

# TECHNICAL SPECIFICATION



Rotating electrical machines –  
Part 34: AC adjustable speed rolling mill motors  
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IEC TS 60034-34:2020  
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### Part 34: AC adjustable speed rolling mill motors

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IEC TS 60034-34, which is a Technical Specification, has been prepared by IEC technical committee 2: Rotating machinery.



The text of this Technical Specification is based on the following documents:

Draft TS	Report on voting
2/1995/DTS	2/2017/RVDTS

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60034 series, published under the general title *Rotating electrical machines*, can be found on the IEC website.

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## INTRODUCTION

Rolling mill DC motors have 100 years of successful history. These metal rolling mill motors have been manufactured based on specific U.S.A. National Electric Manufacturers Association (NEMA) standards.

However, the control technology development, owing to progress in semiconductor device technology and micro-processor application technology, has made it practical to use AC adjustable speed rolling mill motors, both induction and synchronous motor types.

On the other hand, structures and characteristics of AC motors are far different from those for DC motors. Therefore, for application of AC adjustable speed rolling mill motors the purchaser and equipment supplier need a common understanding. This document incorporates various technical aspects of experience with DC mill motors and AC motor application experiences.

It introduces the field weakening control concept and overload operation as applied to AC adjustable speed rolling mill motors, and uses this information to specify factory test voltages to be used.

Various types of overload capacity conditions and overloads are defined. The possible effect on motor insulation life due to operating the motor beyond its design capability is discussed.

Requirements for confirmation of motor under specified variable speed operational conditions are introduced.

Rolling loads are defined for several application conditions. These supplement the duty classifications in IEC 60034-1 with specific cases.

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## ROTATING ELECTRICAL MACHINES –

### Part 34: AC adjustable speed rolling mill motors

#### 1 Scope

This part of IEC 60034 is applicable to AC adjustable speed rolling mill motors and identifies specific requirements for AC adjustable speed rolling mill motors, where those performance characteristics are different from those for conventional AC motors.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-1:2017, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-2 (all parts), *Rotating electrical machines*

IEC 60034-7:1992, *Rotating electrical machines – Part 7: Classification of types of constructions and mounting arrangements (IM Code)*

IEC 60034-7:1992/AMD1:2000 [IEC TS 60034-34:2020](https://standards.iteh.ai/catalog/standards/sist/1b1deae1-8878-4326-898b-662075b7736/iec-60034-7-2000/iec-60034-7-2000-amd1-2000)

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IEC 60417, *Graphical symbols for use on equipment* – 12-month subscription to regularly updated online database comprising all graphical symbols published in IEC 60417

IEC 61800-4:2002, *Adjustable speed electrical power drive systems – Part 4: General requirements – Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV*

#### 3 Terms and definitions

For purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

##### 3.1 Terms and definitions

###### 3.1.1

###### **AC adjustable speed rolling mill motor**

motor which is applied to metal rolling mill applications

Note 1 to entry: AC motors for rolling mills have the following specific features:

- a) high short time overload capability;
- b) strong mechanical construction to withstand shock load torque and vibration.

### 3.1.2

#### **acceleration and deceleration torque**

motor output torque available to accelerate or decelerate the driven load to a different speed

### 3.1.3

#### **base frequency**

frequency at rated output of the AC adjustable speed motor

Note 1 to entry: The motor base frequency is the transition point from the constant torque region to the reduced torque region when field weakening control is used.

Note 2 to entry: Base frequency is measured in hertz (Hz).

### 3.1.4

#### **base speed**

specified motor rotational speed at which the motor is capable of continuously delivering rated torque and rated output

Note 1 to entry: Base speed is the transition point between constant torque and field weakening operation.

[SOURCE: IEC 61800-4:2002, 3.4.4, modified – introduction of rated output condition.]

### 3.1.5

#### **continuous overload capability**

capability for long time overload operation where thermal equilibrium is reached

### 3.1.6

#### **coupled**

condition where the motor is attached to the driven equipment by means of a mechanical device or coupling

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### 3.1.7

#### **cut-off output**

mechanical protection level based on motor output which, when exceeded, results in an immediate trip of the motor

### 3.1.8

#### **cut-off torque**

mechanical protection level based on motor torque which, when exceeded, results in an immediate trip of the motor

### 3.1.9

#### **endshield bearing type motor**

motor which has bearings mounted to the motor frame

### 3.1.10

#### **field weakening range**

speed range from base to top where motor flux is reduced from the value for rated torque

Note 1 to entry: IEC 61800-4:2002, 3.4.5 uses a similar term: "field weakening operation".

### 3.1.11

#### **frequently applied overload output**

output greater than rated which is frequently applied as part of normal rolling operation

### 3.1.12

#### **frequently applied overload torque**

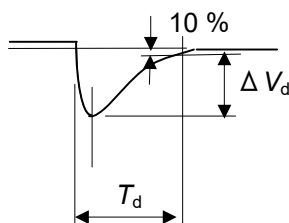
torque greater than rated which is frequently applied as part of normal rolling operation

Note 1 to entry: This is a limit torque for normal rolling process which may be frequently applied provided the RMS value for load current does not exceed 1,0 p.u.

### 3.1.13

#### impact speed drop

phenomenon where rolling speed drops transiently due to a sudden load change due to material impact on the mechanical equipment (see Figure 1)



$$\omega_{\text{impact\_drop}} = \frac{\Delta V_d \times T_d}{2} (\%s)$$

Where

$\omega_{\text{impact\_drop}}$  is the impact speed drop;

$\Delta V_d$  is the maximum speed drop (%);

$T_d$  is the period of speed drop (s).

### 3.1.14

#### journal

part of the shaft where the load surface is in contact with the bearing sleeve

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[SOURCE: IEC 60050-411:1996, 4.11-43-06, modified – relation with bearing sleeve is added.]

### 3.1.15

#### maximum safe operating speed

maximum motor rotational speed which does not lead to mechanical deformation nor deterioration in continuous operation

Note 1 to entry: The definition of maximum safe operating speed is modified from that in IEC TS 60034-25:2014, 18.6

### 3.1.16

#### overspeed

motor rotational speed which exceeds motor maximum safe speed

[SOURCE: IEC 60034-1:2017, 9.7, modified: changed to noun phrase and meaning of the speed is added.]

### 3.1.17

#### pedestal bearing type motor

motor which has separate bearing pedestal stands

### 3.1.18

#### radial load for bearing

mechanical load applied to the bearings in a radial direction

### 3.1.19

#### rated current

motor current when delivering rated output power

### 3.1.20

#### **rated <motor> frequency**

specified frequency corresponding to rated output of the motor

Note 1 to entry: Rated frequency is expressed in hertz (Hz).

### 3.1.21

#### **rated output**

output in mechanical power which is available at the shaft

Note 1 to entry: Rated output is expressed in watts (W) or kilowatts (kW).

Note 2 to entry: It is the practice in some countries for the mechanical power available at the shafts of motors to be expressed in horsepower (1 h.p. is equivalent to 745,7 W; 1 ch (cheval or metric horsepower) is equivalent to 736 W).

[SOURCE: IEC 60034-1:2017, 3.3, modified – “mechanical” and “available at the shaft”, have been added.]

### 3.1.22

#### **rated power factor**

motor power factor when delivering rated output

#### **rated speed**

specified rotational speed of the motor used to define the rated output power

Note 1 to entry: The definition of rated speed in 3.49 of IEC 61800-2:2015 does not consider rated output power in the field weakening range. The definition in IEC 61800-2 corresponds to term 3.1.4 of this document.

### 3.1.23

#### **rated torque**

motor torque at rated output and rated rotational speed

[SOURCE: IEC 60050-411:1996, 411-48-05, modified – definition simplified, considering the definition of 3.1.21: “rated output”.]

### 3.1.24

#### **rating**

set of rated values and operating conditions

[SOURCE: IEC 60034-1:2017, 3.2]

### 3.1.25

#### **reversing operation**

operation where normal motor rotation and opposite to normal motor rotation are repeated alternatively during load cycle

### 3.1.26

#### **rolling torque**

#### **load torque**

motor output torque for metal rolling or other connected load requirements

### 3.1.27

#### **shock load**

mechanical impact load applied from an external source

### 3.1.28

#### **short time overload capability**

capability for short time overload operation where thermal equilibrium is not reached

**3.1.29****sleeve bearing**

bearing where the load surface supporting the journal is cylindrical

[SOURCE: IEC 60050-411:1996, 411-42-07, modified – structure and shape are described.]

**3.1.30****stall operation**

operation generating torque while the motor is not rotating

Note 1 to entry: Special care should be taken to avoid overheating the converter power semiconductor devices and slip rings of a synchronous motor.

**3.1.31****terminal voltage**

line-to-line voltage at the motor terminals

**3.1.32****thrust load**

mechanical load applied to the bearings in an axial direction

**3.1.33****top frequency**

maximum design operational frequency of the AC adjustable speed rolling mill motor

Note 1 to entry: Top frequency is expressed in hertz (Hz).

**3.1.34****top speed**

specified highest motor rotational speed at which continuously rated output is available

**3.1.35****torsional vibration**

vibration caused by transient torque in the multi-mass spring system consisting of the motor, shafts, couplings, gears and driven equipment

**3.2 Terms and definitions for adjustable speed control and rolling operation****3.2.1****automatic field weakening control**

method which controls flux current inversely with speed to maintain the induction voltage constant from motor base speed to top speed

**3.2.2****complete drive module****CDM**

drive module consisting of, but not limited to, the basic drive module, which includes the electric power converter and related control, and extensions such as protection devices, transformers and auxiliaries, but excluding the motor and sensors which are mechanically coupled to the motor shaft

Note 1 to entry: Basic drive module (BDM) is defined in 3.4 for and Figure 2 of IEC 61800-2:2015.

[SOURCE: IEC 61800-2:2015, 3.8, modified – “the electric power converter and related control” is added]

**3.2.3****current control**

control of motor current