

Supplementary Specification to IEC 60034-1 Low Voltage Three Phase Cage Induction Motors

Public Review Draft

Revision history

VERSION	DATE	AMENDMENTS
0.1	16 th September 2019	Issued for public review

Acknowledgements

This IOGP Specification was prepared by a Joint Industry Project 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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Foreword

This specification was prepared under a Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization for projects globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly approved specification, building on recognized industry and/or international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages, facilitating improved standardization of major projects across the globe. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2014).

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Introduction

The purpose of this specification is to define a minimum common set of specification requirements for the procurement of low voltage motors in accordance with IEC 60034, Edition 13.0, 2017, Rotating electrical machines – Part 1: Rating and performance for application in the petroleum and natural gas industries.

This JIP33 standardized procurement specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.



**JIP33 Specification for Procurement Documents
Supplementary Technical Specification**

It is required to use all of these documents in conjunction with each other when applying this specification, as follows:

IOGP S-703: Supplementary Specification to IEC 60034-1 Low Voltage Three Phase Cage Induction Motors

This specification is written as an overlay to IEC 60034-1, following the clause structure of the parent standard, to assist in cross-referencing the requirements. Where clauses from the parent standard IEC 60034-1 are not covered in this specification, there are no supplementary requirements or modifications to the respective clause. The terminology used within this specification follows that of the parent standard and otherwise is in accordance with ISO/IEC Directives, Part 2.

Modifications to the parent standard defined in this specification are identified as Add (add to clause or add new clause), Replace (part of or entire clause) or Delete.

IOGP S-703D: Data Sheet for Low Voltage Motors

This document provides project specific requirements where this specification requires the purchaser to define an application specific requirement. It also includes information required by the purchaser for technical evaluation. Additional purchaser supplied documents are also listed in the data sheet, to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-703L: Information Requirements for Low Voltage Motors

This document defines the information requirements, including format, timing and purpose, for information to be provided by the vendor. It also defines the specific conditions which must be met for conditional information requirements to become mandatory. The information requirements listed in the IRS have references to the source of the requirement.

IOGP S-703Q: Quality Requirements for Low Voltage Motors

This document includes a conformity assessment system (CAS) which specifies standardized user interventions against quality management activities at four different levels. The applicable CAS level is specified by the purchaser in the data sheet.

The data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The supplementary specification and QRS are fixed documents.

Unless defined otherwise in the purchase order, the order of precedence (highest authority listed first) of the documents shall be:

- a) regulatory requirements;
- b) contract documentation (e.g. purchase order);
- c) purchaser defined requirements (data sheet, IRS, QRS);
- d) this specification;
- e) the parent standard.

1 Scope

Add new subclause

1.1 General

This specification amends and supplements IEC 60034-1, Edition 13.0, 2017 for the design, materials, fabrication and testing of low voltage AC squirrel cage induction machines for petroleum, chemical and other severe-duty industry applications.

The requirements detailed in this specification are intended to:

- a) Establish minimum default selections from the options given in IEC 60034-1 and options from other listed normative references;
- b) Specify additional and functional requirements where IEC 60034-1 is insufficiently detailed;
- c) Specify provisions or options to encourage motor variant rationalization.

This specification amends and supplements IEC 60034-1 Edition 13.0 : 2017, referring sequentially to the same clause numbers. Clauses of IEC 60034-1 that are not addressed within this specification shall remain fully applicable as written. Where there is no direct corresponding IEC 60034-1 clause, a new reference clause number has been added in this specification.

Add new subclause

1.2 Machines included in scope

Included in the scope of this specification are electric machines that:

- are of a.c. squirrel cage induction type;
- have a rated power from 0,12 kW to 1 000 kW;
- have a rated voltage above 50 V up to 1 kV;
- have 2, 4, 6 or 8 poles;
- are air cooled;
- are for single speed use; or
- are for adjustable speed use when supplied by a static converter.

Add new subclause

1.3 Machines excluded from scope

Excluded from the scope of this specification are electric machines that:

- rated at a voltage exceeding 1 kV a.c.;
- fitted with sleeve bearings;
- submersible, sub-sea or "canned" machines;
- d.c. machines;

- single phase machines;
- synchronous machines;
- motor operated valve actuators.

Add new subclause

1.4 Extended use of this specification

This specification may be used as a basis for the purchase of electric machines which are outside the immediate scope of this specification, with those clauses that remain relevant for machines of a similar construction and cooling method, such as:

- reluctance motors;
- permanent magnet motors;
- motors with 10 poles or more;
- induction generators;
- close-coupled motors.

Those parameters which are outside the scope of this specification are subject to agreement between the purchaser and the manufacturer.

Add new subclause

1.5 Specification variants

Annex C provides guidance on typical availability of option variants identified in the data sheet IOGP S-703D, according to frame size.

2 Normative references

Add to clause

IEC 60034-1:2017	Rotating electrical machines – Part 1: Rating and performance
IEC 60034-7	Rotating Electrical Machines – Part 7: Classification of Types of Construction, Mounting Arrangements and Terminal Box Position (IM Code)
IEC 60034-9: 2007	Rotating Electrical Machines – Part 9: Noise Limits
IEC 60034-14: 2018	Rotating electrical machines – Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher – Measurement, evaluation and limits of vibration severity
IEC 60072-1: 1991	Dimensions and output series for rotating electrical machines – Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080
IEC 60079-0	Explosive atmospheres – Part 0: Equipment – General requirements
IEC 60079-1	Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”
IEC 60079-7	Explosive atmospheres – Part 7: Equipment protection by increased safety “e”
IEC 60423: 2007	Conduit systems for cable management – Outside diameters of conduits for electrical installations and threads for conduits and fittings

IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
ISO 281	Rolling bearings — Dynamic load ratings and rating life
ISO 1680	Acoustics — Test Code for the Measurement of Airborne Noise Emitted by Rotating Electrical Machines
ISO 3744	Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane
ISO 5753-1: 2009	Rolling bearings — Internal clearance — Part 1: Radial internal clearance for radial bearings
ISO 12944-1	Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 1: General introduction
ISO 12944-2	Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments
ISO 21940-11	Mechanical vibration — Rotor balancing — Part 11: Procedures and tolerances for rotors with rigid behaviour
ISO 21940-32	Mechanical vibration — Rotor balancing — Part 32: Shaft and fitment key convention

3 Terms and definitions

Add new term

3.34

adjustable speed power drive system (ASD)

equipment, based on power electronics, which enables the machine speed and/or torque to be continuously controlled

5 Rating

5.5 Rated output

5.5.3 Motors

Replace first sentence with

The machine rated output is the mechanical power available at the shaft and shall be expressed in kilowatts (kW).

Add new subclause

5.5.3.1

For motors operating in an ambient air temperature not exceeding 40 °C, the motor rated output shall be in accordance with the primary series of preferred rated output values as defined in IEC 60072-1, Table 7.

Add new subclause

5.5.3.2

For motors operating in an ambient air temperature exceeding 40 °C, the motor rated output shall be in accordance with either the primary series or secondary series of preferred rated output values, as defined in IEC 60072-1, Table 7.

6 Site conditions

6.1 General

Replace first sentence with

Unless specified otherwise in the data sheet, machines shall be suitable for the following site conditions outside the casing during operation, for standstill, storage and transportation.

6.2 Altitude

Replace subclause with

Unless specified otherwise in the data sheet, the altitude shall not exceed 1 000 m above sea-level.

6.3 Maximum ambient air temperature

Replace subclause with

Unless specified otherwise in the data sheet, the ambient air temperature shall not exceed 40 °C.

6.4 Minimum ambient air temperature

Replace subclause with

Unless specified otherwise in the data sheet, the ambient air temperature shall not be less than –15 °C.

Add new subclause

6.8 Maximum relative humidity

The machine shall be designed to operate in 100 % relative humidity at a maximum ambient temperature as specified in the data sheet.

Add new subclause heading

6.9 Degree of ingress protection

Add new subclause

6.9.1

Unless specified otherwise in the data sheet, machine enclosures shall have a minimum degree of ingress protection of IP55, in accordance with IEC 60034-5.

Add new subclause

6.9.2

With the exception of Ex db explosion protected machines, a normally open drain hole shall be provided at machine enclosure low point(s) when mounted at the designated IM orientation on frame sizes 80 and above.

Add new subclause

6.10 Degree of impact protection

Machines shall have a minimum degree of protection against harmful external mechanical impacts of IK08 as defined in IEC 62262.

7 Electrical operating conditions

7.1 Electrical supply

Replace second sentence of third paragraph with

In this case, the insulation system shall be suitable for IVIC C for phase-to-phase and IVIC B for phase-to-ground.

7.2 Form and symmetry of voltages and currents

7.2.1 AC motors

7.2.1.1

Add to subclause

Unless specified otherwise in the data sheet, machines intended to be directly connected to distribution or utilisation systems shall be rated to operate with a total harmonic distortion of the supply, not exceeding 8 %.

7.4 Three-phase a.c. machines operating on unearthed systems

Replace second sentence of first paragraph

Machines shall be suitable for operation on unearthed systems with one line at earth potential for periods not exceeding eight hours on any occasion and with the total duration of earth faults in any year not exceeding 125 hours.

8 Thermal performance and tests

8.1 Thermal class

Replace first paragraph with

Unless specified otherwise in the data sheet, the machine insulation system shall be thermal class F as defined in IEC 60085 and rated without exceeding thermal class B temperature limits.

8.6 Determination of winding temperature

8.6.1 Choice of method

Replace first paragraph with

For measuring the temperature of the windings of a machine, the resistance method in accordance with 8.5.2 shall be applied (see also 8.6.2.3.3).

9 Other performance and tests

9.1 Routine tests

Replace third and fourth sentences of first paragraph with

The machine shall be fully assembled with the exception of parts that must be removed to enable the test to be performed. Routine tests do not need the machine to be coupled.

Add new subclause heading

9.12 Machine starting, re-starting and re-acceleration

Add new subclause heading

9.12.1 Starting

Add new subclause

9.12.1.1

Unless specified otherwise in the data sheet, the machine starting performance shall be in accordance with IEC 60034-12 Type NE designation.

Add new subclause

9.12.1.2

The declared locked-rotor current of a machine rated greater than 63 kW shall not exceed 7.5 times the rated current of the machine.

9.12.1.3

The declared locked-rotor current of a machine rated less than or equal to 63 kW shall be in accordance with IEC 60034-12, Table 2 and Table 3.

Add new subclause

9.12.1.4

At 80 % of rated voltage measured at motor terminals, the machine shall be capable of direct-on-line starting, achieving rated speed at rated load, without exceeding maximum temperature rise specified in the data sheet.

Add new subclause heading

9.12.2 Re-starting

Add new subclause

9.12.2.1

At voltage not less than 80 % of rated voltage and maximum ambient air temperature condition, from a "cold start" the machine shall be capable of withstanding three starts in succession, or two "hot starts" following rated full load operation.

Add new subclause

9.12.2.2

The motor shall be capable of repeating these starting cycles after a 30 minute cool down period.

Add new subclause

9.12.3 Re-acceleration

Machines shall be suitable for re-acceleration with 100 % residual voltage and in total phase opposition to the supply voltage.

Add new clause heading

9.13 Noise

Add new subclause

9.13.1

Unless specified otherwise in the data sheet, the maximum A-weighted sound power level at no load and maximum speed, shall not exceed the values defined by IEC 60034-9 Table 2 and not exceed 90 dBA.

Add new subclause

9.13.2

Sound pressure level measurements shall be in accordance with ISO 1680/ISO 3744 (rotating electrical machines)/(grade 2 determination of sound power levels; sound pressure enveloping surface method).

Add new subclause

9.13.3

If tonal characteristics exist, the maximum sound pressure level shall be 5 db(A) less than the value defined in IEC 60034-9, Table 2, when measured at a distance of 1 m from the machine.

NOTE Tonal characteristics are considered to exist if any octave band exceeds the level of adjacent bands by 5 db(A) with the sound meter set to linear response.

Add new subclause

9.13.4

The defined machine noise limitations shall be achieved without the requirement for secondary noise abatement measures, such as the use of acoustic covers.

10 Rating plates

10.1 General

Add new subclause

10.1.1

Rating and marking plates shall be made of 316L stainless steel.

Add new subclause

10.1.2

Rating and marking plates shall be attached to a non-removable part of the machine frame with stainless steel 316L fixings.

Add new subclause

10.1.3

Rating and marking plates shall have information stamped or engraved.

10.2 Marking

Replace list item aa) with

aa) The total mass of the machine, if exceeding 25 kg.

Add to list

ee) D-end and N-end bearing type.

11 Miscellaneous requirements

11.1 Protective earthing of machines

Replace third paragraph with

The terminal for the earthing conductor shall be situated in the vicinity of the terminals for the line conductors within the terminal box.

Add to subclause after third paragraph

Machines of all frame sizes shall have an ISO metric thread earthing terminal fitted externally on the frame body.

Add new subclause heading

11.3 Machine construction

Add new subclause heading

11.3.1 Housing

Add new subclause

11.3.1.1

Frames, stator end-shields and bearing housings shall be constructed from cast iron.

Add new subclause

11.3.1.2

Fan covers shall be constructed from ferrous metal.

Add new subclause

11.3.1.3

Each machine with a fully assembled mass greater than 25 kg shall be provided with frame mounted lifting lugs or lifting eyebolts.

Add new subclause heading

11.3.2 Rotor

Add new subclause

11.3.2.1

All machine rotors shall be balanced with a half-key fitted in the shaft keyway in accordance with IEC 60034-14 and ISO 21940-32.

Add new subclause

11.3.2.2

Rotors shall be balanced in accordance with ISO 21940-11 to meet the limits of maximum vibration magnitude specified in the data sheet, as defined in IEC 60034-14, Table 1.

Add new subclause

11.3.2.3

Both rotor shaft ends shall have an ISO metric threaded hole to facilitate removal of couplings or bearing races.

Add new subclause heading

11.3.3 Fan

Add new subclause

11.3.3.1

Unless specified otherwise in the data sheet, the external fan impeller shall be constructed from glass fibre reinforced polypropylene.

Add new subclause

11.3.3.2

Uni-directional fans external to the stator frame end shields shall be individually balanced prior to fitting to the rotor shaft.

Add new subclause

11.3.3.3

Fan impellers external to the stator frame shall be keyed to the rotor shaft.

Add new subclause heading

11.3.4 Terminal box

Add new subclause

11.3.4.1

Unless specified otherwise in the data sheet, the motor line conductor terminal box shall be located along the top (0°) axis of the motor frame.

Add new subclause

11.3.4.2

The line conductor terminal box shall permit cable entry from any one of at least three directions, 90° apart, from the non-drive end, or the left or the right hand side.

Add new subclause

11.3.4.3

Terminal boxes shall be made of cast iron.

Add new subclause

11.3.4.4

Threaded gland entries shall have a metric thread in accordance with IEC 60423, Table 1.

Add new subclause

11.3.4.5

All gland entries shall be fitted with temporary storage blanking plugs to maintain the ingress protection rating of the machine during transportation and storage.

Add new subclause

11.3.4.6

Unless specified otherwise in the data sheet, cable entry sizes and terminal sizes shall be as per the manufacturer's standard offering for that frame size.

Add new subclause heading

11.3.5 Bearings

Add new subclause

11.3.5.1

Machines of a frame size up to and including 132 shall have grease lubricated anti-friction bearings, packed and sealed for life.

Add new subclause

11.3.5.2

Unless specified otherwise in the data sheet, bearings shall be C3 type as defined in ISO 5753-1, Table 1, Group 3.

Add new subclause

11.3.5.3

Machine bearings shall have an L10 bearing design lifetime of 25 000 hours for 2 pole machines and 50 000 hours for 4, 6 and 8 pole machines, with the design lifetime calculated in accordance with ISO 281.

Add new subclause

11.3.5.4

Where specified as required in the data sheet, stainless steel SPM (shock pulse monitoring) nipples shall be provided on the D-end and N-end of the machine.

Add new subclause heading

11.3.6 Space heaters

Add new subclause

11.3.6.1

Machines shall only be provided with space heaters where specified in the data sheet.

NOTE When advised by the manufacturer that space heaters are necessary at the defined site conditions, machines should be provided with space heaters.

Add new subclause

11.3.6.2

The space heater shall be rated for operation at the heater supply a.c. voltage specified in data sheet.

Add new subclause

11.3.6.3

Space heaters shall maintain the surface temperature of the stator windings at not less than 5 K above ambient air temperature.

Add new subclause

11.3.6.4

Where space heater terminals are incorporated in the motor line conductor terminal box, a dedicated separate space heater earth terminal shall be provided within the terminal box.

Add new subclause**11.3.6.5**

A label shall be fixed externally to the terminal box containing the heater terminals, stating "WARNING: HEATER TERMINALS MAY BE LIVE WHEN MOTOR IS ISOLATED".

Add new subclause**11.3.6.6**

Where space heater terminals are incorporated in the motor line conductor terminal box, the space heater terminals shall be rated a minimum of IP2X.

Add new subclause heading**11.4 Mounting**Add new subclause**11.4.1 Mounting arrangement**

Unless specified otherwise in the data sheet, machines shall have a mounting arrangement as per the following defined, in IEC 60034-7:

- For horizontal shaft, foot mounted machines: IM B3 (IM 1001);
- For horizontal shaft, flange mounted machines: IM B5 (IM 3001);
- For vertical shaft, foot mounted machines: IM V6 (IM 1031);
- For vertical shaft, flange mounted machines: IM V1 (IM 3011).

Add new subclause**11.4.2 Vertically mounted machines**

Vertically mounted machines with a downward facing drive-end shaft shall be provided with a canopy over any upward facing air inlets.

Add new subclause**11.5 Methods of cooling**

Unless specified otherwise in the data sheet, the machine cooling method shall be IC4A1A1 as defined in IEC 60034-6.

Add new subclause heading**11.6 Machine efficiency**Add new subclause**11.6.1**

Unless specified otherwise in the data sheet, duty type S1 machines shall have a minimum rated efficiency class of IE3 as defined in IEC 60034-30-1.

NOTE The above requirement also applies to Ex machines certified for use in potentially explosive atmospheres.

Add new subclause

11.6.2

Unless specified otherwise in the data sheet, duty type S9 machines for use with adjustable speed drives shall have a minimum rated efficiency class of IE2 as defined in IEC 60034-30-1.

NOTE The above requirement also applies to Ex machines certified for use in potentially explosive atmospheres.

Add new subclause

11.7 Vibration

Unless specified otherwise in the data sheet, motors shall be vibration grade A in accordance with IEC 60034-14, Table 1.

Add new subclause heading

11.8 Surface finish

Add new clause

11.8.1

Unless specified otherwise in the data sheet, for onshore applications, the protective paint system corrosivity category shall be a minimum of C3 in accordance with ISO 12944-2.

Add new subclause

11.8.2

Unless specified otherwise in the data sheet, for offshore applications, the protective paint system corrosivity category shall be a minimum of C4 in accordance with ISO 12944-2.

Add new subclause

11.8.3

Unless specified otherwise in the data sheet the protective paint system durability category shall be a minimum of “medium” in accordance with ISO 12944-1.

Add new subclause heading

11.9 Machines for operation with adjustable speed drives

Add new subclause

11.9.1 General

Where adjustable speed operation is specified in the data sheet, machines shall comply with the requirements of IEC TS 60034-25.

Add new subclause

11.9.2 Bearing insulation

For machines with frame sizes 280 and above, the N-end bearing shall be insulated.

Add new subclause heading

11.9.3 Temperature monitoring

Add new subclause

11.9.3.1

Unless specified otherwise in the data sheet, a PTC thermistor shall be embedded in each stator phase winding.

Add new subclause

11.9.3.2

Temperature monitoring devices shall be wired to a separate terminal box mounted on the machine frame.

12 Tolerances

Replace Item 9 "Tolerance" value in Table 21 with

" ± 0 % of the current"

Add new clause heading

15 Machines intended for use in potentially explosive atmospheres

Add new subclause heading

15.1 General

Add new subclause

15.1.1

Machines defined in the data sheet for use in potentially explosive atmospheres shall be in conformance with IEC 60079.

Add new subclause

15.1.2

Machines with a defined equipment protection level of EPL a or EPL b or EPL c shall be supported with an equipment certificate issued by a notified body or certification body to the scheme specified in the data sheet.

Add new subclause**15.1.3**

Unless specified otherwise in the data sheet, the machine shall be certified EPL G for temperature group T3 as a minimum and for gases in group IIB as a minimum.

Add new subclause**15.1.4**

Machines shall be designed, constructed, tested and marked to one of the following:

- Ex db the machine shall comply with IEC 60079-1;
- Ex db eb the machine shall comply with IEC 60079-1 and IEC 60079-7;
- Ex eb the machine shall comply with IEC 60079-7;
- Ex ec the machine shall comply with IEC 60079-7.

Add new subclause heading**15.2 Flameproof (type Ex db)**Add new subclause**15.2.1**

On machines with a defined equipment protection level of Ex db eb, all terminal boxes shall have an equipment protection level of Ex eb.

Add new subclause**15.2.2**

A drain fitted with a certified drain plug shall be provided at the machine enclosure low points when mounted at the designated IM orientation.

Add new subclause heading**15.3 Machines supplied by an ASD**Add new subclause**15.3.1**

Where type test certification is unavailable for this duty as a unit in association with a specific ASD, means of temperature control as specified in IEC 60079-0 shall be provided.

Add new subclause**15.3.2**

On machines with a defined equipment protection level of Ex ec, where type test certification is unavailable for this duty as a unit in association with the specified ASD, or with a comparable ASD, a calculation shall be performed by the manufacturer to establish the thermal performance with a converter (and output filter, if used) throughout the specified speed and torque range as specified in IEC 60079-7.

Public Review Draft

Annex C

(informative)

Typical specification variants according to machine frame size

Table C.1 provides guidance on the availability of options according to frame size. Manufacturer offerings may vary from the guidance below, therefore availability should always be confirmed by the manufacturer prior to order placement.

Add new table

Table C.1 - Options according to frame size

Frame size	S-703 reference	63	71	80	90	100	112	132	160	200	225	250	280	315	355	400	450
Drain hole ⁽¹⁾	6.9.2	O	O	R	R	R	R	R	R	R	R	R	R	R	R	R	R
External earthing bolt	11.1	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
GRP fan	11.3.3.1	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2Z bearings greased for life	11.3.5.1	R	R	R	R	R	R	R	O	O	O	O	N/A	N/A	N/A	N/A	N/A
C4M according to IEC 12944-2 paint system ⁽²⁾	11.8.2	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Separate temperature monitoring terminal box	11.9.3.2	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
SPM compatible nipples for vibration monitoring	-	O	O	O	O	O	O	O	S	S	S	S	S	S	S	S	S
PT100 bearing temperature monitoring	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	O	O	O	O	O	O	O	O
PTC winding temperature monitoring	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Regreasable bearings via grease nipples	-	O	O	O	O	O	O	O	S	S	S	S	S	S	S	S	S
Heaters ⁽³⁾	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Separate heater terminal box	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Bi-directional fan	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Uni-directional fan for reduced noise	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	O	O	O	O	O
Steel fan	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Larger than standard terminal box	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	N/A
C5M according to IEC 12944-2 paint system	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Norsok M-501 coating system	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
⁽¹⁾ With the exception of Ex db explosion protected machines, a normally open drain hole shall be provided at machine enclosure low point(s) on frame sizes 80 and above.																	
⁽²⁾ Additional requirement for machines located offshore.																	
⁽³⁾ When advised by the manufacturer that space heaters are necessary at the defined site conditions, machines should be provided with space heaters.																	
R = IOGP S-703 requirement																	
S = typically provided as a standard feature by manufacturers for severe duty motors																	
O = typically available as priced option																	
N/A = typically not available for this frame size																	

Add new table

Table C.2 - Options for machines supplied by adjustable speed drive

Frame size	S-703 reference	63	71	80	90	100	112	132	160	200	225	250	280	315	355	400	450
Insulated N-end bearing	11.9.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	O	O	O	O	R	R	R	R	R
PTC winding temperature monitoring	11.9.3	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
EMC cable entry	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
R = IOGP S-703 requirement																	
S = typically provided as a standard feature by manufacturers for severe duty motors																	
O = typically available as priced option																	
N/A = typically not available for this frame size																	

Add new table

Table C.3 - Options for testing requirements

Testing	S-703 reference	63	71	80	90	100	112	132	160	200	225	250	280	315	355	400	450
Noise test report (identical machine)	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Vibration test report (actual machine)	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Overspeed test report (actual machine)	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Type test report (identical machine)	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Routine test report (actual machine)	-	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
R = IOGP S-703 requirement																	
S = typically provided as a standard feature by manufacturers for severe duty motors																	
O = typically available as priced option																	
N/A = typically not available for this frame size																	

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