

Intelligent Drivesystems, Worldwide Services



ATEX



B 1091-1 – en

Motors in FI operation for Category 2D/3D

Planning guideline for B 1091



Intended use of three-phase asynchronous motors in frequency inverter operation

Compliance with the planning guide B1091-1 for the operating and installation instructions B1091, as well as with the operating instructions for the frequency inverter is **essential for correct operation** and the fulfilment of any warranty claims. **Read the operating and installation instructions** before starting work with the motors and frequency inverters.

These operating instructions contain **important information about servicing**. They must therefore be kept **close to the motor**.

The asynchronous motors and frequency inverters are intended for industrial and commercial systems for the movement of various drive components and applications.

All details regarding technical data and permissible conditions at the installation site must be complied with.

Commissioning (implementation of the intended use) is not permitted until it has been ensured that the machine complies with the EMC directive 2014/30/EU and that the conformity of the end product meets the machine directive 2006/42/EEC (note EN 60204).

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Documentation

Name:	B 1091-1	Planning Guideline
Part No.:	6052102	
Series:	Three-phase asynchronous motors in frequency inverter operation	
Motor series:	IE1, IE2	
Type of ignition protection:	Ex tb, Ex tc	
Motor types:	Size 63 ... 180 4-pole	

Version list

Designation of previous issues	Comments
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B1091-1, October 2017 Part No. 6052102 verfügbar. / 4317	Change of document reference from G4014 to G4014-1

Table 1: Version list

Validity

This Planning Guideline for the operation and instructions B 1091 describes the planning requirements for NORD three-phase asynchronous motors supplied by frequency inverters for Zone 22 (Ex tc) and for Zone 21 (Ex tb).

Publisher

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Table of Contents

1	Technical explanations	8
1.1	General.....	8
1.2	Overview.....	8
1.2.1	Category 3D motors according to EU Directive 2014/34/EU.....	9
1.3	Wiring:.....	9
1.4	Commissioning.....	10
1.5	Assignment of the frequency inverter and selection of the operating mode.....	11
1.6	Examples.....	12
1.6.1	1. Example: motor 100L/4 3D TF.....	12
1.6.2	2nd Example: motor 100L/4 3D TF.....	15
1.7	Motor data for parameterisation of the frequency inverter.....	16
1.7.1	Parameterisation data for the 50 Hz characteristic curve, IE1 and IE2 motors.....	16
1.7.2	Parameterisation data for the 87 Hz characteristic curve, IE1 and IE2 motors.....	17
1.7.3	Parameterisation data for the 100 Hz characteristic curve, IE1 and IE2 motors.....	18
2	Technical Data	19
2.1	Motors.....	19
2.1.1	Motors with 50 Hz / 87 Hz / 100 Hz nominal points.....	20
2.1.1.1	Motors with 50 Hz nominal point, Size 63S/4 to 71L/4 for Category 2D and 3D.....	20
2.1.1.2	Motors with 50 Hz nominal point, Size 80S/4 to 132M/4 for Category 3D.....	21
2.1.1.3	Motors with 50 Hz nominal point, Size 80SH/4 to 180LH/4 for Category 2D and 3D.....	22
2.1.1.4	Motors with 87 Hz nominal point, Size 63S/4 to 71L/4 for Category 2D and 3D.....	24
2.1.1.5	Motors with 87 Hz nominal point, Size 80S/4 to 132M/4 for Category 3D.....	25
2.1.1.6	Motors with 87 Hz nominal point, Size 80SH/4 to 180LH/4 for Category 2D and 3D.....	26
2.1.1.7	Motors with 100 Hz nominal point, Size 63S/4 to 71L/4 for Category 2D and 3D.....	28
2.1.1.8	Motors with 100 Hz nominal point, Size 80S/4 to 132M/4 for Category 3D.....	29
2.1.1.9	Motors with 100 Hz nominal point, Size 80SH/4 to 180LH/4 for Category 2D and 3D.....	30
2.2	Motors with external fans (Category 3D).....	32
2.2.1	Motors with external fans, 50 Hz nominal point, Category 3D.....	33
2.2.2	Motors with external fans, 87 Hz nominal point, Category 3D.....	34
2.2.3	Motors with external fans, 100 Hz nominal point, Category 3D.....	35
3	Appendix	36
3.1	Abbreviations.....	36
3.2	Legend / Formula symbols.....	36

List of illustrations

Figure 1: Selection of V/f characteristic curves.....	11
Figure 2: Motor 100L/4, 50 Hz characteristic curve	12
Figure 3: Motor 100L/4, 100 Hz characteristic curve	13
Figure 4: Motor 100L/4, 87 Hz characteristic curve	14

List of tables

Table 1: Version list	3
Table 2: Parameterisation data for the 50 Hz characteristic curve, IE1 motors	16
Table 3: Parameterisation data for the 50 Hz characteristic curve, IE2 motors	16
Table 4: Parameterisation data for the 87 Hz characteristic curve, IE1 motors	17
Table 5: Parameterisation data for the 87 Hz characteristic curve, IE2 motors	17
Table 6: Parameterisation data for the 100 Hz characteristic curve, IE1 motors	18
Table 7: Parameterisation data for the 100 Hz characteristic curve, IE2 motors	18
Table 8: IE1 motors, 50 Hz nominal point for Category 2D and 3D	20
Table 9: IE1 motors, 50 Hz nominal point for Category 3D	21
Table 10: IE2 motors, 50 Hz nominal point for Category 2D and 3D	23
Table 11: IE1 motors, 87 Hz nominal point for Category 2D and 3D	24
Table 12: IE1 motors, 87 Hz nominal point for Category 3D	25
Table 13: IE2 motors, 87 Hz nominal point for Category 2D and 3D	27
Table 14: IE1 motors, 100 Hz nominal point for Category 2D and 3D	28
Table 15: IE1 motors, 100 Hz nominal point for Category 3D	29
Table 16: IE2 motors, 100 Hz nominal point for Category 2D and 3D	31
Table 17: IE1 and IE2 motors with external fan, 50 Hz nominal point	33
Table 18: IE1 and IE2 motors with external fan, 87 Hz nominal point	34
Table 19: IE1 and IE2 motors with external fan, 100 Hz nominal point	35

1 Technical explanations

1.1 General

Category 2D and 3D motors supplied by NORD DRIVESYSTEMS comply with the standards EN 60079-0 and EN 60079-31. The insulation of the windings is designed for operation with frequency inverters. For operation with frequency inverters, the motors are always equipped with triple thermistors as per DIN 44082.

For variable speed drives, the thermistor is the most important protective element to ensure compliance with the maximum surface temperature, which is stated in the type plate of the motor.

As the thermistor only provides indirect temperature monitoring of some components of the motor, e.g. the motor shaft, it is necessary to observe all the specifications which are stated in this planning guideline.

The operating ranges stated in the Appendix have been checked in the course of extensive test runs and only these ranges are approved. Compliance with the stated procedures is therefore a prerequisite for the planning and commissioning of Device Group II regulated drive units in Zone 22 (non-conducting dust), as well as in Zone 21.

1.2 Overview

Necessary frequency inverter characteristics:

- Only frequency inverters with a vector regulation process which provides load-dependent terminal voltage adjustment in the low speed range may be used.
- The maximum output voltage of the frequency inverter must not be less than 91 % of the mains voltage.
- The inverter must provide $i^2 \cdot t$ monitoring which is adjustable to the rated current for the motor.
- The pulse frequency of the output stage must be adjustable to 4 kHz or higher.
- If the inverter does not have an input for evaluation of the thermistor, the evaluation must be carried out by a separate triggering device, which switches off the inverter. Operation without evaluation of the thermistor is not permitted.
- Evaluation of the thermistor for motors with ignition protection type tb (Category 2D) must be carried out with an external certified thermistor triggering device with an EU type test certificate. Evaluation of the thermistor via the thermistor evaluation input on the frequency inverter is not permitted. In case of a fault (excessive temperature) the motor and frequency inverter combination must be safely switched off via the external thermistor triggering device.

1.2.1 Category 3D motors according to EU Directive 2014/34/EU

For Category 3D motors as per EU Directive 2014/34/EU with the frequency inverter mounted on the motor, the following steps must be observed for the determination of the maximum permissible torque:

1. Determination of the maximum permissible torque on the basis of B1091-1
2. Determination of the maximum permissible torque for the required operating point according to G4014-1 on the basis of a NORD standard motor (not ATEX) of the same size and power rating.
3. The maximum permissible value must be obtained via the following comparison.
 - a) If the value of the torque from document G4014-1 is larger than the torque value in the Planning Guideline B1091-1, the torque value from the Planning Guideline B1091-1 must be used.
 - b) If the value of the torque from the Planning Guideline B1091-1 is larger than the value of the torque in document G4014-1, the value from document G4014-1 must be used.

1.3 Wiring:

- No filters which come into the resonance range may be wired between the inverter and the motor. The resulting overvoltage could damage the insulation of the cable or the motor.
- Only filters which are prescribed or approved by the supplier of the frequency inverter may be used.
- The wires used must have an insulation strength of at least 2,000 VDC.
- Additional mains or motor chokes reduce the output voltage of the frequency inverter and are not considered in this planning guideline. Chokes shift the threshold of the field weakening range downwards and the field weakening becomes greater.
- The maximum permissible length of the cable is 30 m

1.4 Commissioning

- Set the pulse frequency of the output stage to 4 - 6 kHz.
- Parameterise the vector regulation to the motor used.
- The i^{2*t} monitoring must be set to the rated current for the motor.
- The maximum frequency must be set according to the application and must not exceed 100 Hz.
- Activate the thermistor evaluation. An external, certified thermistor triggering device must be used for 2D motors.
- Check the thermistor monitoring by disconnecting the cable connected to the frequency inverter or to the connection of the external thermistor triggering device.

The type plate of the motor which is suitable for the application must be observed. An explanation of the details on the type plate can be found in the NORD Operating and Installation Instructions B1091.

The values for current, speed and torque which are stated in the tables are maximum values and must not be exceeded.

If the minimum voltage values which are stated on the motor type plate are not achieved, the motor may not be operated at the corresponding operating point.

NOTICE:**Gear unit damage - high speed**

The maximum permissible input speed of the gear unit must be complied with.

Exceeding the permissible speed may cause overheating and damage to the components of the gear units, up to the complete destruction of the gear unit.

For frequency inverter operation the speed of the motor must be limited according to the planning specifications.

1.5 Assignment of the frequency inverter and selection of the operating mode

The rated current of the frequency inverter must match the rated current of the motor in order to achieve an adequate accuracy of the current measurement. The rated current of the frequency inverter must not exceed 2x the rated motor current.

According to this planning guideline, multiple-motor operation is not permitted, as selective $i^2 \cdot t$ monitoring of a motor is then no longer possible.

Please note the technical data in section 2

According to the application, the operating mode of the motor can be selected from one of the following 3 characteristic curves:

- 50 Hz characteristic curve: Nominal point 400 V / 50 Hz, 0 – 50 Hz no field weakening and 50 – 100 Hz field weakening.
- 87 Hz characteristic curve: Nominal point 400 V / 87 Hz, 0 – 87 Hz no field weakening and 87 – 100 Hz field weakening.
- 100 Hz characteristic curve: Nominal point 400 V / 100 Hz, 0 – 100 Hz reduced constant torque with slight field weakening.

V/f characteristic curves

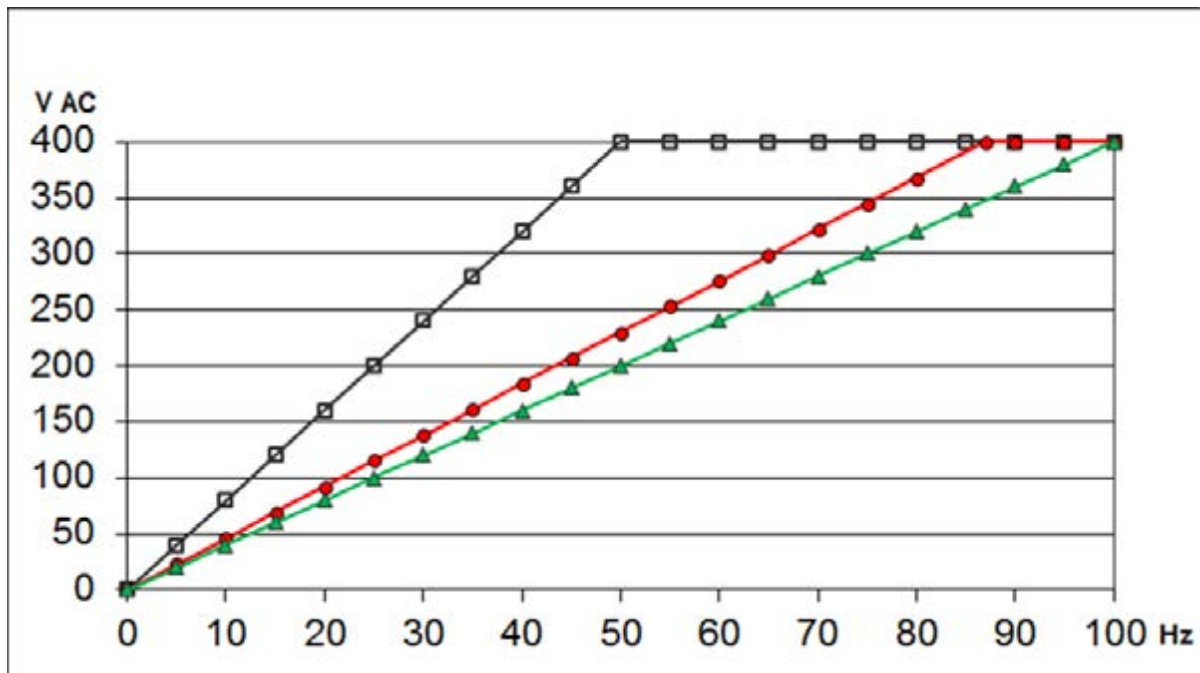





Figure 1: Selection of V/f characteristic curves

Legend

-  50 Hz characteristic curve
-  87 Hz characteristic curve
-  100 Hz characteristic curve

1.6 Examples

1.6.1 1. Example: motor 100L/4 3D TF

Motor type plate information:

Nominal voltage 230 / 400 V
 Nominal frequency: 50 Hz
 Nominal power: 2.2 kW

50 Hz characteristic curve

Motor in star circuit (400 V / 50 Hz), frequency inverter 2.2 kW

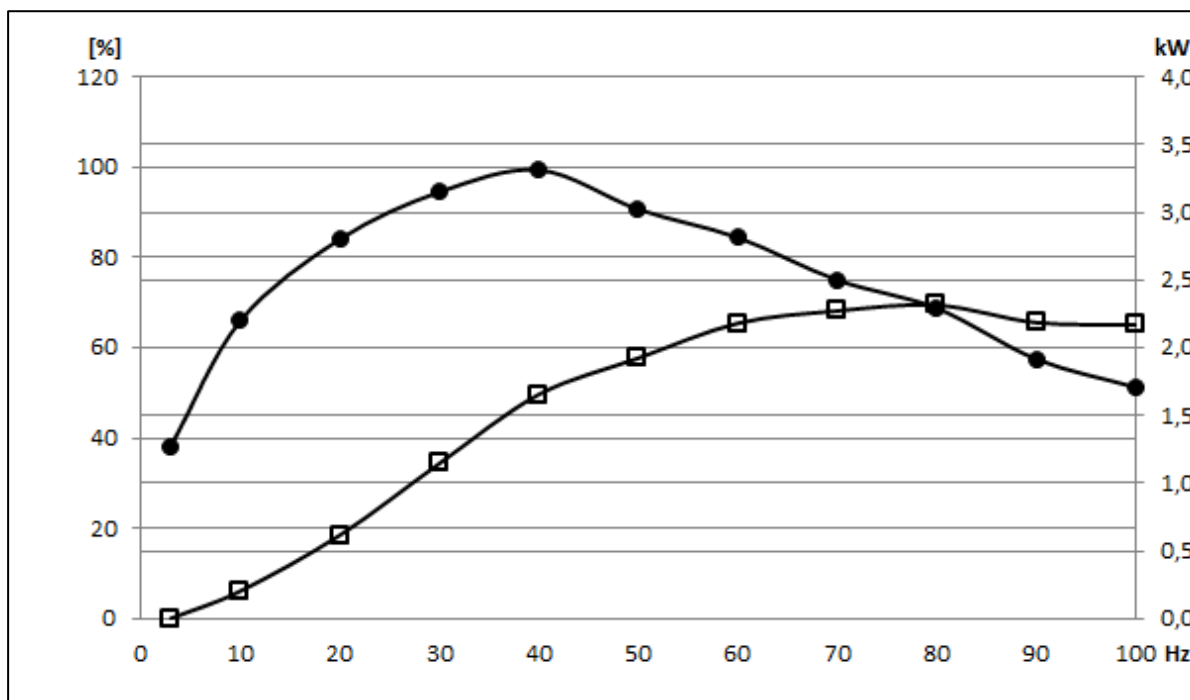




Figure 2: Motor 100L/4, 50 Hz characteristic curve

Legend

-  Motor output power [kW]
-  Torque [%]

100 Hz characteristic curve

Motor in delta circuit (230 V / 50 Hz), frequency inverter 3.0 kW

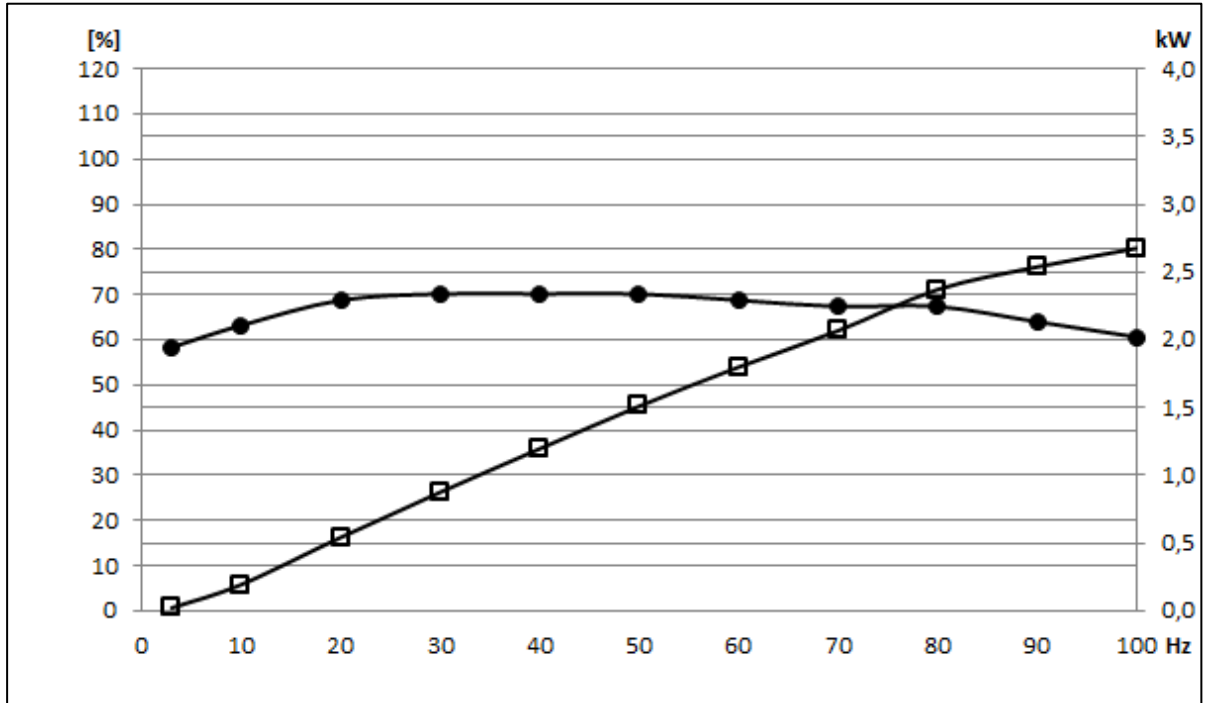


Figure 3: Motor 100L/4, 100 Hz characteristic curve

Legend	
	Motor output power [kW]
	Torque [%]

87 Hz characteristic curve

Motor in delta circuit (230 V / 50 Hz), frequency inverter 4.0 kW

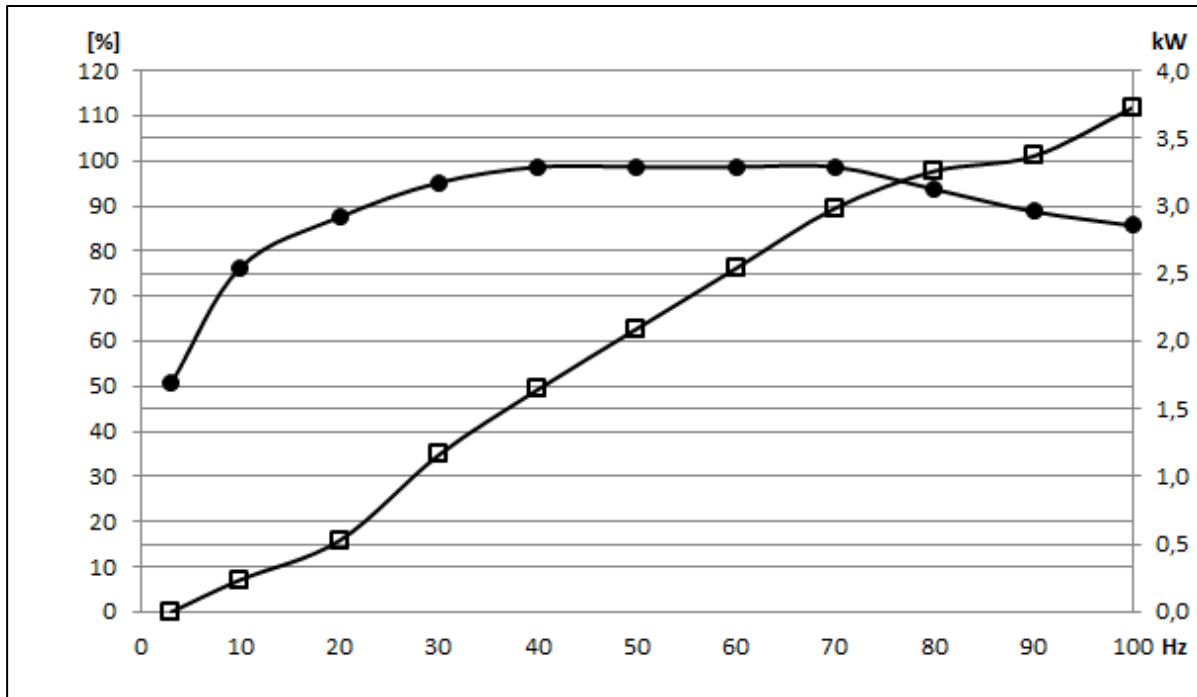


Figure 4: Motor 100L/4, 87 Hz characteristic curve

Legend	
	Motor output power [kW]
	Torque [%]

1.6.2 2nd Example: motor 100L/4 3D TF

Motor type plate information:

Nominal voltage	400 / 690 V
Nominal frequency:	50 Hz
Nominal power:	2.2 kW

Due to the different design of the windings only the 50 Hz characteristic curve can be used with the frequency inverter.

This type of winding is typically used for gentle starting with star/delta circuits. The motor is started in the star circuit (690 V / 50 Hz) and switched to the delta circuit (400 V / 50 Hz) in operation.

1.7 Motor data for parameterisation of the frequency inverter

Motor types: **IE1 and IE2 motors**

1.7.1 Parameterisation data for the 50 Hz characteristic curve, IE1 and IE2 motors

Motor type IE1	Category	f_N [Hz]	n_N [rpm]	I_N [A]	U_N [V]	P_N [kW]	$\cos \varphi$	Circuit	R_{St} [Ω]
63S/4	2D/3D	50	1385	0.51	400	0.12	0.62	Y	68.35
63L/4	2D/3D	50	1368	0.65	400	0.18	0.66	Y	58.19
71S/4	2D/3D	50	1365	0.74	400	0.25	0.80	Y	39.76
71L/4	2D/3D	50	1385	1.05	400	0.37	0.76	Y	22.24
80S/4	3D	50	1385	1.51	400	0.55	0.75	Y	15.79
80L/4	3D	50	1395	2.03	400	0.75	0.75	Y	10.49
90S/4	3D	50	1410	2.76	400	1.1	0.76	Y	6.41
90L/4	3D	50	1390	3.53	400	1.5	0.78	Y	3.99
100L/4	3D	50	1415	5.0	400	2.2	0.78	Y	2.78
100LA/4	3D	50	1415	6.8	400	3.0	0.78	Δ	5.12
112M/4	3D	50	1430	8.24	400	4.0	0.83	Δ	3.47
132S/4	3D	50	1450	11.6	400	5.5	0.8	Δ	2.14
132M/4	3D	50	1450	15.5	400	7.5	0.79	Δ	1.42
132MA/4	3D	50	1445	18.8	400	9.2	0.82	Δ	1.16

Table 2: Parameterisation data for the 50 Hz characteristic curve, IE1 motors

Motor type IE2	Category	f_N [Hz]	n_N [rpm]	I_N [A]	U_N [V]	P_N [kW]	$\cos \varphi$	Circuit	R_{St} [Ω]
80SH/4	2D/3D	50	1415	1.38	400	0.55	0.7	Y	9.34
80LH/4	2D/3D	50	1410	1.8	400	0.75	0.75	Y	6.70
90SH/4	2D/3D	50	1430	2.46	400	1.1	0.8	Y	4.96
90LH/4	2D/3D	50	1420	3.38	400	1.5	0.79	Y	3.27
100LH/4	2D/3D	50	1445	4.76	400	2.2	0.79	Y	1.73
100AH/4	2D/3D	50	1420	6.4	400	3.0	0.77	Δ	4.39
112MH/4	2D/3D	50	1440	8.12	400	4.0	0.83	Δ	2.96
132SH/4	2D/3D	50	1455	10.82	400	5.5	0.83	Δ	1.84
132MH/4	2D/3D	50	1455	15.08	400	7.5	0.8	Δ	1.29
160MH/4	2D/3D	50	1465	20.5	400	11.0	0.85	Δ	0.78
160LH/4	2D/3D	50	1465	27.5	400	15.0	0.87	Δ	0.53
180MH/4	2D/3D	50	1475	34.9	400	18.5	0.84	Δ	0.36
180LH/4	2D/3D	50	1475	40.8	400	22.0	0.86	Δ	0.31

Table 3: Parameterisation data for the 50 Hz characteristic curve, IE2 motors

Legend							
f_N	Nominal frequency	I_N	Nominal current	P_N	Nominal power	Circuit	Δ/Y circuit
n_N	Nominal speed	U_N	Nominal voltage	$\cos \varphi$	Power factor	R_{St}	Resistance on line

1.7.2 Parameterisation data for the 87 Hz characteristic curve, IE1 and IE2 motors

Motor type IE1	Category	f_N [Hz]	n_N [rpm]	I_N [A]	U_N [V]	P_N [kW]	$\cos \varphi$	Circuit	R_{St} [Ω]
63S/4	2D/3D	50	1385	0.88	230	0.12	0.62	Δ	68.35
63L/4	2D/3D	50	1368	1.12	230	0.18	0.66	Δ	58.19
71S/4	2D/3D	50	1365	1.28	230	0.25	0.80	Δ	39.76
71L/4	2D/3D	50	1385	1.82	230	0.37	0.76	Δ	22.24
80S/4	3D	50	1385	2.62	230	0.55	0.75	Δ	15.79
80L/4	3D	50	1395	3.52	230	0.75	0.75	Δ	10.49
90S/4	3D	50	1410	4.78	230	1.1	0.76	Δ	6.41
90L/4	3D	50	1390	6.11	230	1.5	0.78	Δ	3.99
100L/4	3D	50	1415	8.65	230	2.2	0.78	Δ	2.78
100LA/4	3D	50	1415	11.76	230	3.0	0.78	Δ	1.71
112M/4	3D	50	1430	14.2	230	4.0	0.83	Δ	1.11
132S/4	3D	50	1450	20.0	230	5.5	0.8	Δ	0.72
132M/4 3D	3D	50	1450	26.8	230	7.5	0.79	Δ	0.46
132MA/4	3D	50	1455	32.6	230	9.2	0.829	Δ	0.39

Table 4: Parameterisation data for the 87 Hz characteristic curve, IE1 motors

Motor type IE2	Category	f_N [Hz]	n_N [rpm]	I_N [A]	U_N [V]	P_N [kW]	$\cos \varphi$	Circuit	R_{St} [Ω]
80SH/4	2D/3D	50	1415	2.39	230	0.55	0.7	Δ	9.34
80LH/4	2D/3D	50	1410	3.12	230	0.75	0.75	Δ	6.70
90SH/4	2D/3D	50	1430	4.26	230	1.1	0.8	Δ	4.96
90LH/4	2D/3D	50	1420	5.85	230	1.5	0.79	Δ	3.27
100LH/4	2D/3D	50	1445	8.25	230	2.2	0.79	Δ	1.73
100AH/4	2D/3D	50	1420	11.1	230	3.0	0.77	Δ	1.48
112MH/4	2D/3D	50	1440	14.1	230	4.0	0.83	Δ	1.00
132SH/4	2D/3D	50	1455	18.8	230	5.5	0.83	Δ	0.60
132MH/4	2D/3D	50	1455	26.2	230	7.5	0.8	Δ	0.42
160MH/4	2D/3D	50	1465	35.5	230	11.0	0.85	Δ	0.26
160LH/4	2D/3D	50	1465	48.0	230	15.0	0.87	Δ	0.17
180MH/4	2D/3D	50	1475	60.8	230	18.5	0.84	Δ	0.12
180LH/4	2D/3D	50	1475	71.0	230	22.0	0.86	Δ	0.10

Table 5: Parameterisation data for the 87 Hz characteristic curve, IE2 motors

Legend							
f_N	Nominal frequency	I_N	Nominal current	P_N	Nominal power	Circuit	Δ/Y circuit
n_N	Nominal speed	U_N	Nominal voltage	$\cos \varphi$	Power factor	R_{St}	Resistance on line

1.7.3 Parameterisation data for the 100 Hz characteristic curve, IE1 and IE2 motors

Motor type IE1	Category	f_N [Hz]	n_N [rpm]	I_N [A]	U_N [V]	P_N [kW]	$\cos \varphi$	Circuit	R_{St} [Ω]
63S/4	2D/3D	100	2878	0.77	400	0.18	0.63	Δ	68.35
63L/4	2D/3D	100	2880	0.93	400	0.25	0.64	Δ	58.19
71S/4	2D/3D	100	2895	1.07	400	0.37	0.71	Δ	39.76
71L/4	2D/3D	100	2905	1.5	400	0.55	0.74	Δ	22.24
80S/4	3D	100	2910	2.0	400	0.75	0.72	Δ	15.79
80L/4	3D	100	2910	2.8	400	1.1	0.74	Δ	10.49
90S/4	3D	100	2925	3.75	400	1.5	0.76	Δ	6.41
90L/4	3D	100	2920	4.96	400	2.2	0.82	Δ	3.99
100L/4	3D	100	2930	6.95	400	3.0	0.78	Δ	2.78
100LA/4	3D	100	2950	7.46	400	4.0	0.76	Δ	1.71
112M/4	3D	100	2945	11.3	400	5.5	0.82	Δ	1.11
132S/4	3D	100	2955	16.0	400	7.5	0.82	Δ	0.72
132M/4 3D	3D	100	2965	19.6	400	9.2	0.79	Δ	0.46
132MA/4	3D	100	2960	23.0	400	11.0	0.8	Δ	0.39

Table 6: Parameterisation data for the 100 Hz characteristic curve, IE1 motors

Motor type IE2	Category	f_N [Hz]	n_N [rpm]	I_N [A]	U_N [V]	P_N [kW]	$\cos \varphi$	Circuit	R_{St} [Ω]
80SH/4	2D/3D	100	2930	1.9	400	0.75	0.7	Δ	9.34
80LH/4	2D/3D	100	2920	2.56	400	1.1	0.73	Δ	6.7
90SH/4	2D/3D	100	2930	3.53	400	1.5	0.79	Δ	4.96
90LH/4	2D/3D	100	2925	4.98	400	2.2	0.79	Δ	3.27
100LH/4	2D/3D	100	2955	6.47	400	3.0	0.78	Δ	1.73
100AH/4	2D/3D	100	2940	8.24	400	4.0	0.79	Δ	1.48
112MH/4	2D/3D	100	2950	11.13	400	5.5	0.82	Δ	1.0
132SH/4	2D/3D	100	2960	15.3	400	7.5	0.83	Δ	0.6
132MH/4	2D/3D	100	2965	19.5	400	9.2	0.79	Δ	0.42
160MH/4	2D/3D	100	2967	29.0	400	15.0	0.87	Δ	0.256
160LH/4	2D/3D	100	2975	35.7	400	18.5	0.86	Δ	0.168
180MH/4	2D/3D	100	2980	43.2	400	22	0.85	Δ	0.115
180LH/4	2D/3D	100	2980	55.5	400	30	0.88	Δ	0.306

Table 7: Parameterisation data for the 100 Hz characteristic curve, IE2 motors

Legend							
f_N	Nominal frequency	I_N	Nominal current	P_N	Nominal power	Circuit	Δ/Y circuit
n_N	Nominal speed	U_N	Nominal voltage	$\cos \varphi$	Power factor	R_{St}	Resistance on line

2 Technical Data

Data:

Motor type:	IE1 and IE2	Circuit:	See tables
Mains voltage:	400 V	Ambient temperature Tu:	max. 40 °C *
Surface temperature:	T125 °C / T140 °C		

2.1 Motors

*  **Information** **Increased ambient temperatures for 3D motors**

Operation is possible up to an ambient temperature of 60 °C. The stated torques must then be reduced to 72 %.

 **Information** **Interpolation**

A linear interpolation of the data between adjacent frequencies is permissible.

2.1.1 Motors with 50 Hz / 87 Hz / 100 Hz nominal points

2.1.1.1 Motors with 50 Hz nominal point, Size 63S/4 to 71L/4 for Category 2D and 3D

Motor type / Circuit type	Category	3	20	40	60	100	f _s [Hz]
63S/4 230/400 V, 50 Hz Y circuit	2D/3D	0.65	0.86	0.86	0.86	0.54	M [Nm]
	2D/3D	0	450	1073	1484	1805	n [rpm]
	2D/3D	0	0.04	0.1	0.13	0.1	P [kW]
	2D/3D	80	187	347	363	361	V _s [V]
	2D/3D	0.45	0.48	0.52	0.48	0.65	I _s [A]
63L/4 230/400 V, 50 Hz Y circuit	2D/3D	0.71	1.26	1.26	1.26	0.74	M [Nm]
	2D/3D	0	438	1060	1428	1886	n [rpm]
	2D/3D	0	0.06	0.14	0.19	0.15	P [kW]
	2D/3D	65	185	352	361	360	V _s [V]
	2D/3D	0.5	0.61	0.66	0.71	0.8	I _s [A]
71S/4 230/400 V, 50 Hz Y circuit	2D/3D	1.15	1.76	1.76	1.56	0.72	M [Nm]
	2D/3D	0	441	1059	1448	2469	n [rpm]
	2D/3D	0	0.08	0.2	0.24	0.19	P [kW]
	2D/3D	62	187	342	356	357	V _s [V]
	2D/3D	0.54	0.72	0.72	0.88	0.79	I _s [A]
71L/4 230/400 V, 50 Hz Y circuit	2D/3D	1.81	2.55	2.57	2.38	1.22	M [Nm]
	2D/3D	0	461	1069	1481	2312	n [rpm]
	2D/3D	0	0.12	0.29	0.37	0.3	P [kW]
	2D/3D	57	181	329	344	343	V _s [V]
	2D/3D	0.83	1.02	1.04	1.24	1.3	I _s [A]

Table 8: IE1 motors, 50 Hz nominal point for Category 2D and 3D

Legend			
f _s	Stator frequency	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres
		M	Torque
		[%]	in % of rated torque
		n	Speed
		[rpm]	Speed in rpm

2.1.1.2 Motors with 50 Hz nominal point, Size 80S/4 to 132M/4 for Category 3D

Motor type ↓	For the circuit, please refer to 1.7													Legend see below
	Frequency inverter power and rated current													
	↓	Motor power in [kW] at 50 Hz (upper value) and 100 Hz (lower value)												
	↓	↓	3	10	20	30	40	50	60	70	80	90	100	f_s [Hz]
80S/4	0.55 kW	0.48	1.6	2.0	2.9	3.4	3.8	3.5	3.2	2.7	2.3	2.0	1.6	M [Nm]
	1.6 A		42	52	76	89	99	91	82	71	59	52	42	M [%]
		0.43	30	150	463	765	1061	1314	1604	1837	2073	2296	2529	n [rpm]
80L/4	0.75 kW	0.67	2.1	3.1	4.0	4.7	5.2	4.7	4.4	3.8	3.2	2.8	2.3	M [Nm]
	2.2 A		40	60	77	90	100	90	85	73	62	54	45	M [%]
		0.63	26	166	471	769	1091	1377	1614	1864	2108	2348	2564	n [rpm]
90S/4	1.1 kW	1.01	3.5	5.4	6.6	7.3	7.6	7.0	6.4	5.6	5.1	4.3	3.9	M [Nm]
	3.0 A		46	71	87	96	100	92	84	73	68	57	51	M [%]
		1.06	10	207	503	800	1032	1379	1626	1875	2096	2372	2606	n [rpm]
90L/4	1.5 kW	1.31	4.3	5.8	7.8	9.0	9.5	9.0	8.3	7.2	6.5	5.6	4.9	M [Nm]
	3.7 A		42	56	76	87	92	87	80	70	63	54	47	M [%]
		1.37	0	196	495	790	1091	1388	1654	1909	2173	2437	2695	n [rpm]
100L/4	2.2 kW	1.92	5.5	9.5	12.1	13.6	14.3	13.1	12.2	10.8	9.9	8.3	7.4	M [Nm]
	5.5 A		38	66	84	95	99	91	84	75	69	58	51	M [%]
		2.17	0	207	488	805	1106	1408	1715	2010	2234	2523	2807	n [rpm]
100LA/4 T140°C	3 kW	2.61	10.7	13.6	16.4	18.0	18.9	17.7	15.6	13.2	11.4	10.0	8.3	M [Nm]
	7.0 A		53	67	81	89	93	87	77	65	56	49	41	M [%]
		2.39	12	256	541	833	1140	1410	1681	1940	2233	2490	2760	n [rpm]
112M/4	4 kW	3.52	13.2	18.1	21.9	24.0	25.5	23.8	21.1	18.0	15.9	14.0	12.1	M [Nm]
	9.5 A		50	69	83	91	97	90	80	68	60	53	46	M [%]
		3.51	17	237	529	824	1120	1414	1689	1963	2236	2506	2775	n [rpm]
132S/4	5.5 kW	5.04	22.0	25.8	30.0	34.0	36.2	33.7	29.6	25.5	21.9	18.4	16.1	M [Nm]
	12.5 A		61	71	83	94	100	93	82	71	60	51	45	M [%]
		4.78	44	240	536	832	1130	1428	1714	1995	2276	2556	2834	n [rpm]
132M/4	7.5 kW	6.66	30.0	35.0	41.0	47.1	49.5	44.5	39.3	32.2	27.7	23.8	20.5	M [Nm]
	16.0 A		60	70	82	94	99	89	79	64	55	48	41	M [%]
		6.06	62	241	538	837	1133	1431	1713	1967	2268	2551	2828	n [rpm]

Table 9: IE1 motors, 50 Hz nominal point for Category 3D

Legend

f_s	Stator frequency	M	Torque	M	Torque	n	Speed
[Hz]	in Hertz	[Nm]	in Newton metres	[%]	in % of rated torque	[rpm]	Speed in rpm

2.1.1.3 Motors with 50 Hz nominal point, Size 80SH/4 to 180LH/4 for Category 2D and 3D

Motor type / Circuit type	Category	3	20	40	60	100	f _s [Hz]
80SH/4 230/400 V, 50 Hz Y circuit	2D/3D	2.64	3.74	3.73	3.71	1.83	M [Nm]
	2D/3D	14.8	516	1118	1628	2551	n [rpm]
	2D/3D	0	0.2	0.44	0.63	0.49	P [kW]
	2D/3D	38	174	328	368	352	V_s [V]
	2D/3D	1.11	1.4	1.41	1.61	1.75	I_s [A]
80LH/4 230/400 V, 50 Hz Y circuit	2D/3D	3.33	4.92	5.08	4.84	2.51	M [Nm]
	2D/3D	10	508	1105	1596	2549	n [rpm]
	2D/3D	0	0.26	0.59	0.81	0.67	P [kW]
	2D/3D	36	172	333	363	363	V_s[V]
	2D/3D	1.38	1.77	1.81	2.13	2.22	I_s [A]
90SH/4 230/400 V, 50 Hz Y circuit	2D/3D	0.97	5.52	6.83	5.72	3.11	M [Nm]
	2D/3D	76	540	1127	1676	2763	n [rpm]
	2D/3D	0.01	0.31	0.81	1	0.9	P [kW]
	2D/3D	29	168	332	361	362	V_s[V]
	2D/3D	1.29	2.06	2.36	2.43	2.49	I_s [A]
90LH/4 230/400 V, 50 Hz Y circuit	2D/3D	5.99	9.75	10.22	10.07	5.43	M [Nm]
	2D/3D	33	521	1115	1605	2603	n [rpm]
	2D/3D	0.02	0.53	1.19	1.69	1.48	P [kW]
	2D/3D	35	173	338	361	361	V_s[V]
	2D/3D	2.38	3.28	3.33	4.19	4.31	I_s [A]
100LH/4 230/400 V, 50 Hz Y circuit	2D/3D	2.38	14.6	14.79	12.08	6.96	M [Nm]
	2D/3D	80	545	1143	1704	2818	n [rpm]
	2D/3D	0.02	0.83	1.77	2.16	2.05	P [kW]
	2D/3D	27	171	334	360	361	V_s[V]
	2D/3D	2.8	4.84	4.82	4.89	4.9	I_s [A]
100AH/4 230/400 V, 50 Hz Y circuit	2D/3D	9.8	19.31	20.19	18.21	10.14	M [Nm]
	2D/3D	49	528	1122	1646	2690	n [rpm]
	2D/3D	0.05	1.07	2.37	3.14	2.86	P [kW]
	2D/3D	32	172	336	363	363	V_s[V]
	2D/3D	4.17	6.15	6.41	7.08	7.36	I_s [A]
112MH/4 230/400 V, 50 Hz Y circuit	2D/3D	16.56	24.27	26.49	21.76	11.92	M [Nm]
	2D/3D	47.4	543	1139	1683	2774	n [rpm]
	2D/3D	0.08	1.38	3.16	3.83	3.46	P [kW]
	2D/3D	33	170	338	349	349	V_s[V]
	2D/3D	5.78	7.63	8.31	9	9.2	I_s [A]

Motor type / Circuit type	Category	3	20	40	60	100	f _s [Hz]
132SH/4 230/400 V, 50 Hz Y circuit	2D/3D	26.8	36	36	30.9	15.86	M [Nm]
	2D/3D	57	558	1158	1712	2827	n [rpm]
	2D/3D	0.16	2.11	4.37	5.53	4.7	P [kW]
	2D/3D	33	172	338	345	344	V _s [V]
	2D/3D	8.63	10.76	10.73	12.97	13.12	I _s [A]
132MH/4 230/400 V, 50 Hz Y circuit	2D/3D	30.6	48.54	49.17	41.8	21.15	M [Nm]
	2D/3D	62	559	1158	1720	2845	n [rpm]
	2D/3D	0.2	2.84	5.96	7.53	6.3	P [kW]
	2D/3D	31	169	337	350	341	V _s [V]
	2D/3D	10.94	15	15.6	16.9	16.9	I _s [A]
132LH/4 230/400 V, 50 Hz Y circuit	2D/3D	28.8	56.57	60.9	53.3	27.5	M [Nm]
	2D/3D	68	556	1151	1704	2830	n [rpm]
	2D/3D	0.21	3.29	7.34	9.5	8.15	P [kW]
	2D/3D	29	168	333	354	355	V _s [V]
	2D/3D	11.95	18.2	19.7	21	20.2	I _s [A]
160MH/4 230/400 V, 50 Hz Y circuit	2D/3D	48.8	64.3	72	58.4	32.8	M [Nm]
	2D/3D	67	564	1159	1739	2885	n [rpm]
	2D/3D	0.34	3.8	8.75	10.6	9.9	P [kW]
	2D/3D	30	155	308	351	352	V _s [V]
	2D/3D	15.2	19.5	21.9	22.7	23.4	I _s [A]
160LH/4 2D TF 230/400 V, 50 Hz Y circuit	2D/3D	66.9	97.3	97.3	85.3	48	M [Nm]
	2D/3D	65	566	1167	1735	2875	n [rpm]
	2D/3D	0.46	5.78	11.9	15.5	14.5	P [kW]
	2D/3D	28	167	336	350	350	V _s [V]
	2D/3D	21.1	27.8	27.8	32.2	33.2	I _s [A]
180MH/4 230/400 V, 50 Hz Y circuit	2D/3D	79.9	121	120	102	51.7	M [Nm]
	2D/3D	64	575	1176	1752	2908	n [rpm]
	2D/3D	0.54	7.3	14.7	18.8	15.7	P [kW]
	2D/3D	25	164	334	347	349	V _s [V]
	2D/3D	28.7	37.5	36.2	41.6	41.1	I _s [A]
180LH/4 230/400 V, 50 Hz Y circuit	2D/3D	102	142	142	117	54.6	M [Nm]
	2D/3D	68	573	1173	1749	2926	n [rpm]
	2D/3D	0.73	8.54	17.5	21.6	16.7	P [kW]
	2D/3D	28	166	325	341	342	V _s [V]
	2D/3D	32.3	40.6	40.8	47	41	I _s [A]

Table 10: IE2 motors, 50 Hz nominal point for Category 2D and 3D

Legend			
f _s [Hz]	Stator frequency in Hertz	M [Nm]	Torque in Newton metres
		M [%]	Torque in % of rated torque
		n [rpm]	Speed in rpm

2.1.1.4 Motors with 87 Hz nominal point, Size 63S/4 to 71L/4 for Category 2D and 3D

Motor type / Circuit type	Category	3	20	40	100	f _s [Hz]
63S/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.65	0.86	0.86	0.86	M [Nm]
	2D/3D	0	450	1073	2741	n [rpm]
	2D/3D	0	0.04	0.1	0.25	P [kW]
	2D/3D	46	108	200	358	V _s [V]
	2D/3D	0.78	0.82	0.89	0.81	I _s [A]
63L/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.71	1.26	1.26	1.26	M [Nm]
	2D/3D	0	438	1060	2719	n [rpm]
	2D/3D	0	0.06	0.14	0.36	P [kW]
	2D/3D	38	107	203	361	V _s [V]
	2D/3D	0.87	1.06	1.15	1.1	I _s [A]
71S/4 230/400 V, 50 Hz Δ Circuit	2D/3D	1.15	1.76	1.76	1.88	M [Nm]
	2D/3D	0	441	1059	2661	n [rpm]
	2D/3D	0	0.08	0.2	0.52	P [kW]
	2D/3D	36	108	198	356	V _s [V]
	2D/3D	0.94	1.25	1.25	1.63	I _s [A]
71L/4 230/400 V, 50 Hz Δ Circuit	2D/3D	1.81	2.55	2.57	2.56	M [Nm]
	2D/3D	0	461	1069	2770	n [rpm]
	2D/3D	0	0.12	0.29	0.74	P [kW]
	2D/3D	33	104	190	342	V _s [V]
	2D/3D	1.43	1.77	1.8	2.12	I _s [A]

Table 11: IE1 motors, 87 Hz nominal point for Category 2D and 3D

Legend			
f _s	Stator frequency	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres
		M	Torque
		[%]	in % of rated torque
		n	Speed
		[rpm]	Speed in rpm

2.1.1.5 Motors with 87 Hz nominal point, Size 80S/4 to 132M/4 for Category 3D

Motor type ↓	For the circuit, please refer to 1.7 Frequency inverter power and rated current													Legend see below	
	↓	Motor power in [kW] at 50 Hz (upper value) and 100 Hz (lower value)												f _s [Hz]	
		↓	3	10	20	30	40	50	60	70	80	90	100		
80S/4	1.1 kW	0.55	1.9	2.3	3.0	3.4	3.7	3.9	3.9	3.9	3.8	3.6	3.5	M [Nm]	
	3.0 A	0.93	50	60	79	89	97	102	102	102	99	94	92	M [%]	
		1.03	0	164	440	757	1052	1351	1638	1947	2237	2457	2814	n [rpm]	
80L/4	1.5 kW	0.78	2.9	3.3	4.2	4.7	5.0	5.4	5.6	5.7	5.5	5.3	5.0	M [Nm]	
	3.7 A	1.36	56	63	81	90	96	104	108	110	106	102	95	M [%]	
		1.46	0	207	493	792	1086	1377	1668	1970	2256	2439	2813	n [rpm]	
90S/4	2.2 kW	1.10	4.3	5.0	6.3	7.0	7.6	7.7	7.6	7.6	7.4	7.0	6.8	M [Nm]	
	5.5 A	1.83	57	66	83	92	100	101	100	100	98	92	90	M [%]	
		2.03	0	192	482	778	1070	1370	1675	1978	2270	2489	2833	n [rpm]	
90L/4	3 kW	1.39	4.1	5.4	7.3	8.5	9.3	9.6	9.9	9.9	9.8	9.1	8.6	M [Nm]	
	7.0 A	2.38	40	52	71	83	90	93	96	96	95	88	83	M [%]	
		2.56	73	179	487	789	1085	1387	1684	1988	2284	2497	2863	n [rpm]	
100L/4	4 kW	2.10	7.3	11.0	12.6	13.7	14.2	14.2	14.2	14.2	13.5	12.8	12.3	M [Nm]	
	9.5 A	3.37	51	76	88	95	99	99	99	99	94	89	86	M [%]	
		3.73	0	207	520	809	1106	1409	1709	2008	2307	2518	2887	n [rpm]	
100LA/4 T140°C	5.5 kW	2.98	11.3	14.1	17.2	18.6	19.6	19.8	20.2	20.0	18.8	18.0	17.6	M [Nm]	
	12.5 A	4.72	56	69	85	92	96	97	99	98	93	89	86	M [%]	
		5.27	7	229	524	819	1116	1413	1713	2014	2304	2505	2869	n [rpm]	
112M/4	7.5 kW	4.01	12.4	18.6	22.6	24.7	26.2	26.9	26.9	26.0	25.1	23.8	22.4	M [Nm]	
	16.0 A	6.50	47	71	86	94	99	102	102	98	95	90	85	M [%]	
		6.79	34	244	535	830	1126	1425	1725	2024	2325	2609	2890	n [rpm]	
132S/4	11 kW	5.75	20.7	25.9	31.0	34.9	36.7	38.2	38.5	38.3	36.8	34.3	29.7	M [Nm]	
	24.0 A	9.14	57	71	86	96	101	105	106	106	102	95	82	M [%]	
		9.06	49	241	541	839	1139	1437	1737	2037	2335	2544	2918	n [rpm]	
132M/4	15 kW	7.55	20.0	31.0	40.0	45.0	47.7	50.3	50.5	50.0	48.9	45.5	39.0	M [Nm]	
	31.0 A	12.1	40	62	80	90	95	101	101	100	98	91	78	M [%]	
		11.91	18	244	541	837	1137	1434	1734	2034	2332	2540	2916	n [rpm]	

Table 12: IE1 motors, 87 Hz nominal point for Category 3D

Legend			
f _s [Hz]	Stator frequency in Hertz	M [Nm]	Torque in Newton metres
M [%]	Torque in % of rated torque	n [rpm]	Speed in rpm

2.1.1.6 Motors with 87 Hz nominal point, Size 80SH/4 to 180LH/4 for Category 2D and 3D

Motor type / Circuit type	Category	3	20	40	100	f _s [Hz]
80SH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	2.64	3.74	3.73	3.74	M [Nm]
	2D/3D	15	516	1118	2840	n [rpm]
	2D/3D	0	0.2	0.44	1.11	P [kW]
	2D/3D	22	100	190	355	V _s [V]
	2D/3D	1.92	2.42	2.44	2.77	I _s [A]
80LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	3.33	4.92	5.08	5.1	M [Nm]
	2D/3D	10	508	1105	2803	n [rpm]
	2D/3D	0	0.26	0.59	1.5	P [kW]
	2D/3D	21	99	192	357	V _s [V]
	2D/3D	2.38	3.06	3.14	3.69	I _s [A]
90SH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.97	5.52	6.83	5.96	M [Nm]
	2D/3D	76	540	1127	2882	n [rpm]
	2D/3D	0.01	0.31	0.81	1.8	P [kW]
	2D/3D	17	97	192	358	V _s [V]
	2D/3D	2.24	3.57	4.08	4.25	I _s [A]
90LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	6	9.75	10.2	10.1	M [Nm]
	2D/3D	33	521	1115	2822	n [rpm]
	2D/3D	0.02	0.53	1.19	2.98	P [kW]
	2D/3D	20	100	195	357	V _s [V]
	2D/3D	4.13	5.68	5.77	7.08	I _s [A]
100LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	2.38	14.6	14.8	12.56	M [Nm]
	2D/3D	80	545	1143	2905	n [rpm]
	2D/3D	0.02	0.83	1.77	3.82	P [kW]
	2D/3D	16	99	193	359	V _s [V]
	2D/3D	4.85	8.39	8.35	8.5	I _s [A]
100AH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	9.8	19.3	20.2	20.2	M [Nm]
	2D/3D	49	528	1122	2840	n [rpm]
	2D/3D	0.05	1.07	2.37	6	P [kW]
	2D/3D	18	99	194	357	V _s [V]
	2D/3D	7.22	10.6	11.1	13	I _s [A]
112MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	16.5	24.3	26.5	22.5	M [Nm]
	2D/3D	47	543	1139	2884	n [rpm]
	2D/3D	0.08	1.38	3.16	6.8	P [kW]
	2D/3D	19	98	195	341	V _s [V]
	2D/3D	10	13.2	14.4	15.8	I _s [A]

Motor type / Circuit type	Category	3	20	40	100	f _s [Hz]
132SH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	26.8	36.1	36.1	31	M [Nm]
	2D/3D	57	558	1158	2915	n [rpm]
	2D/3D	0.16	2.11	4.37	9.46	P [kW]
	2D/3D	19	99	195	338	V _s [V]
	2D/3D	14.9	18.65	18.6	22.15	I _s [A]
132MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	30.6	48.5	49.17	39.5	M [Nm]
	2D/3D	62	559	1158	2921	n [rpm]
	2D/3D	0.2	2.84	5.96	12.1	P [kW]
	2D/3D	18	98	195	332	V _s [V]
	2D/3D	18.95	26	27	28.4	I _s [A]
132LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	28.8	56.6	60.9	48	M [Nm]
	2D/3D	68	556	1151	2927	n [rpm]
	2D/3D	0.21	3.29	7.34	14.7	P [kW]
	2D/3D	17	97	192	353	V _s [V]
	2D/3D	20.7	31.5	34.1	31.5	I _s [A]
160MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	48.8	64.3	72.1	56.9	M [Nm]
	2D/3D	67	564	1159	2944	n [rpm]
	2D/3D	0.34	3.8	8.75	17.5	P [kW]
	2D/3D	17	89	178	348	V _s [V]
	2D/3D	26.4	33.9	37.9	37.2	I _s [A]
160LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	66.9	97.4	97.4	82.4	M [Nm]
	2D/3D	65	566	1167	2939	n [rpm]
	2D/3D	0.46	5.78	11.9	25.4	P [kW]
	2D/3D	16	96	194	344	V _s [V]
	2D/3D	36.5	48.1	48.2	53.4	I _s [A]
180MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	79.9	121	120	93.6	M [Nm]
	2D/3D	64	575	1176	2957	n [rpm]
	2D/3D	0.54	7.3	14.8	29	P [kW]
	2D/3D	14	95	193	343	V _s [V]
	2D/3D	49.8	65.1	62.7	65.8	I _s [A]
180LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	102	14	142.8	96.8	M [Nm]
	2D/3D	68	573	1173	2963	n [rpm]
	2D/3D	0.73	8.54	17.5	30	P [kW]
	2D/3D	16	96	188	335	V _s [V]
	2D/3D	56	70.4	70.7	65.4	I _s [A]

Table 13: IE2 motors, 87 Hz nominal point for Category 2D and 3D

Legend			
f _s	Stator frequency	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres
		M	Torque
		[%]	in % of rated torque
		n	Speed
		[rpm]	Speed in rpm

2.1.1.7 Motors with 100 Hz nominal point, Size 63S/4 to 71L/4 for Category 2D and 3D

Motor type / Circuit type	Category	3	20	40	100	f_s [Hz]
63S/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.55	0.61	0.61	0.6	M [Nm]
	2D/3D	0	500	1097	2835	n [rpm]
	2D/3D	0	0.03	0.07	0.18	P [kW]
	2D/3D	42	100	178	349	Vs [V]
	2D/3D	0.7	0.74	0.76	0.68	Is [A]
63L/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.56	0.83	0.83	0.83	M [Nm]
	2D/3D	0	488	1088	2844	n [rpm]
	2D/3D	0	0.04	0.09	0.25	P [kW]
	2D/3D	32	94	170	349	Vs [V]
	2D/3D	0.73	0.89	0.91	0.88	Is [A]
71S/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.92	1.22	1.22	1.22	M [Nm]
	2D/3D	0	474	1081	2832	n [rpm]
	2D/3D	0	0.06	0.14	0.36	P [kW]
	2D/3D	32	94	172	357	Vs [V]
	2D/3D	0.83	0.97	1.01	1.1	Is [A]
71L/4 230/400 V, 50 Hz Δ Circuit	2D/3D	1.53	1.82	1.81	1.81	M [Nm]
	2D/3D	0	479	1087	2830	n [rpm]
	2D/3D	0	0.09	0.21	0.54	P [kW]
	2D/3D	30	91	168	342	Vs [V]
	2D/3D	1.3	1.44	1.46	1.51	Is [A]

Table 14: IE1 motors, 100 Hz nominal point for Category 2D and 3D

Legend			
f_s	Stator frequency	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres
		M	Torque
		[%]	in % of rated torque
		n	Speed
		[rpm]	Speed in rpm

2.1.1.8 Motors with 100 Hz nominal point, Size 80S/4 to 132M/4 for Category 3D

Motor type ↓	For the circuit, please refer to 1.7													Legend see below		
	Frequency inverter power and rated current															
	↓	Motor power in [kW] at 50 Hz (upper value) and 100 Hz (lower value)													↓	↓
			3	10	20	30	40	50	60	70	80	90	100	f_s [Hz]		
80S/4	0.75 kW	0.39	1.8	2.3	2.5	2.6	2.6	2.6	2.6	2.5	2.5	2.4	2.2	M [Nm]		
	2.2 A		48	61	64	68	68	68	67	66	66	62	57	M [%]		
		0.67	0	163	410	810	1108	1416	1712	2028	2344	2627	2910	n [rpm]		
80L/4	1.1 kW	0.53	3.0	3.3	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.4	3.2	M [Nm]		
	3.0 A		58	63	69	69	69	69	69	69	67	66	62	M [%]		
		0.99	0	196	505	812	1116	1414	1715	2015	2313	2611	2908	n [rpm]		
90S/4	1.5 kW	0.75	4.2	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.0	4.9	4.6	M [Nm]		
	3.7 A		55	64	64	64	66	66	66	66	66	65	60	M [%]		
		1.40	0	183	516	822	1120	1425	1725	2025	2321	2620	2911	n [rpm]		
90L/4	2.2 kW	1.06	4.0	5.6	7.2	7.2	7.2	7.2	7.2	7.2	7.1	6.9	6.6	M [Nm]		
	5.5 A		39	54	70	70	70	70	70	70	69	67	64	M [%]		
		2.00	20	192	484	799	1098	1406	1707	2008	2309	2606	2905	n [rpm]		
100L/4	3 kW	1.51	8.4	9.1	9.9	10.1	10.1	10.1	9.9	9.7	9.7	9.2	8.7	M [Nm]		
	7.0 A		58	63	69	70	70	70	69	67	67	64	61	M [%]		
		2.68	25	205	524	829	1132	1429	1736	2036	2335	2631	2927	n [rpm]		
100LA/4 T140°C	4 kW	1.99	6.6	11.3	13.1	13.2	13.2	13.2	13.2	13.3	13.3	12.6	12.0	M [Nm]		
	9.5 A		32	56	64	65	65	65	65	65	66	62	59	M [%]		
		3.69	20	200	530	834	1130	1442	1734	2028	2332	2639	2944	n [rpm]		
112M/4	5.5 kW	2.72	14.4	17.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	17.3	16.3	M [Nm]		
	12.5 A		54	64	68	68	68	68	68	68	68	65	62	M [%]		
		5.02	36	233	539	840	1142	1442	1742	2042	2341	2640	2933	n [rpm]		
132S/4	7.5 kW	3.63	20.6	22.0	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	M [Nm]		
	16.0 A		57	61	67	67	67	67	67	67	67	67	67	M [%]		
		7.42	36	227	530	828	1124	1425	1724	2023	2324	2623	2918	n [rpm]		
132M/4	11 kW	5.32	17.2	28.9	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	M [Nm]		
	24.0 A		34	58	71	71	71	71	71	71	71	71	71	M [%]		
		10.9	16	233	530	826	1125	1423	1723	2022	2321	2625	2916	n [rpm]		

Table 15: IE1 motors, 100 Hz nominal point for Category 3D

Legend					
f_s	Stator frequency	M	Torque	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres	[%]	in % of rated torque
				n	Speed
				[rpm]	Speed in rpm

2.1.1.9 Motors with 100 Hz nominal point, Size 80SH/4 to 180LH/4 for Category 2D and 3D

Motor type / Circuit type	Category	3	20	40	100	f _s [Hz]
80SH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	1.99	2.45	2.45	2.46	M [Nm]
	2D/3D	29	534	1134	2913	n [rpm]
	2D/3D	0.01	0.14	0.29	0.75	P [kW]
	2D/3D	19	87	167	362	Vs [V]
	2D/3D	1.63	1.89	1.91	1.95	Is [A]
80LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	2.17	3.59	3.6	3.6	M [Nm]
	2D/3D	0	511	1115	2886	n [rpm]
	2D/3D	0	0.19	0.42	1.09	P [kW]
	2D/3D	16	84	163	350	Vs [V]
	2D/3D	1.91	2.54	2.55	2.73	Is [A]
90SH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	0.97	4.92	4.89	4.9	M [Nm]
	2D/3D	76	529	1131	2902	n [rpm]
	2D/3D	0.01	0.27	0.58	1.49	P [kW]
	2D/3D	17	85	164	343	Vs [V]
	2D/3D	2.24	3.39	3.39	3.78	Is [A]
90LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	4.3	7.21	7.17	7.14	M [Nm]
	2D/3D	0	518	1120	2913	n [rpm]
	2D/3D	0	0.39	0.84	2.18	P [kW]
	2D/3D	16	84	164	347	Vs [V]
	2D/3D	3.7	4.74	4.94	5.25	Is [A]
100LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	2.38	9.71	9.65	9.67	M [Nm]
	2D/3D	80	551	1152	2934	n [rpm]
	2D/3D	0.02	0.56	1.16	2.97	P [kW]
	2D/3D	16	83	164	348	Vs [V]
	2D/3D	4.85	6.46	6.62	6.98	Is [A]
100AH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	9.29	12.96	13.11	13	M [Nm]
	2D/3D	0	535	1136	2932	n [rpm]
	2D/3D	0	0.73	1.56	4	P [kW]
	2D/3D	20	84	164	347	Vs [V]
	2D/3D	7.54	8.47	8.7	9.37	Is [A]
112MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	16.56	17.85	17.85	17.8	M [Nm]
	2D/3D	47	548	1147	2915	n [rpm]
	2D/3D	0.08	1.02	2.14	5.44	P [kW]
	2D/3D	19	89	173	345	Vs [V]
	2D/3D	10.01	9.53	9.46	12.35	Is [A]

Motor type / Circuit type	Category	3	20	40	100	f _s [Hz]
132SH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	24.3	24.2	24.2	24.2	M [Nm]
	2D/3D	51	563	1163	2939	n [rpm]
	2D/3D	0.13	1.43	2.95	7.45	P [kW]
	2D/3D	18	88	167	342	V_s [V]
	2D/3D	13.8	14.6	14.6	17.2	I_s [A]
132MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	29.7	29.6	29.6	29.7	M [Nm]
	2D/3D	50	568	1167	2946	n [rpm]
	2D/3D	0.16	1.76	3.62	9.15	P [kW]
	2D/3D	16	84	166	335	V_s [V]
	2D/3D	18.2	17.4	16.95	20.1	I_s [A]
132LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	28.81	35.4	35.5	35.3	M [Nm]
	2D/3D	68	564	1163	2947	n [rpm]
	2D/3D	0.21	2.09	4.32	10.9	P [kW]
	2D/3D	17	84	164	340	V_s [V]
	2D/3D	20.7	22.1	21.6	21.4	I_s [A]
160MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	48.4	48.4	48.3	48.2	M [Nm]
	2D/3D	58	564	1164	2954	n [rpm]
	2D/3D	0.29	2.86	5.88	14.9	P [kW]
	2D/3D	15	77	151	347	V_s [V]
	2D/3D	27.1	29.2	25.1	32.1	I_s [A]
160LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	59.5	59.7	59.4	59	M [Nm]
	2D/3D	55	574	1173	2959	n [rpm]
	2D/3D	0.34	3.59	7.3	18.3	P [kW]
	2D/3D	14	82	163	346	V_s [V]
	2D/3D	35.5	32.9	31.9	37.3	I_s [A]
180MH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	70.7	70.5	69.8	70.8	M [Nm]
	2D/3D	69	582	1181	2969	n [rpm]
	2D/3D	0.51	4.29	8.63	22	P [kW]
	2D/3D	14	85	163	344	V_s [V]
	2D/3D	42.2	41.2	38.6	36	I_s [A]
180LH/4 230/400 V, 50 Hz Δ Circuit	2D/3D	95.9	94.5	96.3	96.4	M [Nm]
	2D/3D	54	576	1176	2965	n [rpm]
	2D/3D	0.54	5.7	11.9	29.9	P [kW]
	2D/3D	15	82	162	337	V_s [V]
	2D/3D	65.5	53.6	54.6	65.7	I_s [A]

Table 16: IE2 motors, 100 Hz nominal point for Category 2D and 3D

Legend

f _s [Hz]	Stator frequency in Hertz	M [Nm]	Torque in Newton metres	M [%]	Torque in % of rated torque	n [rpm]	Speed Speed in rpm
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2.2 Motors with external fans (Category 3D)

Information

Interpolation

A linear interpolation of the data between adjacent frequencies is permissible.

2.2.1 Motors with external fans, 50 Hz nominal point, Category 3D

Motor type ↓	For the circuit, please refer to 1.7													Legend see below	
	Frequency inverter power and rated current														
	↓	Motor power in [kW] at 50 Hz (upper) and 100 Hz (lower)													
		↓	3	10	20	30	40	50	60	70	80	90	100	f _s [Hz]	
63S/4	0.55 kW	0.11	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.6	0.4	M [Nm]	
	1.6 A		94	94	94	94	94	94	92	90	82	66	50	M [%]	
		0.09	10	150	375	690	1010	1320	1381	1441	1641	1840	1932	n [rpm]	
63L/4	0.55 kW	0.17	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.1	0.9	0.8	M [Nm]	
	1.6 A		96	96	96	96	96	96	93	91	83	73	61	M [%]	
		0.18	0	142	419	696	990	1282	1458	1633	1787	1941	2151	n [rpm]	
71S/4	0.55 kW	0.23	1.7	1.7	1.7	1.7	1.7	1.6	1.5	1.4	1.2	1.1	0.9	M [Nm]	
	1.6 A		100	100	100	100	100	92	87	81	72	61	53	M [%]	
		0.23	10	150	437	733	1032	1364	1537	1710	1939	2168	2388	n [rpm]	
71L/4	0.55 kW	0.33	2.4	2.4	2.4	2.4	2.4	2.4	2.2	1.9	1.6	1.4	1.3	M [Nm]	
	1.6 A		92	92	92	92	92	92	83	73	62	55	48	M [%]	
		0.33	0	128	427	734	1042	1339	1594	1843	2092	2326	2490	n [rpm]	
80S/4	0.55 kW	0.48	3.5	3.5	3.5	3.5	3.5	3.5	3.2	2.7	2.3	2.0	1.6	M [Nm]	
	1.6 A		91	91	91	91	91	91	82	71	59	52	42	M [%]	
		0.43	30	150	463	765	1061	1314	1604	1837	2073	2296	2529	n [rpm]	
80L/4	0.75 kW	0.67	4.7	4.7	4.7	4.7	4.7	4.7	4.4	3.8	3.2	2.8	2.3	M [Nm]	
	2.2 A		90	90	90	90	90	90	85	73	62	54	45	M [%]	
		0.63	26	166	471	769	1091	1377	1614	1864	2108	2348	2564	n [rpm]	
90S/4	1.1 kW	1.01	7.0	7.0	7.0	7.0	7.0	7.0	6.4	5.6	5.1	4.3	3.9	M [Nm]	
	3.0 A		92	92	92	92	92	92	84	73	68	57	51	M [%]	
		1.06	10	207	503	800	1032	1379	1626	1875	2096	2372	2606	n [rpm]	
90L/4	1.5 kW	1.31	9.0	9.0	9.0	9.0	9.0	9.0	8.3	7.2	6.5	5.6	4.9	M [Nm]	
	3.7 A		87	87	87	87	87	87	80	70	63	54	47	M [%]	
		1.37	0	196	495	790	1091	1388	1654	1909	2173	2437	2695	n [rpm]	
100L/4	2.2 kW	1.92	13.1	13.1	13.1	13.1	13.1	13.1	12.2	10.8	9.9	8.3	7.4	M [Nm]	
	5.5 A		91	91	91	91	91	91	84	75	69	58	51	M [%]	
		2.17	0	207	488	805	1106	1408	1715	2010	2234	2523	2807	n [rpm]	
100LA/4 T140°C	3 kW	2.68	20.3	20.3	20.3	20.3	20.3	18.2	16.1	13.9	12.1	10.1	9.0	M [Nm]	
	7.0 A		100	100	100	100	100	90	79	69	59	50	44	M [%]	
		2.59	11	172	488	804	1105	1406	1673	1940	2214	2488	2753	n [rpm]	
112M/4	4 kW	3.57	26.4	26.4	26.4	26.4	26.4	24.0	21.2	18.6	16.0	13.8	12.1	M [Nm]	
	9.5 A		100	100	100	100	100	91	80	70	61	52	46	M [%]	
		3.53	2	224	402	827	1123	1418	1691	1967	2242	2519	2793	n [rpm]	
132S/4	5.5 kW	4.88	35.2	36.4	36.4	36.4	35.8	32.3	28.3	23.4	19.5	17.3	14.2	M [Nm]	
	12.5 A		97	100	100	100	98	89	78	64	54	47	39	M [%]	
		4.28	26	250	551	851	1153	1444	1725	2010	2299	2585	2876	n [rpm]	
132M/4	7.5 kW	6.83	47.0	49.6	49.6	49.6	49.6	45.2	38.6	31.3	27.1	23.1	20.0	M [Nm]	
	16.0 A		95	100	100	100	100	91	78	63	55	47	40	M [%]	
		6.03	27	249	551	851	1151	1442	1727	2011	2302	2585	2875	n [rpm]	
132MA/4 T140°C	11 kW	8.19	57.2	60.8	60.8	60.8	60.8	54.5	46.8	38.8	32.9	28.9	25.1	M [Nm]	
	24.0 A		94	100	100	100	100	90	77	64	54	48	41	M [%]	
		7.52	18	238	539	840	1140	1435	1720	2008	2298	2580	2866	n [rpm]	

Table 17: IE1 and IE2 motors with external fan, 50 Hz nominal point

Legend			
f _s [Hz]	Stator frequency in Hertz	M [Nm]	Torque in Newton metres
M [%]	Torque in % of rated torque	n [rpm]	Speed in rpm

2.2.2 Motors with external fans, 87 Hz nominal point, Category 3D

Motor type	For the circuit, please refer to 1.7													Legend see below	
	Frequency inverter power and rated current														
	Motor power in [kW] at 50 Hz (upper), 87 Hz (middle) and 100 Hz (lower)														
			3	10	20	30	40	50	60	70	80	90	100	f _s [Hz]	
63S/4	0.55 kW	0.12	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	M [Nm]	
	1.6 A	0.20	100	100	100	100	100	100	100	100	96	92	90	M [%]	
		0.22	20	152	369	688	1007	1310	1612	1914	2213	2419	2763	n [rpm]	
63L/4	0.55 kW	0.18	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	M [Nm]	
	1.6 A	0.30	100	100	100	100	100	100	100	100	96	92	90	M [%]	
		0.33	20	175	407	715	1002	1306	1610	1909	2207	2415	2713	n [rpm]	
71S/4	0.55 kW	0.25	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	M [Nm]	
	1.6 A	0.41	100	100	100	100	100	100	100	100	97	92	92	M [%]	
		0.47	100	146	442	734	1031	1364	1663	1962	2260	2460	2818	n [rpm]	
71L/4	0.75 kW	0.35	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.3	M [Nm]	
	2.2 A	0.61	95	95	95	95	95	95	95	95	95	92	90	M [%]	
		0.69	0	188	488	782	1077	1350	1633	1941	2245	2457	2797	n [rpm]	
80S/4	1.1 kW	0.54	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.6	3.5	M [Nm]	
	3.0 A	0.93	99	99	99	99	99	99	99	99	99	94	92	M [%]	
		1.03	0	164	440	757	1052	1351	1638	1947	2237	2457	2814	n [rpm]	
80L/4	1.5 kW	0.79	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.0	M [Nm]	
	3.7 A	1.36	106	106	106	106	106	106	106	106	106	102	95	M [%]	
		1.46	0	207	493	792	1086	1377	1668	1970	2256	2439	2813	n [rpm]	
90S/4	2.2 kW	1.07	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.0	6.8	M [Nm]	
	5.5 A	1.83	98	98	98	98	98	98	98	98	98	92	90	M [%]	
		2.03	0	192	482	778	1070	1370	1675	1978	2270	2489	2833	n [rpm]	
90L/4	3 kW	1.42	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.1	8.6	M [Nm]	
	7.0 A	2.38	95	95	95	95	95	95	95	95	95	88	83	M [%]	
		2.56	73	179	487	789	1085	1387	1684	1988	2284	2497	2863	n [rpm]	
100L/4	4 kW	1.99	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.8	12.3	M [Nm]	
	9.5 A	3.37	94	94	94	94	94	94	94	94	94	89	86	M [%]	
		3.73	0	207	520	809	1106	1409	1709	2008	2307	2518	2887	n [rpm]	
100LA/4 T140°C	5.5 kW	3.02	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	19.3	18.5	17.3	M [Nm]	
	12.5 A	4.87	100	100	100	100	100	100	100	100	95	91	85	M [%]	
		5.21	51	211	516	820	1120	1419	1718	2016	2263	2510	2877	n [rpm]	
112M/4	7.5 kW	3.92	21.1	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.3	26.1	21.6	M [Nm]	
	16.0 A	6.87	80	100	100	100	100	100	100	100	100	99	82	M [%]	
		6.54	15	213	518	820	1119	1419	1719	2016	2312	2517	2896	n [rpm]	
132S/4	11 kW	5.52	33.5	36.4	36.4	36.4	36.4	36.4	33.8	31.7	28.7	25.3	20.5	M [Nm]	
	24.0 A	6.79	92	100	100	100	100	100	93	87	79	70	56	M [%]	
		6.27	15	240	545	848	1150	1450	1755	2057	2357	2566	2921	n [rpm]	
132M/4	15 kW	7.40	46.9	49.6	49.6	49.6	49.6	48.7	47.0	45.3	41.6	39.0	33.8	M [Nm]	
	31.0 A	10.47	95	100	100	100	100	98	95	91	84	79	68	M [%]	
		10.43	19	244	547	849	1151	1452	1757	2054	2356	2562	2944	n [rpm]	
132MA/4 T140°C	18 kW	9.01	51.9	60.8	60.8	60.8	59.7	59.6	56.4	53.9	50.4	45.6	42.6	M [Nm]	
	38.0 A	12.20	85	100	100	100	98	98	93	89	83	75	70	M [%]	
		13.09	17	234	540	840	1143	1443	1746	2049	2349	2556	2934	n [rpm]	

Table 18: IE1 and IE2 motors with external fan, 87 Hz nominal point

Legend					
f _s	Stator frequency	M	Torque	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres	[%]	in % of rated torque
				n	Speed
				[rpm]	Speed in rpm

2.2.3 Motors with external fans, 100 Hz nominal point, Category 3D

Motor type ↓	For the circuit, please refer to 1.7 Frequency inverter power and rated current													Legend see below
	Motor power in [kW] at 50 Hz (upper) and 100 Hz (lower)													
	↓	3	10	20	30	40	50	60	70	80	90	100	f _s [Hz]	
63S/4	0.55 kW	0.09	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	M [Nm]
	1.6 A		71	71	71	71	71	71	71	71	71	71	70	M [%]
		0.18	6	134	401	731	1033	1346	1652	1947	2253	2542	2827	n [rpm]
63L/4	0.55 kW	0.13	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	M [Nm]
	1.6 A		68	68	68	68	68	68	68	68	68	67	64	M [%]
		0.25	30	185	422	750	1057	1351	1648	1944	2256	2548	2851	n [rpm]
71S/4	0.55 kW	0.18	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	M [Nm]
	1.6 A		71	71	71	71	71	71	71	71	71	69	65	M [%]
		0.34	30	181	462	774	1076	1389	1687	1985	2284	2583	2884	n [rpm]
71L/4	0.55 kW	0.24	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.4	M [Nm]
	1.6 A		63	63	63	63	63	63	63	63	63	58	54	M [%]
		0.42	0	152	475	788	1090	1398	1700	1992	2283	2587	2891	n [rpm]
80S/4	0.75 kW	0.38	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.2	M [Nm]
	2.2 A		66	66	66	66	66	66	66	66	66	62	57	M [%]
		0.67	0	163	410	810	1108	1416	1712	2028	2344	2627	2910	n [rpm]
80L/4	1.1 kW	0.52	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.2	M [Nm]
	3.0 A		67	67	67	67	67	67	67	67	67	66	62	M [%]
		0.99	0	196	505	812	1116	1414	1715	2015	2313	2611	2908	n [rpm]
90S/4	1.5 kW	0.75	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.6	M [Nm]
	3.7 A		66	66	66	66	66	66	66	66	66	65	60	M [%]
		1.40	0	183	516	822	1120	1425	1725	2025	2321	2620	2911	n [rpm]
90L/4	2.2 kW	1.05	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	6.9	6.6	M [Nm]
	5.5 A		69	69	69	69	69	69	69	69	69	67	64	M [%]
		2.00	20	192	484	799	1098	1406	1707	2008	2309	2606	2905	n [rpm]
100L/4	3 kW	1.45	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.2	8.7	M [Nm]
	7.0 A		67	67	67	67	67	67	67	67	67	64	61	M [%]
		2.68	25	205	524	829	1132	1429	1736	2036	2335	2631	2927	n [rpm]
100LA/4 T140°C	4 kW	1.96	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	12.4	11.8	M [Nm]
	9.5 A		65	65	65	65	65	65	65	65	65	61	58	M [%]
		3.61	20	210	520	830	1131	1431	1731	2031	2330	2629	2924	n [rpm]
112M/4	5.5 kW	2.67	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	M [Nm]
	12.5 A		68	68	68	68	68	68	68	68	68	68	68	M [%]
		5.46	5	220	520	820	1120	1420	1720	2020	2320	2599	2898	n [rpm]
132S/4	7.5 kW	3.68	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	23.8	M [Nm]
	16.0 A		67	67	67	67	67	67	67	67	67	67	66	M [%]
		7.36	15	240	550	850	1150	1450	1750	2050	2350	2650	2950	n [rpm]
132M/4	11 kW	5.42	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	33.9	M [Nm]
	24.0 A		72	72	72	72	72	72	72	72	72	72	68	M [%]
		10.46	15	240	550	850	1150	1450	1750	2050	2350	2650	2950	n [rpm]
132MA/4 T140°C	15 kW	6.58	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	41.5	M [Nm]
	31.0 A		72	72	72	72	72	72	72	72	72	72	68	M [%]
		12.73	15	238	536	837	1138	1439	1731	2029	2329	2633	2930	n [rpm]

Table 19: IE1 and IE2 motors with external fan, 100 Hz nominal point

Legend			
f _s	Stator frequency	M	Torque
[Hz]	in Hertz	[Nm]	in Newton metres
		M	Torque
		[%]	in % of rated torque
		n	Speed
		[rpm]	Speed in rpm


3 Appendix

3.1 Abbreviations

2D	Category 2D		
3D	Category 3D (non-conducting dust)		
ATEX	AT mospheres EX plosibles	IE1	Efficiency as per IE1
DIN	Deutsche Industrie Norm	IE2	Efficiency as per IE2
EN	European standard	V/f	Voltage/frequency characteristic curve

3.2 Legend / Formula symbols

cos φ	Power factor	M	Torque [Nm] or [%]
T_u	Ambient temperature [°C]	n	Speed [rpm]
T125 / T140	Max. surface temperature [°C]	P_N	Rated power [kW]
f_s	Stator frequency [Hz]	R_{St}	Resistance on line [Ω]
f_N	Nominal frequency [Hz]	U_N	Rated voltage [V]
I_N	Nominal motor current [A]		



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