	2	4	6
0.75	77.0 ^{a)}	85.5	82.5
1.1	84.0	86.5	87.5
1.5	85.5	86.5	88.5
2.2	86.5	89.5	89.5
3.7	88.5	89.5	89.5
5.5	89.5	91.7	91.0
7.5	90.2	91.7	91.0
11	91.0	92.4	91.7
15	91.0	93.0	91.7
18.5	91.7	93.6	93.0
22	91.7	93.6	93.0
30	92.4	94.1	94.1