SEW EURODRIVE

Latest News

Permanent magnet synchronous motor

DR2C71MSA4 – DR2C132SA6 (IPM-Technology)

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Content

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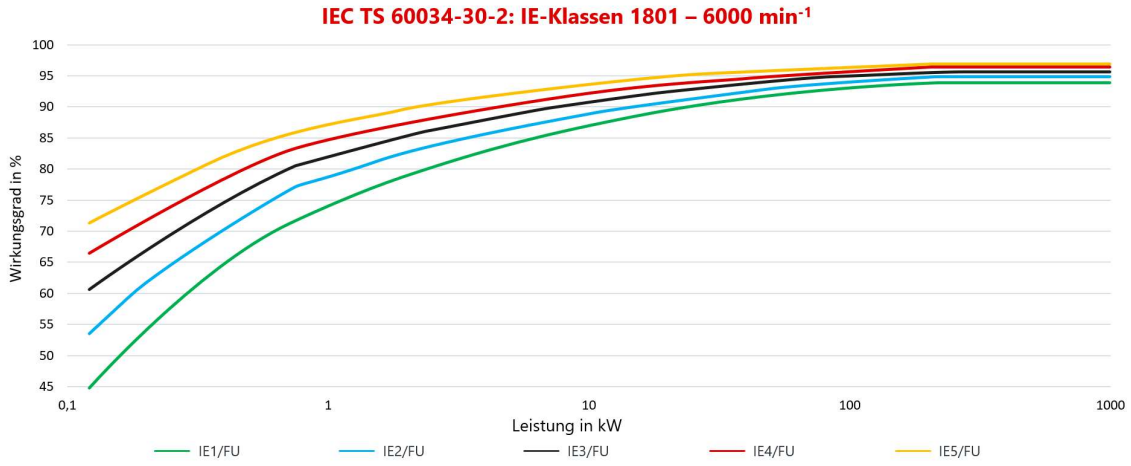
1 Target market and target groups

1.1 Market requirements

Energy efficiency and sustainability are becoming increasingly important worldwide. We are looking for new solutions that can further reduce energy consumption.
If a speed-controlled drive is the most energy-efficient solution for the application, innovative motor technologies can be used for pure inverter operation. Switching from line-operated motors or line motors operated on the inverter to motors developed for inverter-only operation offers significant potential for more efficient use of energy
The greatest benefit in saving money is when the speed control options of these IE5 motors are consistently effective in the systems and machines.
In combination with efficient gear units and intelligent frequency inverters, energy-efficient drive solutions are created that focus on losses in a wide range of applications.

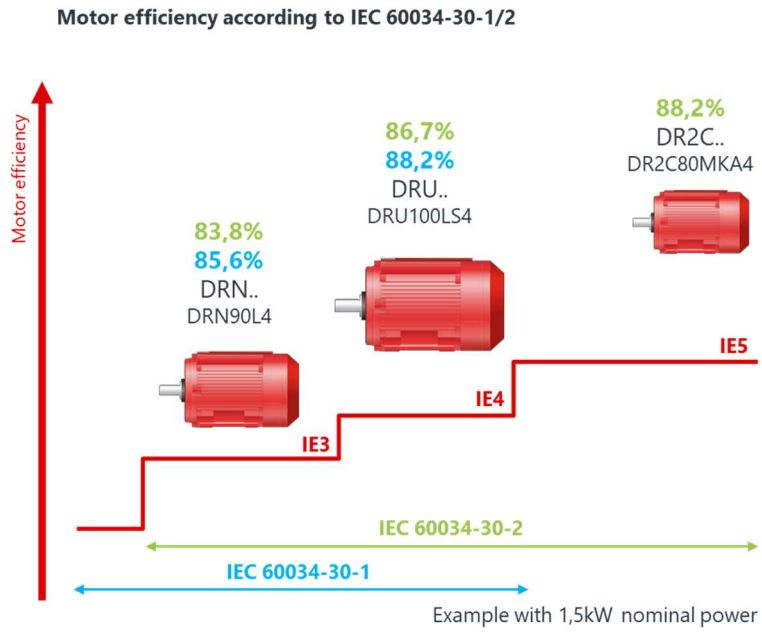
1.2 Efficiency standards

Electrical motors for line operation are measured according to IEC 60034-2-1 and divided into efficiency classes according to IEC 60034-30-1. IEC 60034-30-2 applies to pure inverter motors. The motors are measured as a system here.
The maximum possible efficiency class IE4 for line motors (without/with inverter operation) from part 30-1 of IEC 60034 is compared to an IE5 stage from part 30-2 of the IEC/TS 60034 standard for the inverter motor. An IE5 motor according to part 30-2 has about 20% less losses than an IE4 motor.



The IE class of a line motor operated on a frequency inverter and a pure inverter motor according to part IEC60034-30-2 can be compared directly with each other. The IEC 60034-30-2 takes into account the additional losses in the motor caused by the frequency inverter. 15% additional losses are assumed for motors up to 90 kW. The limit values of the IE classes are correspondingly lower.

For example, an IE4 motor with 1,5 kW has an efficiency of 88,2% according to IEC 60034-30-1. The efficiency of the frequency inverter according to IEC 60034-30-2 is 86,7%.



1.3 Target branches and target applications

The target industries and applications of IE5 synchronous motors do not differ from those of previous asynchronous motors. This means the new DR2C..a motor can be used wherever a DRN.. Motor is already used today.
Particular emphasis should be placed on applications with very long runtimes and start/stop applications in cyclic production processes. The following applications can be mentioned as examples:

- Transport and logistics
  - Belt conveyors, especially sorter belts
  - Roller Conveyors
  - Belt Conveyor
  - Rotary Switch Tables
  - Scissor Lift Tables
  - Palletizer

- Production technology
  - Skid Conveyor
  - Turning Units
  - Lifting Lowering Conveyor
  - Rapid/Creep Speed Positioning

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2 Product description

2.1 Technology

To achieve higher motor efficiency levels, switching from asynchronous to synchronous motors has the highest energy-saving potential. Approximately one third of the losses in the asynchronous motor are rotor losses. These are virtually eliminated in the synchronous motor.
The DR2C..a motor is a permanent-magnet-controlled AC synchronous motor with IPM technology (interior permanent magnet). Unlike synchronous servomotors, the magnets are not located on the surface of the rotor, but inside it.

This results in the following properties:

- Lower torque density compared to a servomotor
- Reduced use of magnetic material
- Very cost-effective and robust assembly concept of the magnets
- Low housing costs due to the use of the standard DR.. Modular system
- Higher torque density compared to an asynchronous motor
- Smaller size compared to an asynchronous motor
- Low heating or high thermal reserves

The IPM motor represents the most cost-effective compromise between efficiency and power density.

Permanent magnet motors can only be operated on the frequency inverter. In the past, this required encoder feedback. This led to high system investments. The introduction of the MOVI-C® modular automation system with the ELSM® (Encoderless Synchronous Motor) encoderless control system has made it possible to use the entire range of IPM technology.

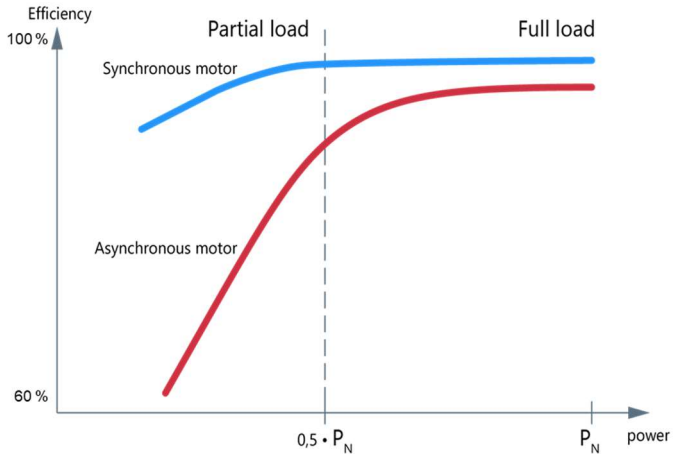
2.2 Energy savings through system solutions

Optimizing the overall system saves significantly more energy than simply optimizing the system at the component level. In addition to the high efficiency of the DR2C.. motors, two other aspects are important:

-High efficiency in the partial load range
If production processes require different speeds, the motor does not run at the rated operating point. The significantly higher efficiency of a synchronous motor compared to an asynchronous motor in the partial-load range offers a high additional potential for savings.

-Reduction of the kinetic energy in the system
In cyclic processes, a load profile usually consists of the three sections acceleration, constant travel and deceleration. In the acceleration phase, large motors require more energy than small, compact motors due to their high mass inertia.

The following diagram shows the characteristic of the motor efficiency levels in the partial load range for asynchronous and synchronous motors.



Depending on the load profile, additional energy savings of between 10% and 30% can be achieved using a solution with speed control and a DR2C..A motor.

2.3 Energy efficiency vs. power density

Due to its characteristics, the IPM motor can be used in two ways:

Power utilization IE5	**Maximum thermal power utilization**
Operation at IE5 operating point	Utilization of the thermally permissible limit characteristic curve,
Thermal class F	Thermal class F
Highest energy efficiency	Reduced energy efficiency (partially IE3/IE4, depending on Motor Size)
High power density	Highest power density
Compact design	Most compact design
Low mass inertia	Lowest mass inertia - High dynamics - Lower kinetic energy
Low heating (depending on size) - Minimum surface temperature	Thermal utilization 80K
Cooling types ventilated (IC411, TEFC), unventilated (IC410, TENV)	Cooling types ventilated (IC411, TEFC),
Used for applications with constant load e.g. mixer, stirrer	Used for applications with changing loads or frequent start/stop cycles e.g. parcel distribution centers

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2.4 Key facts

Motor type	Permanent magnet synchronous motor with IPM-Technology
Number of poles	Size 71/80: 4 Size 90/100: 6 Size 112/132S: 6
Speed classes	2000 1/min 3000 1/min
IE5 Power	2000 1/min: 0,7…13 kW 3000 1/min: 1,1…17 kW
thermal Power	2000 1/min: 0,9…13 kW 3000 1/min: 1,4…20 kW
Operating Mode	S9
SEW System solution	In Combination with MOVI-C® Inverter: - Encoderless in ELSM® Operating mode - With encoder in CFC Operating mode In combination with MOVITRAC® LTE-B+ and MOVITRAC® LTP-B - Encoderless in PMVC® Operating mode
Cooling methods	- self ventilated (IC411, default) - non ventilated (IC410, Option /U, /OL)
System voltage	400 V (no voltage range available)
Thermal class	Thermal class F (155 °C)
Sealing type	FKM
Mounting options	DR.. modular platform options (with restrictions)
Marking	Inverter duty only, PM (Permanent Magnet), Operating Mode S9

2.5 Inverter operation

The DR2C. motors must be operated on a frequency inverter. Operation on the supply system is not possible.
If the motors are operated at a frequency inverter with more than 1800 rpm, SEW-EURODRIVE recommends using FKM oil seals (fluorocarbon rubber) on the A and B sides of the motor. For DR2C..a motors, the FKM oil seals are therefore used as standard.

2.6 System overview DR2C.. motors with SEW frequency inverter

The following tables show the inverter assignment for 100% utilization of the IE5 power or the thermally permitted power. The standard assignment refers to horizontal applications or vertical applications with encoders.
Depending on the utilization and load profile, inverters with lower nominal currents can also be assigned. The application-dependent assignment is performed during project planning with the SEW Workbench®. In general, each IE5 solution should be designed using the Workbench.

2.6.1 MOVI-C® decentralized technology IE5 power utilization

Type	Speed	P_{IE5}	M_{IE5}	I_{IE5}	MOVIMOT® flexible
DR2C 71MSA 4	2000	0,69	3,3	1,77	-0020-.
DR2C 71MA 4	2000	1	4,95	2,45	-0025-..
DR2C 80MKA 4	2000	1,5	7,1	3,55	-0040-..
DR2C 80MA 4	2000	2,3	10,8	5	-0055-..
DR2C 90SA 6	2000	3,6	17,3	8	-0095-..
DR2C 90LA 6	2000	4,7	22,5	10,2	-0125-..
DR2C 100LSA 6	2000	5,9	28	13,3	-0160-..
DR2C 100LA 6	2000	7,2	34,5	17,1	-
DR2C 112MA 6	2000	9,8	47	21,5	-
DR2C 132SA 6	2000	13	63	27,5	-
DR2C 71MSA 4	3000	1,1	3,55	2,65	-0032-..
DR2C 71MA 4	3000	1,7	5,3	3,95	-0040-..
DR2C 80MKA 4	3000	2,4	7,6	5,7	-0070-..
DR2C 80MA 4	3000	3,5	11,3	7,9	-0095-..
DR2C 90SA 6	3000	5,6	18	12,5*	-0125-..
DR2C 90LA 6	3000	7,1	22,5	14,9	-0160-..
DR2C 100LSA 6	3000	9,4	30	22	-
DR2C 100LA 6	3000	11	34	24	-
DR2C 112MA 6	3000	15	47	32,5	-
DR2C 132SA 6	3000	17	54	34	-

* Limited to the nominal current of the inverter -0125-..

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2.6.2 MOVITRAC® advanced IE5 power utilization

Type	Speed	P_{IE5}	M_{IE5}	I_{IE5}	MOVITRAC® advanced
DR2C 71MSA 4	2000	0,69	3,3	1,77	MCX91A-0025-5E3-4-..
DR2C 71MA 4	2000	1	4,95	2,45	MCX91A-0040-5E3-4-..
DR2C 80MKA 4	2000	1,5	7,1	3,55	MCX91A-0055-5E3-4-..
DR2C 80MA 4	2000	2,3	10,8	5	MCX91A-0070-5E3-4-..
DR2C 90SA 6	2000	3,6	17,3	8	MCX91A-0125-5E3-4-..
DR2C 90LA 6	2000	4,7	22,5	10,2	MCX91A-0160-5E3-4-..
DR2C 100LSA 6	2000	5,9	28	13,3	MCX91A-0240-5E3-4-..
DR2C 100LA 6	2000	7,2	34,5	17,1	MCX91A-0240-5E3-4-..
DR2C 112MA 6	2000	9,8	47	21,5	MCX91A-0320-5E3-4-..
DR2C 132SA 6	2000	13	63	27,5	MCX91A-0400-5E3-4-..
DR2C 71MSA 4	3000	1,1	3,55	2,65	MCX91A-0040-5E3-4-..
DR2C 71MA 4	3000	1,7	5,3	3,95	MCX91A-0055-5E3-4-..
DR2C 80MKA 4	3000	2,4	7,6	5,7	MCX91A-0095-5E3-4-..
DR2C 80MA 4	3000	3,5	11,3	7,9	MCX91A-0125-5E3-4-..
DR2C 90SA 6	3000	5,6	18	12,5*	MCX91A-0160-5E3-4-..
DR2C 90LA 6	3000	7,1	22,5	14,9	MCX91A-0240-5E3-4-..
DR2C 100LSA 6	3000	9,4	30	22	MCX91A-0320-5E3-4-..
DR2C 100LA 6	3000	11	34	24	MCX91A-0320-5E3-4-..
DR2C 112MA 6	3000	15	47	32,5	MCX91A-0460-5E3-4-..
DR2C 132SA 6	3000	17	54	34	MCX91A-0460-5E3-4-..

* Limited to the nominal current of the inverter -0125-..

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2.6.3 MOVIDRIVE® Technology / System / modular IE5 power utilization

Type	Speed	P_{IE5}	M_{IE5}	I_{IE5}	MOVIDRIVE® system/technology	MOVIDRIVE® modular
DR2C 71MSA 4	2000	0,69	3,3	1,77	MDX91A-0020-5E3-4-..	MDA90A-0040-503-X-..
DR2C 71MA 4	2000	1	4,95	2,45	MDX91A-0032-5E3-4-..	MDA90A-0040-503-X-..
DR2C 80MKA 4	2000	1,5	7,1	3,55	MDX91A-0040-5E3-4-..	MDA90A-0040-503-X-..
DR2C 80MA 4	2000	2,3	10,8	5	MDX91A-0055-5E3-4-..	MDA90A-0080-503-X-..
DR2C 90SA 6	2000	3,6	17,3	8	MDX91A-0095-5E3-4-..	MDA90A-0080-503-X-..
DR2C 90LA 6	2000	4,7	22,5	10,2	MDX91A-0125-5E3-4-..	MDA90A-0120-503-X-..
DR2C 100LSA 6	2000	5,9	28	13,3	MDX91A-0160-5E3-4-..	MDA90A-0160-503-X-..
DR2C 100LA 6	2000	7,2	34,5	17,1	MDX91A-0240-5E3-4-..	MDA90A-0240-503-X-..
DR2C 112MA 6	2000	9,8	47	21,5	MDX91A-0240-5E3-4-..	MDA90A-0240-503-X-..
DR2C 132SA 6	2000	13	63	27,5	MDX91A-0320-5E3-4-..	MDA90A-0320-503-X-..
DR2C 71MSA 4	3000	1,1	3,55	2,65	MDX91A-0032-5E3-4-..	MDA90A-0040-503-X-..
DR2C 71MA 4	3000	1,7	5,3	3,95	MDX91A-0040-5E3-4-..	MDA90A-0040-503-X-..
DR2C 80MKA 4	3000	2,4	7,6	5,7	MDX91A-0070-5E3-4-..	MDA90A-0080-503-X-..
DR2C 80MA 4	3000	3,5	11,3	7,9	MDX91A-0095-5E3-4-..	MDA90A-0080-503-X-..
DR2C 90SA 6	3000	5,6	18	12,5*	MDX91A-0125-5E3-4-..	MDA90A-0125-503-X-..
DR2C 90LA 6	3000	7,1	22,5	14,9	MDX91A-0160-5E3-4-..	MDA90A-0160-503-X-..
DR2C 100LSA 6	3000	9,4	30	22	MDX91A-0240-5E3-4-..	MDA90A-0240-503-X-..
DR2C 100LA 6	3000	11	34	24	MDX91A-0240-5E3-4-..	MDA90A-0240-503-X-..
DR2C 112MA 6	3000	15	47	32,5	MDX91A-0460-5E3-4-..	MDA90A-0320-503-X-..
DR2C 132SA 6	3000	17	54	34	MDX91A-0460-5E3-4-..	MDA90A-0480-503-X-..

* Limited to the nominal current of the inverter -0125-.

2.6.4 MOVITRAC® LTE B+ (operating mode PMVC) IE5 power utilization

Type	Speed	P_{IE5}	M_{IE5}	I_{IE5}	MOVITRAC® LTE B+
DR2C 71MSA 4	2000	0,69	3,3	1,77	MC LTE-B 0008-5A3-..
DR2C 71MA 4	2000	1	4,95	2,45	MC LTE-B 0015-5A3-..
DR2C 80MKA 4	2000	1,5	7,1	3,55	MC LTE-B 0015-5A3-..
DR2C 80MA 4	2000	2,3	10,8	5	MC LTE-B 0022-5A3-..
DR2C 90SA 6	2000	3,6	17,3	8	MC LTE-B 0040-5A3-..
DR2C 90LA 6	2000	4,7	22,5	10,2	MC LTE-B 0055-5A3-..
DR2C 100LSA 6	2000	5,9	28	13,3	MC LTE-B 0055-5A3-..
DR2C 100LA 6	2000	7,2	34,5	17,1	MC LTE-B 0075-5A3-..
DR2C 112MA 6	2000	9,8	47	21,5	MC LTE-B 0110-5A3-..
DR2C 132SA 6	2000	13	63	27,5	MC LTE-B 0150-5A3-..
DR2C 71MSA 4	3000	1,1	3,55	2,65	MC LTE-B 0015-5A3-..
DR2C 71MA 4	3000	1,7	5,3	3,95	MC LTE-B 0015-5A3-..
DR2C 80MKA 4	3000	2,4	7,6	5,7	MC LTE-B 0022-5A3-..
DR2C 80MA 4	3000	3,5	11,3	7,9	MC LTE-B 0040-5A3-..
DR2C 90SA 6	3000	5,8	18,5	12,8	MC LTE-B 0055-5A3-..
DR2C 90LA 6	3000	7,1	22,5	14,9	MC LTE-B 0075-5A3-..
DR2C 100LSA 6	3000	9,4	30	22	MC LTE-B 0110-5A3-..
DR2C 100LA 6	3000	11	34	24	MC LTE-B 0110-5A3-..
DR2C 112MA 6	3000	15	47	32,5	MC LTE-B 0185-5A3-..
DR2C 132SA 6	3000	17	54	34	MC LTE-B 0185-5A3-..

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2.6.5 MOVITRAC® LTP-B (operating mode PMVC) IE5 power utilization

Type	Speed	P_{IE5}	M_{IE5}	I_{IE5}	MOVITRAC® LTE B+
DR2C 71MSA 4	2000	0,69	3,3	1,77	MC LTP-B 0008-5A3-..
DR2C 71MA 4	2000	1	4,95	2,45	MC LTP-B 0015-5A3-..
DR2C 80MKA 4	2000	1,5	7,1	3,55	MC LTP-B 0015-5A3-..
DR2C 80MA 4	2000	2,3	10,8	5	MC LTP-B 0022-5A3-..
DR2C 90SA 6	2000	3,6	17,3	8	MC LTP-B 0040-5A3-..
DR2C 90LA 6	2000	4,7	22,5	10,2	MC LTP-B 0055-5A3-..
DR2C 100LSA 6	2000	5,9	28	13,3	MC LTP-B 0055-5A3-..
DR2C 100LA 6	2000	7,2	34,5	17,1	MC LTP-B 0075-5A3-..
DR2C 112MA 6	2000	9,8	47	21,5	MC LTP-B 0110-5A3-..
DR2C 132SA 6	2000	13	63	27,5	MC LTP-B 0150-5A3-..
DR2C 71MSA 4	3000	1,1	3,55	2,65	MC LTP-B-0015-5A3-..
DR2C 71MA 4	3000	1,7	5,3	3,95	MC LTP-B-0015-5A3-..
DR2C 80MKA 4	3000	2,4	7,6	5,7	MC LTP-B-0022-5A3-..
DR2C 80MA 4	3000	3,5	11,3	7,9	MC LTP-B-0040-5A3-..
DR2C 90SA 6	3000	5,8	18,5	12,8	MC LTP-B 0055-5A3-..
DR2C 90LA 6	3000	7,1	22,5	14,9	MC LTP-B 0075-5A3-..
DR2C 100LSA 6	3000	9,4	30	22	MC LTP-B 0110-5A3-..
DR2C 100LA 6	3000	11	34	24	MC LTP-B 0110-5A3-..
DR2C 112MA 6	3000	15	47	32,5	MC LTP-B 0185-5A3-..
DR2C 132SA 6	3000	17	54	34	MC LTP-B 0185-5A3-..

2.6.6 Control mode ELSM®

The ELSM® control mode allows encoderless operation of permanent-magnet magnets synchronous motors. There are two areas in the ELSM® control mode: Open-loop control and closed-loop controlled operation. Open-loop control takes place when starting from standstill and below a transition speed. This transition speed is approximately 2% of the nominal speed. Above this transition speed, the drive is operated in a closed-loop controlled manner.

In open-loop control, a current of 150% of the rated motor current is set.
The optimum assignment of the SEW frequency inverter to the motor takes place in the SEW Workbench, taking into account the maximum inverter currents at 0 Hz.
The following rules apply for a flat-rate assignment:

Inverter	Motor nominal Current : Inverter nominal current
MOVI-C® decentral	1 : 1
MOVITRAC® advanced	1 : 1,3
MOVIDRIVE® system/technology	1 : 1
MOVIDRIVE® modular	1 : 1

Inertia Ratios:
- For a ratio greater than 1:15 of the rotor mass moment of inertia to the load mass moment of inertia, it is recommended to optimize the drive train (entering the external mass moment of inertia) during startup.

PMW Frequency:
- The recommended PWM frequency is 4 kHz. In open-loop operation, the frequency inverter automatically switches to 4 kHz

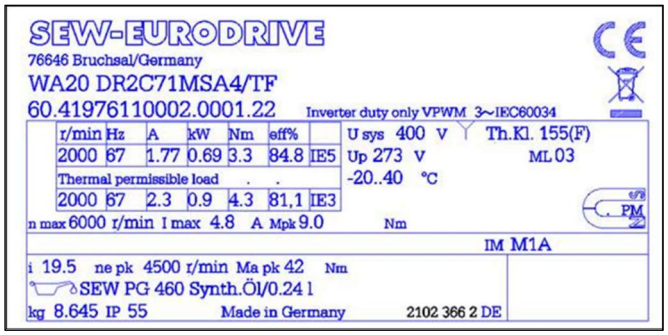
The use of the drives in hoist applications is not permitted in conjunction with the ELSM® control mode.

2.7 Type designation & nameplate

The following table shows an example of the structure of the type designation:

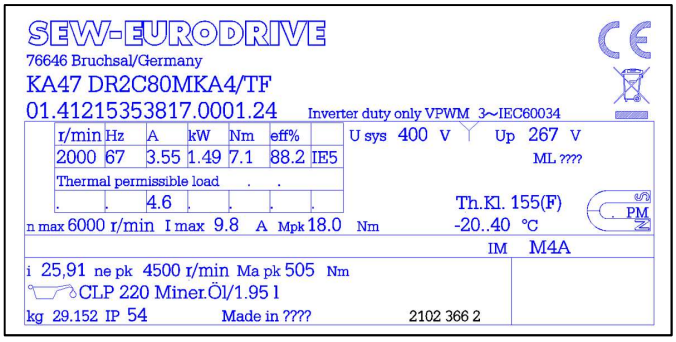
DR2C71MSA4	
DR2	Product family
C	Product series C = Synchronous inverter motor
71	Motor size
MS	Motor length
A	Rotor technology A = IPM Technology (Interior Permanent Magnet)

The figure below shows an example of the nameplate of a DR2C..A geared motor



Both operating points are confirmed on the nameplate with the IE5 performance and the thermally permissible performance.

There is also the option of deselecting the thermal operating point, so that only the IE5 operating point is confirmed on the nameplate.



2.8 International approvals

The status of country relevant approvals depending on the applicable regulations can be seen in the following table:

Market		001 Europe (CE)	012 Europe (CE) /USA (UR) /Canada (CSA)	0013 Europe (CE) /USA (UR)
Brazil	ABNT			
China	CEL			
	CCC			
EAC	EAC			
Europe	CE			
India				
Japan				
Canada	CSA			
Colombia	RETIE			
Morocco	CMIM			
Mexico				
South Korea				
UK + NI	UKCA			
Ukraine	UA.TR			
USA	UR			

	available
	in preparation
	Not affected
	Not available

DR2C..A motors are only subject to the country-specific MEPs requirements in China. In all other countries, the information on efficiency and IE class is voluntary. There are currently no other country-specific regulations for permanent magnet synchronous motors.

If you require DR2C..A motors with certifications other than here listed, please contact SEW-EURODRIVE

2.9 Operating temperature

The motors are designed as standard for use in a temperature range from -20 °C to +40 °C. According to IEC 60034, the standard temperature range is reduced by -15 °C to +40 °C.
If the motors are to be operated outside the standard temperature range, you may have to Modifications. Please contact SEW-EURODRIVE in this case
losses

2.9.1 Derating for increased ambient temperature and installation altitude

In case the DR2C.. motor are operated within the ambient temperature range of +40°C to +60°C, or at an installation altitude between 1000m and 4000 m, adjust the operating points. The effective operating point for this installation altitude and increased ambient temperature is determined by factor fAU in the following table, as well as by the correlation:

$$M_{AU,eff} = \frac{1}{\sqrt{f_{AU}}} \times M_{eff}$$

$$n_{AU,eff} = \frac{1}{K_e \times f_{AU}} \times n_{eff}$$

M_{eff}	=	Effective motor torque based on the load profile	$[M_{eff}]$ = Nm
$M_{AU,eff}$	=	Effective torque based on the load profile, installation altitude and/or increased ambient temperature taken into consideration	$[M_{AU,eff}]$ = Nm
n_{eff}	=	Mean thermal motor speed based on the load profile	$[n_{eff}] = min^{-1}$
$n_{AU,eff}$	=	Effective speed based on the load profile, under consideration of installation altitude and/or increased ambient temperature	$[\eta_{AU}] = min^{-1}$
f_{AU}	=	Derating factor for installation altitude and/or increased ambient temperature	$[f_{AU}] = 1$
K_e	=	Encoder factor for resolvers = 1; for electronic encoders (e.g. HIPERFACE® encoders) = 0.9	$[K_e] = 1$

f_{AU}	+40° C	+45° C	50 °C	55 °C	60 °C
1000 m	1	0.95	0.9	0.86	0.81
2000 m	0.9	0.86	0.81	0.77	0.73
3000 m	0.8	0.76	0.72	0.69	0.65
4000 m	0.7	0.67	0.63	0.6	0.57

Derating factor f_{AU} depending on installation altitude and ambient temperature

Example for a motor with the following framework conditions:

– Ambient temperature 50 °C

– Installation altitude 3000 m

– Resolver

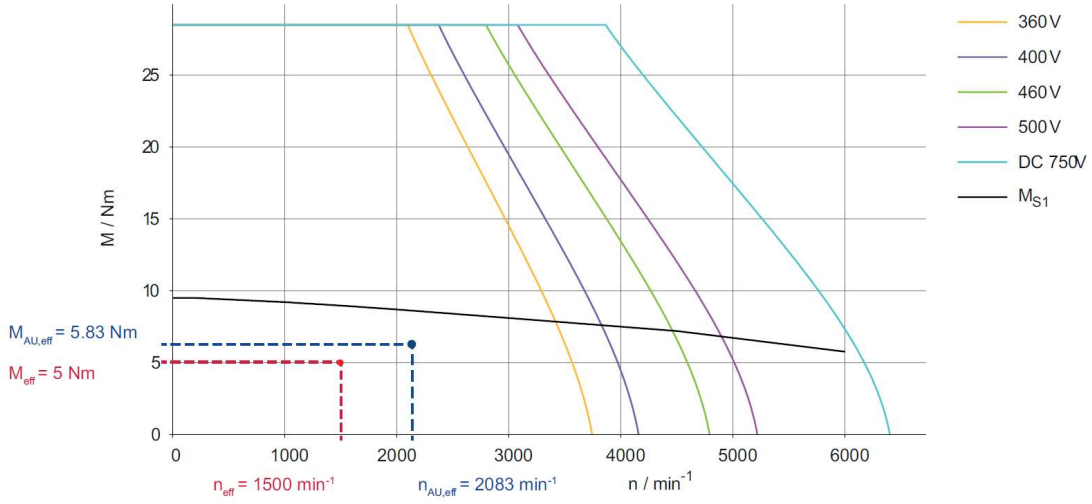
– From the configuration or load profile: Meff = 5 Nm and neff = 1500 min-1

The previous table determines the derating factor: fAU = 0.72.

$$M_{AU,eff} = \frac{1}{\sqrt{0.72}} \times 5Nm = 5.89Nm$$

$$n_{AU,eff} = \frac{1}{1 \times 0.72} \times 1500min^{-1} = 2083min^{-1}$$

If this point is below the MS1 characteristic of the motor, you can operate the motor continuously under the described conditions.



3 Variants, Options and Accessoires

DR2C..A motors are always equipped with the same options as DRN.. or DR2L.. motors in the same size.
The DR2C..A is available as an inverter motor as standard with temperature protection /TF.

The following **new** options will be available with DR2C..A motors:

- /EK8W: Add-on incremental and single-turn encoders (18 bit incremental)
- /RK8M: Add-on resolver

The following options or versions are **not** available:

- Incremental encoder (not absolute) in the control loop
- Backstop
- Reinforced winding insulation RI2
- In conjunction with a VU and VZ variable speed gear unit
- Voltage range because it can only be operated on the frequency inverter
- Inch flanges, inch shafts only as required
- Temperature detection 3xPT
- Thermal class B, H

3.1 Encoders

For technical details on the encoders, refer to the "Addendum to the operating instructions – built-in encoders and add-on encoders".
https://download.sew-eurodrive.com/download/pdf_u/27785742.pdf#search=%22Einbaugeber%20und%20Anbaugeber%22
In addition to the encoders listed below for motor control in the control loop, the DR2C..A motors can be configured with additional encoders that are not used in the closed control loop but also for additional position information. These are the built-in encoders of the EI7 family as well as the EI8R and EI8C built-in encoders.

3.1.1 AK8W / AV8W

AK8W /AV8W	
Description	Multi-turn absolute encoders in a high capability class with SinCos and RS485 interface
Mounting	Cone shaft/cone shaft in flange cover mounting
Connection	Integrated encoder plug connector on encoder cover
Availability	Available
Technical data	See addendum to the operating instructions: built in encoders, add-on encoders ans safety encoders (P/N 30586070)

3.1.2 AK8H / AV8H

AK8H /AV8H	
Description	Multi-turn absolute encoders in a high capability class with Hiperface®-interface
Mounting	Cone shaft/cone shaft in flange cover mounting
Connection	Integrated encoder plug connector on encoder cover
Availability	Available
Technical data	See addendum to the operating instructions: built in encoders, add-on encoders ans safety encoders (P/N 30586070)

3.1.3 AK8Z

AK8Z	
Description	Multi-turn absolute encoders in a high capability class with MOVILINK® DDI-interface
Mounting	Cone shaft/cone shaft in flange cover mounting
Connection	KD1 (M23 Hybrid connection)
Availability	Available
Technical data	See addendum to the operating instructions - AC Motors with MOVILINK® DDI Interface (p/n 30593182

3.1.4 EK8W

EK8W	
Description	Singleturn absolute encoders in a high capability class with SinCos and RS485 interface
Mounting	Cone shaft/cone shaft in flange cover mounting
Connection	Integrated encoder plug connector on encoder cover
Availability	available
Technical data	See addendum to the operating instructions: built in encoders, add-on encoders ans safety encoders (P/N 30586070)

3.1.5 EK9Z

EK9Z	
Description	Singleturn absolute encoders in a high capability class with MOVILINK® DDI-interface
Mounting	Cone shaft/cone shaft in flange cover mounting
Connection	KD1 (M23 Hybrid connection)
Availability	Available
Technical data	See addendum tot he operating instruction AC Motors with MOVILINK® DDI Interface (P/N 30593174)

3.1.6 RK8M

RK8M	
Description	Resolver in a medium capability class
Mounting	Cone shaft/cone shaft in flange cover mounting
Connection	Integrated encoder plug connector on encoder cover
Availability	In preparation, Q2/2023
Technical data	See addendum to the operating instructions: built in encoders, add-on encoders ans safety encoders (P/N 30586070)

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3.1.7 Additional encoders

Description	Inkrementalgeber **EI71:** HTL Interface with 1 period/turn **EI72:** HTL Interface with 2 periods/turn **EI76:** HTL Interface with 6 periods/turn **EI7C:** HTL Interface with 24 periods/turn **EI8C:** HTL Interface with 1024 periods/turn **EI8C:** HTL Interface with 1024 periods/turn
Mounting	Motor integrated with standard shaft
Connection	**EI7.:** M12 on the terminal box or terminal strip in the terminal box **EI8.:** M23 on the terminal box or terminal strip in the terminal box
Availability	available
Technical data	See addendum to the operating instructions: built in encoders, add-on encoders ans safety encoders (P/N 30586070)

3.1.8 Encoder mounting adapter

Encoder mounting adapter serve to prepare the motor for later retrofitting of an encoder. The motor can therefore be retrofitted with an encoder using an encoder set.

EI7A EI8A EK8A XV.A	
Description	Encoder mounting adapter **EI7A:** retrofit to an EI7 built- in encoder. **EI8A:** retrofit to an EI8 built- in encoder. **EK8A:** retrofit to an EK7 or AK8 built- in encoder.. (Encoder with MOVILINK® DDI interface cannot currently be retrofitted If necessary, please get in touch with SEW-EURODRIVE. **XV.A:** retrofit of encoders mounted on the fan guard
Mounting	As with the respective encoder to be retrofitted.
Connection	As with the respective encoder to be retrofitted.
Availability	Available
Technical data	See addendum to the operating instructions: built in encoders, add-on encoders ans safety encoders (P/N 30586070)

3.2 Brakes

The brake assignment of BE.. brakes for the DR2C..A motors is realized in the same way as the size-dependent assignment in the DR.. modular motor system.

3.2.1 Assignment and brake torques:

Motor	Brake	Brake torques											
DR2C71MSA DR2C71MA	BE03	0,9	1,3	1,7	2,1	2,7	3,4						
	BE05				1,8	2,5	3,5	5					
	BE1							5	7	10			
DR2C80MKA DR2C80MA	BE05				1,8	2,5	3,5	5	7*				
	BE1							5	7	10			
	BE2							5	7	10	14	20	

Motor	Brake	Brake torques								
DR2C90SA DR2C90LA DR2C100LSA DR2C100LA	BE1	5	7	10						
	BE2	5	7	10	14	20				
	BE5				14	20	28	40	55	
DR2C 112MA DR2C 132SA	BE5				14	20	28	40	55	
	BE11					20	28	40	55	110

3.3 General overview

3.3.1 Motor design

Code in the type designation	Description	Size
/FI	IEC foot-mounted motor	71 – 132S
/F.A, /F.B	Universal foot-mounted design	71 – 132S
/FF	IEC flange-mounted motor with through bores	71 – 132S
/FE	IEC flange-mounted motor with through bores and IEC feet	71 – 132S
/FT	IEC flange-mounted motor with threads	71 – 100
/FY	IEC flange-mounted motor with thread and IEC feet	71 – 100
/FC	C-face flange-mounted motor, dimensions in inches	As required
/FG	Integral motor, as stand-alone motor	71 – 132S
/FM	Integral motor with IEC feet	71 – 132S
/FL	Flange-mounted motor (deviating from IEC)	71 – 132S
/FK	Flange-mounted motor (deviating from IEC) with feet	71 – 132S

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3.3.2 Oil seals

Material

Code in the type designation	Description	Size
None	Oil seal made of NBR	71 – 132S
None	Oil seal made of FKM	71 – 132S

Design

Code in the type designation	Description	Size
None	Premium Sine Seal	71 – 132S
None	Premium Sine Seal conductive	71 – 132S

3.3.3 Bearings

Code in the type designation	Description	Size
/NIB	Current-insulated rolling bearings (B-side, NDE)	Not available
/ERF	Reinforced bearings (A-side, DE) with roller bearing	Not available
/NS	Relubrication device	Not available

3.3.4 Winding

Thermal class

Code in the type designation	Description	Size
None	Thermal class B	Not available
None	Thermal class F	71 – 132S
None	Thermal class H	Not available

Insulation

Code in the type designation	Description	Size
/RI	Reinforced winding insulation	71 – 132S
/RI2	Reinforced winding insulation with increased resistance against partial discharge	Not available

3.3.5 Condition monitoring

Thermal monitoring

Code in the type designation	Description	Size
/TF	Temperature sensor (PTC thermistor / PTC resistor)	71 – 132S
/TH	Thermostat (bimetallic switch)	71 – 132S
/PK	PT1000 sensor	71 – 132S
/PT	PT100 sensor	71 – 132S

Brake

Code in the type designation	Description	Size
/DUE	Diagnostic Unit Eddy Current = function/wear monitoring for BE1 to BE122 brake	80 – 132S

Vibration

Code in the type designation	Description	Size
None	Preparation for accommodating SPM measuring nipples	112 – 132S

3.3.6 Terminal box

Material

Code in the type designation	Description	Size
None	Aluminum terminal box (standard)	71 – 132S
None	Gray cast iron terminal box (option)	71 – 132S

3.3.7 Connection

Terminal board

Code in the type designation	Description	Size
None	Terminal board – 6 terminals	71 – 132S
None	Terminal board – 12 terminals	Not available

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Cage clamp terminals

Code in the type designation	Description	Size
/KCC	6-pole terminal strip with cage clamp contacts	71 – 132S
/KC1	C1 profile compliant connection of electrified monorail drive (acc. to VDI Directive 3643)	71 – 132S
/KCW	6-pole series terminal	Not available

Integrated plug connector

Code in the type designation	Description	Size
/IS	Integrated plug connector with terminal block in upper part of terminal box	71 – 132S
/ISU	Integrated plug connector without terminal block in upper part of terminal box	71 – 132S

Mounted plug connector

Code in the type designation	Description	Size
/ASE.	Mounted Han® 10ES plug connector on terminal box with single locking latch (cage clamp contacts on the motor side)	71 – 132S
/ASB.	Mounted Han® 10ES plug connector on terminal box with double locking latch (cage clamp contacts on the motor side)	71 – 132S
/ACE.	Mounted Han® 10E plug connector on terminal box with single locking latch (crimp contacts on the motor side)	71 – 132S
/ACB.	Mounted Han® 10E plug connector on terminal box with double locking latch (crimp contacts on the motor side)	71 – 132S
/AME.	Mounted Han® Modular 10B plug connector on terminal box with single locking latch (crimp contacts on the motor side)	71 – 132S
/ABE.	Mounted Han® Modular 10B plug connector on terminal box with single locking latch (crimp contacts on the motor side)	71 – 132S
/ADE.	Mounted Han® Modular 10B plug connector on terminal box with single locking latch (crimp contacts on the motor side)	71 – 132S
/AKE.	Mounted Han® Modular 10B plug connector on terminal box with single locking latch (crimp contacts on the motor side)	Not available
/AMB.	Mounted Han® Modular 10B plug connector on terminal box with double locking latch (crimp contacts on the motor side)	71 – 132S
/ABB.	Mounted Han® Modular 10B plug connector on terminal box with double locking latch (crimp contacts on the motor side)	71 – 132S
/ADB.	Mounted Han® Modular 10B plug connector on terminal box with double locking latch (crimp contacts on the motor side)	71 – 132S
/AKB.	Mounted Han® Modular 10B plug connector on terminal box with double locking latch (crimp contacts on the motor side)	Not available
/AND.	Harting Han® Q8/0, single locking latch	71 – 132S
/IV	Other industrial plug connectors according to customer specifications	71 – 132S

3.3.8 Ventilation

Fan guard design

Code in the type designation	Description	Size
None	Noise-reducing fan guard made of plastic	71 – 90
None	Fan guard made of sheet steel	71 – 132S
/LN	Noise-reducing fan guard	100L – 132S

Type of ventilation

Code in the type designation	Description	Size
None	Fan-cooled	71 – 132S
/V	Forced cooling fan	71 – 132S
/U	Non-ventilated (without fan)	71 – 132S
/OL	Non-ventilated (closed B-side)	71 – 132S

Fan

Code in the type designation	Description	Size
None	Fan made of plastic	71 – 132S
/AL	Aluminum fan	71 – 132S
/Z	Additional inertia mass (flywheel fan)	71 – 132S

3.3.9 Brake and backstop

Brake

Code in the type designation	Description	Size
/BE..	Spring-loaded brake with specification of size	71 – 132S

Brake options

Code in the type designation	Description	Size
HR	Manual brake release, re-engaging	71 – 132S
HF	Manual brake release, lockable	71 – 132S

Backstop

Code in the type designation	Description	Size
/RS	Backstop	Not available

3.3.10 Encoder

Built-in encoders (not in the control loop)

Code in the type designation	Description	Size
/EI7C[1)]	Built-in incremental encoder with HTL interface, 24 periods	71 – 132S
/EI76	Built-in incremental encoder with HTL interface and 6/2/1 period(s)	71 – 132S
/EI72		71 – 132S
/EI71		71 – 132S
/EI8R	Built-in incremental encoder with TTL interface and 1024 periods (4096 increments)	71 – 132S
/EI8C	Built-in incremental encoder with HTL interface and 1024 periods (4096 increments)	71 – 132S
/EI8Z	Built-in incremental encoder with MOVILINK® DDI interface (12 bit incremental)	Nicht verfügbar

Add-on encoders

Code in the type designation	Description	Size
/EK8S	Add-on encoder with sin/cos interface	Not available
/EV8S		Not available
/EK8R	Add-on encoder with TTL(RS422) interface	Not available
/EV8R		Not available
/EK8C	Add-on encoder with HTL interface	Not available
/EV8C		Not available
/EK8Z	Add-on incremental and single-turn encoder with MOVILINK® DDI interface (18 bit incremental)	Not available
/EK8W*	Add-on incremental and single-turn encoders (18 bit incremental)	71 – 132S
/AK8W	Add-on absolute encoder with sin/cos and RS485 interface (multi-turn)	71 – 132S
/AV8W		71 – 132S
/AK8Y	Add-on absolute encoder with sin/cos and SSI interface (multi-turn)	Not available
/AV8Y		Not available
/AK8H	Add-on absolute encoder with sin/cos and RS485 interface and HIPERFACE® protocol	71 – 132S
/AV8H		71 – 132S
/AK8Z	Add-on absolute encoder with MOVILINK® DDI interface (18 bit incremental, 16 bit multi-turn)	71 – 100 112 – 132S in prep..
/RK8M	Add-on Resolver	71 – 132S

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Encoder mounting adapters

Code in the type designation	Description	Size
/EK8A	Mounting adapter for encoders from the SEW-EURODRIVE portfolio	71 – 132S
/EI7A		71 – 132S
/EI8A		71 – 132S
/XV8A		71 – 132S
/XV.A	Mounting adapter for third-party encoders	71 – 132S
/XH1.	Mounted third-party encoders	71 – 132S
/XV..		71 – 132S

3.3.11 Digital motor integration

Interfaces

Code in the type designation	Description	Size
/DI	MOVILINK® DDI	71 – 100 112 – 132S in prep

Mounted plug connector

Code in the type designation	Description	Size
/KD1	M23 hybrid plug connector (cable cross section 1.5 mm² – 4 mm²)	71 – 100 112 – 132S in prep
/KD	Hybrid cable gland M25/M32 (cable cross section 1.5 mm² – 10 mm²)	71 – 100 112 – 132S in prep
/KDB	M40 hybrid plug connector (cable cross section 6 mm² – 10 mm²)	71 – 100 112 – 132S in prep
/KDD	Power cable gland and M23 signal connector (MOVILINK® DDI)	71 – 100 112 – 132S in prep

Add-on encoders

Code in the type designation	Description	Size
/EK8Z	Add-on incremental and single-turn encoder with MOVILINK® DDI interface (18 bit incremental)	Not available
/AK8Z	Add-on absolute encoder with MOVILINK® DDI interface (18 bit incremental, 16 bit multi-turn)	71 – 100 112 – 132S in prep

Brake rectifier

Code in the type designation	Description	Size
BG1Z	Integrated brake control with MOVILINK® DDI interface and brake diagnostics as well as brake wear detection	71 – 100 112 – 132S in prep

3.3.12 Functional safety

Brake

Code in the type designation	Description	Size
/BE..	Spring-loaded brake with specification of size	71 – 132S

Brake options

Code in the type designation	Description	Size
HR	Manual brake release, re-engaging	71 – 132S

Built-in encoders (not in the control loop)

Code in the type designation	Description	Size
/EI7C	Built-in incremental encoder with HTL interface, 24 periods 63 – 132S	Not available

Add-on encoders

Code in the type designation	Description	Size
/EK8S	Add-on encoder with sin/cos interface	Not available In preparation
/AK8W	Add-on absolute encoder with sin/cos and RS485 interface (multi-turn)	71 – 132S In preparation
/EK8W	Add-on incremental and single-turn encoders (18 bit incremental)	71 – 132S In preparation
/AK8Y	Add-on absolute encoder with sin/cos and SSI interface (multi-turn)	71 – 132S In preparation
/AK8H	Add-on absolute encoder with sin/cos- und RS485-interface and HIPERFACE®-protocoll	71 – 132S In preparation
/AK8Z	Add-on absolute encoder with MOVILINK® DDI-interface (18 bit incremental, 16 bit multi-turn)	71 – 132S In preparation
/EK9Z	Multi-turn absolute encoders in a high capability class with MOVILINK® DDI-interface	71 – 132S In preparation

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3.3.13 Decentralized technology

Code in the type designation	Description	Size
/MM03 – MM40	MOVIMOT®	Not available
/MO	MOVIMOT® options	Not available
/MI	Motor identification module for MOVIMOT®	Not available
/MSW	MOVI-SWITCH®	Not available
/DFC, /DAX, /DBC, /DSI	MOVIMOT® Advanced	71 – 132S

3.3.14 Environmental influences

IP degree of protection

Code in the type designation	Description	Size
None	IP 54	71 – 132S
None	IP 55	71 – 132S
None	IP 56	71 – 132S
None	IP 65	71 – 132S
None	IP 66	71 – 132S

Winding protection

Code in the type designation	Description	Size
None	Encapsulated stator winding	As Required
None	Humidity and acid protection	71 – 132S
None	Tropicalized	71 – 132S

Surface protection

Code in the type designation	Description	Size
None	Unpainted design	71 – 132S
None	Base coat OSG	71 – 132S
None	Painting OS1 to OS4	71 – 132S

Corrosion protection

Code in the type designation	Description	Size
None	Corrosion protection	71 – 132S

Other

Code in the type designation	Description	Size
None	Anti-condensation heating	71 – 132S
/DH	Condensation drain hole	71 – 132S
/C	Canopy for fan guard	71 – 132S

3.3.15 Other motor designs

Code in the type designation	Description	Size
/2W	Second shaft end at motor	71 – 132S
None	Motor design according to recommendation VE01 of the VIK (Verband der Industriellen Energie- und Kraftwirtschaft e.V. – Association of Energy and Power Generation Industry)	71 – 132S

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4 Project planning for DR2C..A gearmotors

4.1 General information

The project planning of the DR2C..A motors differs in whether the motors are operated with encoder feedback in CFC mode or without encoder feedback in ELSM control mode.

As the DR2C..A motors are primarily intended for use in applications that were previously equipped with DRN.. motors, the project planning procedure is based on the procedure of controlled DRN.. motors.

For operation in CFC control mode, the project planning of the DR2C..A motors is based on the project planning procedure for DRN.. asynchronous motors.

When operated in ELSM control mode, the DR2C..A motors are initially operated in a controlled manner at low speeds before the magnetic motor feedback is sufficiently good and the motor is operated in a controlled manner by the inverter.
In controlled operation, the inverter operates the motor at 150 percent of its nominal current, which means that the motor has a higher temperature rise than in controlled operation.

4.2 Project planning tools

The SEW-Workbench is the central planning and project planning tool for SEW-EURODRIVE products. All required design tasks can be processed starting with the application entry, and continuing with gear unit, motor and inverter calculations.

Optimization of the various axis cycles including selection of accessories and error check of the entire drive system design are further features.

The SEW-Workbench therefore allows for a completely consistent definition of the drive solution from the entire product range of SEW-EURODRIVE. This saves time and reduces complexity while making operation as simple as possible.

The core features of the SEW Workbench are:

- The selection of the application
- The calculation of the gear unit and motor
- Price-optimized project planning
- Comparison of different solutions
- The inverter calculation
- Multi-axis optimization
- The parameterization of the cable and accessory selection
- The design error check
- The creation of parts lists
- The electronic catalog with all products

SEW-EURODRIVE offers the SEW-Workbench project planning software for download on the official website.
To use the SEW-Workbench, you only need to register via Online Support after the download and installation.
An Internet update service ensures that the products and functions are always up-to-date.

In addition, the Motor-inverter characteristic curves application in Online Support on the SEW-EURODRIVE homepage offers motor characteristic curves for the thermally permitted torque and the peak torque of the motor above the speed. If an inverter is also selected, the specific motor characteristic curve is generated on this inverter.

The following link takes you directly to the tool:
sew-eurodrive.co.uk/os/motorcharacteristics/

4.3 Drive determination of DR2C..A motors

The advantages of a permanent magnet synchronous drive can only be fully utilized with complete drive determination.
The schematic sequence is shown in chapter "Flow diagram".
The selection of the thermal and dynamic limit characteristic curve is taken into account the speed class, the type of ventilation and the frequency inverter.

The higher inertia of the DR2C..A motors compared to synchronous servomotors results in advantages when controlling loads with high intrinsic inertia.

The higher power density of DR2C..A motors compared to asynchronous motors and the higher efficiency over the entire speed range result in advantages in terms of the required motor size and energy costs.

4.3.1 Speed classes

Available speed classes of DR2C..A motors:

- 2000 rpm
- 3000 rpm

The speed classes are realized by different winding calculations and not by star-delta connection.

The speed classes offer different advantages:

- Speed class 2000 rpm
  - lower noise development
  - lower current demand with the same motor torque (higher WB)
- Speed class 3000 rpm
  - larger possible setting range
  - larger possible gear ratio (less torque required on the motor)

For the technical data of the DR2C..A motors in the different speed classes, refer to chapter "Technical data".

4.3.2 Control modes

In general, the DR2C..A motors can be operated on a suitable inverter both in CFC control mode (with encoder) and in ELSM control mode (without encoder).

Depending on the selected control mode, there are restrictions with regard to the selected application.

Approved Applications:

- CFC control mode with encoder
  - Travel drives
  - Hoists
- ELSM control mode without encoder
  - Travel drives

If the inverter is operated in ELSM® control mode, the use of DR2C..A motors in hoist applications is only permitted to a limited extent. For more information, refer to chapter 4.7.1.

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4.3.3 Encoders

If the DR2C..A motors are equipped with an encoder, the following encoders with absolute values are possible:

- Mounted cone resolver /RK8M
- Mounted cone encoder /EK8W
- Mounted cone encoder /AK8W, /AK8H, /AK8Z

Startup is simplified by the electronic nameplate included in the encoder (not with RK8M).

Please note the hints on zero-angle adjustment of the encoders after uninstalling / reinstalling an encoder in accordance with the “Addendum to the operating instructions - integrated encoders, add-on encoders and safety encoders - three-phase AC motors DR.., DRN.., DRU.., DR2.., EDR.., EDRN...”.
EN: DR.., DRN.., DRU.., DR2.., EDR.., EDRN.. AC Motors Integrated, Cone Shaft, Spread Shaft, Plug-in Shaft, Hollow Shaft, Encoder Mounting Adapters (sew-eurodrive.com)

4.3.4 Mass inertia ratio

The maximum permitted mass inertia ratio between external and internal inertia for DR2C..A motors is 50.
For mass moment of inertia ratios greater than 15, the mass moments of inertia must be adjusted during startup in the frequency inverter.

4.3.5 Forced cooling fan

The use of the forced cooling fan /V prevents the permitted load torque from being reduced at low speeds.
For detailed information on the operation of DR2C..A motors with forced cooling fan, please contact SEW-EURODRIVE.

4.4 Data for motor and gear unit design

For project planning of a DR2C..A motor, the data of the application must be known in addition to the product data. For a summary of the data required for project planning and the corresponding abbreviations, refer to the gearmotors catalog or the project planning manual for controlled and non-controlled drives from SEW-EURODRIVE.

4.5 Flow diagram

The following flow diagram shows the procedure for determining a controlled drive with DR2C..A motor. The drive consists of a gearmotor that is supplied by an inverter.

Required information about the machine to be driven
- Technical data
- Travel cycle
- Speed setting range
- Positioning accuracy
- Ambient conditions
- Country of application, voltage and frequency
- Required approvals and certifications
- Installation situation

↓

Calculation of the relevant application data
- Travel Diagram (Acceleration, Maximum Speed, Deceleration, Pauses)
- Speeds
- Static and dynamic torques
- Static and dynamic overhung loads
- Static and dynamic power requirements
- Thermally effective torques
- Thermally effective power
- Regenerative power and duty cycle

↓

Gear unit selection
- Selection of gear unit type, gear unit size, gear unit ratio and gear unit design
- Checking the maximum gear unit load ($M_{amax} \geq M_a$, $F_{Ramax} \geq F_{Ra}$)
- Checking the thermal gear unit load
- Checking the input speed (churning losses)
- Checking the positioning accuracy

↓

Motor selection
- Identification of the efficiency class required in the country of use, required approvals and certifications
- Selection of the speed class
- Selection of utilization (IE5 or thermal maximum)
- Selection of the type of ventilation
- Selection of the control mode (CFC with encoder or ELSM without encoder)
- Static and maximum torque
- Consideration of the thermal torque curves taking into account the mean speed and the effective torque
- Consideration of the dynamic torque curves taking into account the dynamic torques
- Consideration of derating due to installation altitude or ambient temperature
- Consideration of the permitted overhung loads (stand-alone motor)
- Consideration of the mass moment of inertia ratio
- Consideration of the speed limits (maximum speed and minimum speed)
- Selection of the mounting position
- Selection of a permitted encoder (CFC controlled operation)
- Motor options (brake, ventilation, plug connector, thermal motor protection, degree of protection, Painting, oil seal, etc.)

↓

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Motor selection in ELSM control mode
- Consideration of the restrictions in the ELSM control mode
- Transition Speed
- Consideration of the maximum permitted static torque in controlled operation
- Consideration of the maximum permitted dynamic torque in controlled operation
- Consideration of the mean dynamic torques for acceleration and deceleration

↓

Optional: brake selection
- Determine brake size and braking torque (hoist drives MB ≥ 2,5 x M_{Load_static})
- Selection of brake control (ELSM only with rapid excitation)
- Determining the brake application speed
- Determination of the braking work
- Determining the thermal load of the brake
- Determining the brake service life
- Determining the braking distance
- Determining the braking time
- Determining the gear unit brake load (torque, overhung load)

↓

Selection of the inverter
- Consideration of the motor/inverter assignment
- Consideration of continuous current and peak current
- Selection of additional inverter options according to functional requirements

↓

Selection of the braking resistor
- Based on the calculated regenerative power
- Based on the on duration and peak braking power

↓

Inverter options
- EMC measures
- Operation/Communication
- Additional Functions
- Functional safety technology, if required

4.6 DR2C..A-specific information on project planning in CFC control mode

Gear unit check:
For DR2C..A project planning, the application torques and overhung are checked against the Mamax value of the gear unit loads, similar to DRN.. gearmotors.

Maximum torque: $M_a \leq M_{amax}$
Maximum permitted overhung load: $F_{Ra} \leq F_{Ramax}$

Motor Design:
When calculating DR2C..A motors, the speed class must first be defined. Depending on the selected speed class, the speed setting range of the motors changes with constant torque. Compared to DRN.. motors the gear unit ratio must be adjusted in order to be able to use the DR2C..A motor to the maximum utilization.

When designing DR2C..A motors in CFC control mode, the effective torque and the mean speed are calculated in the same way as DRN.. Motors without additional factors.

Mean speed: $n_{eff} = \frac{n_1 x t_1 + \ldots + n_n x t_n}{t_1 + \ldots t_n}$

Effective motor torque: $M_{Mot\_eff} = \sqrt{\frac{M_{Mot\_1}^2 x t_1 + \ldots + M_{Mot\_n}^2 x t_n}{t_1 + \ldots t_n}}$

The dynamic utilization must be checked with the maximum torque and the maximum speed per travel section. The maximum permitted motor torque depends on the actual speed, the pinion shaft end and the frequency inverter power used

Brake selection:
When selecting the brakes and calculating the brakes it should be noted that DR2C..A motors may only be operated with closed-loop control.
Accordingly, the necessary braking torque is calculated in the same way as for controlled DRN.. motors as a holding brake for controlled drives.

Required braking torque: $M_B \geq 250\%\ M_{static\_application}$

4.7 DR2C..A-specific information on project planning in ELSM control mode

In addition to the applicable project planning rules in the CFC control mode, the following additional points must be observed in the ELSM control mode when configuring DR2C..A motors.

As described in chapter 2.6.7, the static and dynamic torques of the DR2C..A motors in ELSM control mode are reduced at frequencies below 2% of the nominal motor speed. This in turn affects the starting behavior of the motors in the ELSM control mode.

Controlled operation (below transition speed):
Controlled operation takes place when starting from standstill and below a transition speed, which is calculated by the inverter firmware depending on the motor parameters during motor startup and set in the inverter. In controlled operation, the actual position of the rotor is not known because the error effects caused by voltage offsets and incorrect parameterization below the transition speed are so severe that it is not possible to determine the rotor position there. This is why a current space indicator runs the synchronous motor in controlled operation and it is assumed that the rotor follows the current space indicator. The motor is operated with speed control below the transition speed. Therefore, in controlled operation, the available torque is limited compared to controlled operation above transition speed.

Controlled operation (above transition speed):
Above the transition speed, the actual position of the rotor can be determined with sufficient precision and the drive is operated in a controlled manner. The usable dynamic torque above the transition speed increases linearly above the speed. The maximum motor torque is then available from approx. 8% of the rated motor speed.
The calculations and tests in controlled operation do not differ from those in CFC control mode with encoder.

Depending on whether the control method is in controlled or regulated operation, the drive configuration must be checked against various limit values in order to be able to make a statement about whether the motor can be provide the required torques. To configure DR2C..A motors in the ELSM® control method, it is recommended to use the SEW Workbench configuration software. The data required for configuration is available in the SEW Workbench, but is not in table form. Therefore, manual configuration of the DR2C..A motors in the ELSM® control method is not possible.

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4.7.1 Restrictions

If the inverter is operated in ELSM® control mode, the use of DR2C..A motors in hoist applications is not allowed

4.7.2 Dynamic and thermal limit characteristic curve

As described in chapter 2.6.7, the available dynamic torque in open loop controlled operation is limited compared to closed loop controlled operation.
For this reason, a different speed/torque characteristic curve must be taken into account for project planning of the drive in ELSM control mode than is the case for motors with encoders in CFC control mode.
The linear increasing torque from the transition speed to the maximum motor torque is neglected for drive project planning in the SEW Workbench because the speed range is very small. This is why the dynamic speed-torque characteristic curve shows the step change for the torque when the transition between controlled and controlled operation is made.
The thermal limit characteristic curve does not change.

5 Technical Data

5.1 Key to the data tables

The following table describes the abbreviations used in the "Technical data" tables

P_{IE5}	Rated power at operating point IE5
M_{IE5}	Rated torque at operating point IE5
I_{IE5}	Rated current at operating point IE5
P_{th}	Rated power at the thermally permitted operating point
M_{th}	Rated torque at thermally permitted operating point
I_{th}	Rated current at thermally permitted operating point
$\eta_{50\%}$	Efficiency at 50% of the rated power
$\eta_{75\%}$	Efficiency at 75% of the rated power
$\eta_{100\%}$	Efficiency at 100% of the rated power
M_{MAX}	Short-term dynamic limit torque of the motor
I_{MAX}	Maximum permitted current for a short time
M_{Mot}	Mass of the motor
J_{Mot}	Mass moment of inertia of the motor
M_{BMot}	Mass of the brakemotor
J_{BMot}	Mass moment of inertia of the brakemotor
BE..	Brake Used
M_B	Braking Torque
S.F.	Service factor – factor that describes the ratio of thermally permitted power to IE5 power
U_{nenn}	System Voltage
R/Phase	Phase resistance at 20°C.
Lq	Transverse Inductance
Up0	Voltage at the open terminals of the motor in cold state in V/1000 min-1

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5.2 Technical data of the motors

Speed class	Motor	P_{IE5} kW	M_{IE5} Nm	I_{IE5} A	$\eta_{100\%}$ %	IE-Class IEC TS 60034-30-2	M_{pk} Nm	I_{max} A	M_{Mot} kg	J_{Mot} 10-4 kg m²
2000	DR2C 71MSA 4	0,69	3,3	1,77	84,8	IE5	9	4,8	6,8	5,43
	DR2C 71MA 4	1	4,95	2,45	86,9	IE5	13,5	7,3	8	7,33
	DR2C 80MKA 4	1,5	7,1	3,55	88,2	IE5	18	9,8	11	16,83
	DR2C 80MA 4	2,3	10,8	5	89,6	IE5	30	14,9	14	25,11
	DR2C 90SA 6	3,6	17,3	8	91,1	IE5	43	21,5	19	52,9
	DR2C 90LA 6	4,7	22,5	10,2	91,7	IE5	62	32	23	66,8
	DR2C 100LSA 6	5,9	28	13,3	92,3	IE5	62	31	27	86,9
	DR2C 100LA 6	7,2	34,5	17,1	92,8	IE5	92	49	34	106
	DR2C 112MA 6	9,8	47	21,5	93,4	IE5	128	67	45	152
	DR2C 132SA 6	13	63	27,5	93,9	IE5	190	99	56	219
3000	DR2C 71MSA 4	1,1	3,55	2,65	87,4	IE5	9	7,1	6,8	5,43
	DR2C 71MA 4	1,7	5,3	3,95	88,4	IE5	13,5	11,1	8	7,33
	DR2C 80MKA 4	2,4	7,6	5,7	89,7	IE5	18	14,9	11	16,83
	DR2C 80MA 4	3,5	11,3	7,9	90,8	IE5	30	22	14	25,11
	DR2C 90SA 6	5,8	18,5	12,8	92,2	IE5	43	31,5	19	52,9
	DR2C 90LA 6	7,1	22,5	14,9	92,6	IE5	62	45,5	23	66,8
	DR2C 100LSA 6	9,4	30	22	93,3	IE5	62	46,5	27	86,9
	DR2C 100LA 6	11	34	24	93,5	IE5	92	69	34	106
	DR2C 112MA 6	15	47	32,5	94,1	IE5	128	99	45	152
	DR2C 132SA 6	17	54	34	94,2	IE5	190	138	56	219

Further technical data:

Drehzahl -klasse	Motor	P_{IE5} kW	M_{BMot} kg	J_{BMot} 10-4 kg m²	ΔJ Alu-Lüfter 10-4 kg m²	ΔJ Z-Lüfter 10-4 kg m²	Bremse	M_B Nm	S.F
2000	DR2C 71MSA 4	0,69	9,4	6,73	2,5	21,01	BE1	7	1,30
	DR2C 71MA 4	1,0	11	8,63	2,5	21,01	BE1	10	1,35
	DR2C 80MKA 4	1,5	15	21,33	3,59	37,18	BE2	14	1,27
	DR2C 80MA 4	2,3	18	29,61	3,59	37,18	BE2	20	1,20
	DR2C 90SA 6	3,6	25	58,9	5,65	100	BE5	40	1,13
	DR2C 90LA 6	4,7	29	72,8	5,65	100	BE5	55	1,11
	DR2C 100LSA 6	5,9	33	92,9	5,65	144	BE5	55	1,07
	DR2C 100LA 6	7,2	40	112	5,65	144	BE5	55	1,07
	DR2C 112MA 6	9,8	47	163	4,99	197	BE11	110	1,00
	DR2C 132SA 6	13	54	230	10,5	192	BE11	110	1,00
3000	DR2C 71MSA 4	1,1	9,4	6,73	2,5	21,01	BE1	7	1,21
	DR2C 71MA 4	1,7	11	8,63	2,5	21,01	BE1	10	1,26
	DR2C 80MKA 4	2,4	15	21,33	3,59	37,18	BE2	20	1,18
	DR2C 80MA 4	3,5	18	29,61	3,59	37,18	BE2	20	1,15
	DR2C 90SA 6	5,8	25	58,9	5,65	100	BE5	40	1,06
	DR2C 90LA 6	7,1	29	72,8	5,65	100	BE5	55	1,11
	DR2C 100LSA 6	9,4	33	92,9	5,65	144	BE5	55	1,00
	DR2C 100LA 6	11	40	112	5,65	144	BE5	55	1,09
	DR2C 112MA 6	15	59	163	4,99	197	BE11	110	1,00
	DR2C 132SA 6	17	71	230	10,5	192	BE11	110	1,16

Thermal limit power (electrical data for startup):

Speed class	Motor	P_{th} kW	Polp.	U_{nenn} V	I_{th} A	M_{th} Nm	I_{Max} A	M_{Max} Nm	R/Phase Ω	Lq mH	Up0 V/ 1000min^{-1}
2000	DR2C 71MSA 4	0,90	**4**	400	2,3	4,3	4,8	9	7,32	111,4	136,6
	DR2C 71MA 4	1,4	**4**	400	3,35	6,7	7,3	13,5	4,6	78,3	137,5
	DR2C 80MKA 4	1,9	**4**	400	4,6	9	9,8	18	3,19	51,6	133,3
	DR2C 80MA 4	2,7	**4**	400	6,2	13	14,9	30	1,84	35,8	140,3
	DR2C 90SA 6	4,1	**6**	400	9,1	19,5	21,5	43	0,926	12,9	142
	DR2C 90LA 6	5,2	**6**	400	11,5	25	32	62	0,645	10,5	146
	DR2C 100LSA 6	6,3	**6**	400	14,3	30	31	62	0,445	9	139
	DR2C 100LA 6	7,7	**6**	400	18,4	37	49	92	0,312	6,72	132
	DR2C 112MA 6	9,8	**6**	400	21,5	47	67	67	0,23	5,5	142
	DR2C 132SA 6	13	**6**	400	27,5	63	99	99	0,159	4,34	150
3000	DR2C 71MSA 4	1,4	**4**	400	3,25	4,3	7,1	9	3,43	50,5	91,9
	DR2C 71MA 4	2,1	**4**	400	5	6,7	11,1	13,5	2	33,9	90,5
	DR2C 80MKA 4	2,8	**4**	400	6,9	9	14,9	18	1,35	22,4	87,9
	DR2C 80MA 4	4,1	**4**	400	9,3	13	22	30	0,799	15,9	93,5
	DR2C 90SA 6	6,1	**6**	400	13,6	19,5	31,5	43	0,43	5,97	96,6
	DR2C 90LA 6	7,9	**6**	400	16,7	25	45,5	62	0,322	5,14	102
	DR2C 100LSA 6	9,4	**6**	400	22	30	46,5	62	0,196	4	92,7
	DR2C 100LA 6	12	**6**	400	26	37	69	92	0,161	3,43	94,2
	DR2C 112MA 6	15	**6**	400	32,5	47	99	128	0,102	2,53	96,7
	DR2C 132SA 6	20	**6**	400	40,5	63	138	190	0,0798	2,21	107

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5.3 Power losses according to EN 61800-9-2

The following tables show the 7 measured operating points according to IEC 60034-2-3 listed.

The power losses of the rated output power are relative in % and absolute specified in W for the following rating points (speed; torque):
(25;25) (25;100) (50;25) (50;50) (50;100) (90;50) (90;100).

The operating point (100;100) is outside the normative specifications and is independent stated in this regard.

5.3.1 Power losses in relation to IE5 operating point

Relative Power Losses in %:

Speed class	motor	P_{IE5} kW	25;25	25;100	50;25	50;50	50;100	90;50	90;100		100;100
2000	DR2C 71MSA 4	0,69	3,3%	13,7%	4,2%	5,8%	14,3%	8,2%	17,0%		18,0%
	DR2C 71MA 4	1,0	2,5%	12,1%	3,4%	5,0%	13,0%	6,6%	14,7%		15,1%
	DR2C 80MKA 4	1,5	2,0%	10,8%	2,5%	4,2%	11,4%	5,2%	13,0%		13,4%
	DR2C 80MA 4	2,3	1,5%	9,2%	2,1%	3,6%	9,9%	4,6%	11,2%		11,6%
	DR2C 90SA 6	3,6	1,2%	7,9%	1,7%	2,9%	8,5%	4,0%	9,5%		9,8%
	DR2C 90LA 6	4,7	1,0%	6,8%	1,6%	2,7%	7,6%	3,8%	8,7%		9,0%
	DR2C 100LSA 6	5,9	0,9%	6,7%	1,3%	2,4%	7,2%	3,3%	8,1%		8,3%
	DR2C 100LA 6	7,2	0,8%	5,9%	1,3%	2,3%	6,5%	3,3%	7,6%		7,8%
	DR2C 112MA 6	9,8	0,7%	5,5%	1,1%	2,0%	6,0%	2,9%	6,8%		7,0%
	DR2C 132SA 6	13	0,7%	4,6%	1,2%	2,0%	5,2%	3,0%	6,2%		6,5%
3000	DR2C 71MSA 4	1,1	2,5%	9,7%	3,4%	4,5%	12,2%	6,4%	14,2%		14,4%
	DR2C 71MA 4	1,7	2,0%	9,4%	2,8%	4,3%	10,3%	6,2%	12,4%		13,1%
	DR2C 80MKA 4	2,4	1,5%	8,2%	2,1%	3,4%	9,2%	4,9%	11,0%		11,5%
	DR2C 80MA 4	3,6	1,3%	7,1%	2,0%	3,1%	7,9%	4,5%	9,6%		10,1%
	DR2C 90SA 6	5,8	0,9%	6,0%	1,6%	2,5%	6,7%	3,9%	8,1%		8,5%
	DR2C 90LA 6	7,1	0,9%	5,3%	1,6%	2,4%	6,2%	3,9%	7,6%		8,0%
	DR2C 100LSA 6	9,4	0,7%	5,1%	1,2%	2,1%	5,8%	3,2%	6,9%		7,2%
	DR2C 100LA 6	11	0,8%	4,5%	1,5%	2,2%	5,3%	3,5%	6,6%		7,0%
	DR2C 112MA 6	15	0,7%	4,2%	1,2%	1,9%	4,9%	3,0%	6,0%		6,2%
	DR2C 132SA 6	17	0,7%	3,2%	1,5%	2,0%	4,1%	3,5%	5,7%		6,2%

Absolute power losses in W:

Speed class	motor	P_{IE5} kW	25;25	25;100	50;25	50;50	50;100	90;50	90;100		100;100
2000	DR2C 71MSA 4	0,69	23,1	94,7	29,3	40,1	98,7	56,5	117,3		124,3
	DR2C 71MA 4	1,0	26,5	125,4	34,9	52,5	135,4	68,5	152,4		156,9
	DR2C 80MKA 4	1,5	30,0	160,5	37,2	62,4	170,6	77,7	193,0		199,8
	DR2C 80MA 4	2,3	34,9	208,3	47,7	80,8	224,8	104,0	253,8		261,5
	DR2C 90SA 6	3,6	42,3	285,8	60,8	106,6	307,0	143,7	345,2		355,5
	DR2C 90LA 6	4,7	45,9	321,3	73,5	126,9	356,2	180,3	410,7		424,1
	DR2C 100LSA 6	5,9	53,8	392,0	78,4	142,5	422,9	191,9	475,0		488,5
	DR2C 100LA 6	7,2	59,3	427,1	95,9	167,5	472,2	237,5	546,0		564,8
	DR2C 112MA 6	9,8	68,3	542,3	109,2	199,3	592,6	280,7	672,2		691,9
	DR2C 132SA 6	13	93,4	603,7	161	258,7	684,5	394,1	820,1		855,3
3000	DR2C 71MSA 4	1,1	28,2	108,6	37,8	50,6	136,7	71,9	159,4		160,9
	DR2C 71MA 4	1,7	33,7	156,5	47,5	71,4	172,0	102,9	207,9		219,1
	DR2C 80MKA 4	2,4	34,7	195,4	50,2	81,4	218,8	118,0	262,6		274,8
	DR2C 80MA 4	3,6	46,8	252,4	71,4	110,0	280,2	161,2	340,7		358,9
	DR2C 90SA 6	5,8	52,7	345,7	91,5	148,1	391,5	228,0	472,1		493,7
	DR2C 90LA 6	7,1	61,5	374,9	111,6	172,7	435,2	272,7	538,0		564,9
	DR2C 100LSA 6	9,4	69,5	484,6	117,3	198,7	544,4	300,1	652,7		682,2
	DR2C 100LA 6	11	86,3	480,7	156,4	236,7	567,9	373,8	710,4		746,5
	DR2C 112MA 6	15	101,3	628,3	184,5	286,2	7300,	446,7	885,8		923,3
	DR2C 132SA 6	17	124,1	549,0	248,3	335,2	697,9	592,6	974,5		1051,1

5.3.2 Power losses in relation to the thermally permitted operating point

Relative power losses in %:

Speed class	motor	P_{th} kW	25;25	25;100	50;25	50;50	50;100	90;50	90;100		100;100
2000	DR2C 71MSA 4	0,90	5,0%	18,9%	5,7%	8,3%	21,3%	10,2%	23,2%		23,3%
	DR2C 71MA 4	1,4	2,3%	17,9%	2,8%	5,6%	18,6%	6,8%	19,9%		20,3%
	DR2C 80MKA 4	1,9	2,0%	16,2%	2,6%	5,0%	16,8%	6,0%	18,0%		18,4%
	DR2C 80MA 4	2,7	1,9%	14,0%	2,3%	4,6%	14,6%	5,5%	15,9%		16,3%
	DR2C 90SA 6	4,1	1,2%	9,8%	1,8%	3,3%	10,4%	4,3%	11,4%		11,7%
	DR2C 90LA 6	5,2	1,0%	8,7%	1,6%	3,0%	9,4%	4,1%	10,5%		10,8%
	DR2C 100LSA 6	6,3	1,1%	8,3%	1,5%	2,9%	8,9%	3,8%	9,9%		10,2%
	DR2C 100LA 6	7,7	0,9%	7,5%	1,4%	2,7%	8,2%	3,7%	9,2%		9,5%
	DR2C 112MA 6	9,8	0,7%	5,5%	1,1%	2,0%	6,0%	2,9%	6,8%		7,0%
	DR2C 132SA 6	13	0,7%	4,6%	1,2%	2,0%	5,2%	3,0%	6,2%		6,5%
3000	DR2C 71MSA 4	1,4	2,6%	12,2%	3,4%	4,1%	14,3%	7,3%	16,7%		17,1%
	DR2C 71MA 4	2,1	1,7%	11,7%	2,5%	4,3%	12,6%	5,9%	14,4%		14,8%
	DR2C 80MKA 4	2,8	1,5%	10,4%	2,1%	3,7%	11,2%	5,2%	12,9%		13,5%
	DR2C 80MA 4	4,1	1,4%	9,1%	2,0%	3,4%	10,0%	4,8%	11,4%		11,8%
	DR2C 90SA 6	6,1	1,2%	9,8%	1,8%	3,3%	10,4%	4,3%	11,4%		11,7%
	DR2C 90LA 6	7,9	1,0%	8,7%	1,6%	3,0%	9,4%	4,1%	10,5%		10,8%
	DR2C 100LSA 6	9,4	1,1%	8,3%	1,5%	2,9%	8,9%	3,8%	9,9%		10,2%
	DR2C 100LA 6	12	0,9%	7,5%	1,4%	2,7%	8,2%	3,7%	9,2%		9,5%
	DR2C 112MA 6	15	0,7%	4,2%	1,2%	1,9%	4,9%	3,0%	6,0%		6,2%
	DR2C 132SA 6	20	0,8%	4,3%	1,5%	2,2%	5,2%	3,7%	6,9%		7,3%

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Absolute power losses in W:

Speed class	motor	P_{th} kW	25;25	25;100	50;25	50;50	50;100	90;50	90;100		100;100
2000	DR2C 71MSA 4	0,90	45,3	170,6	51,1	74,7	191,6	92,1	208,6		209,6
	DR2C 71MA 4	1,4	32,8	250,4	38,8	78,2	260,1	94,8	278,9		284,3
	DR2C 80MKA 4	1,9	37,7	304,9	48,0	93,8	316,4	112,8	338,8		345,1
	DR2C 80MA 4	2,7	51,4	381,2	63,4	124,0	396,2	150,0	432,1		443,4
	DR2C 90SA 6	4,1	50,8	398,9	71,6	135,4	423,8	176,6	467,0		478,5
	DR2C 90LA 6	5,2	54,3	453,8	83,3	159,1	491,7	215,9	550,9		565,4
	DR2C 100LSA 6	6,3	66,9	523,5	96,2	182,9	560,9	240,1	622,2		637,8
	DR2C 100LA 6	7,7	70,2	581,3	109,6	209,5	633,9	286,8	716,1		736,3
	DR2C 112MA 6	9,8	68,3	542,3	109,2	199,3	592,6	280,7	672,2		691,9
	DR2C 132SA 6	13	93,4	603,7	161,0	258,7	684,5	394,1	820,1		855,3
3000	DR2C 71MSA 4	1,4	35,1	165,1	46,1	55,6	193,2	99,2	225,4		231,0
	DR2C 71MA 4	2,1	36,4	246,1	52,1	89,9	265,6	123,1	301,5		311,5
	DR2C 80MKA 4	2,8	42,3	294,7	60,7	104,3	317,3	146,0	366,2		380,9
	DR2C 80MA 4	4,1	57,2	371,4	79,7	139,8	407,0	193,9	467,0		482,6
	DR2C 90SA 6	6,1	63,9	463,5	108,8	184,2	520,1	277,1	611,7		634,9
	DR2C 90LA 6	7,9	77,8	526,0	136,2	223,9	602,2	341,8	722,6		752,4
	DR2C 100LSA 6	9,4	69,5	484,6	117,3	198,7	544,4	300,1	652,7		682,2
	DR2C 100LA 6	12	103,6	669,6	185,5	297,6	770,7	450,6	942,0		986,7
	DR2C 112MA 6	15	101,3	628,3	184,5	286,2	730,0	446,7	885,8		923,3
	DR2C 132SA 6	20	150,7	850,3	289,5	427,7	1029,9	730,2	1357,8		1447,6

5.4 Motor losses extrapolated according to IEC 61800-9-2

The following tables show the power losses from chapter „Power losses based on the IE5 rating point" extrapolated according to IEC 61800-9-2 to 8 rating points listed and based on the motor.

The power losses of the rated output power are relative in % and absolute specified in W for the following rating points (speed; torque):
(0;25) (0;50) (0;100) (50;25) (50;50) (50;100) (90;50) (90;100).

5.4.1 Power losses related to the IE5 operating point

Relative Power Losses in %:

Speed class	motor	P_{IE5} kW	0;25	0;50	0;100	50;25	50;50	50;100	90;50	90;100
2000	DR2C 71MSA 4	0,69	2,9	4,6	14,0	4,2	5,8	14,3	8,2	17,0
	DR2C 71MA 4	1,0	1,8	3,5	11,1	3,4	5,0	13,0	6,6	14,7
	DR2C 80MKA 4	1,5	1,6	3,2	10,3	2,5	4,2	11,4	5,2	13,0
	DR2C 80MA 4	2,3	1,0	2,4	8,5	2,1	3,6	9,9	4,6	11,2
	DR2C 90SA 6	3,6	0,8	2,0	7,4	1,7	2,9	8,5	4,0	9,5
	DR2C 90LA 6	4,7	0,5	1,5	6,1	1,6	2,7	7,6	3,8	8,7
	DR2C 100LSA 6	5,9	0,6	1,6	6,2	1,3	2,4	7,2	3,3	8,1
	DR2C 100LA 6	7,2	0,4	1,3	5,3	1,3	2,3	6,5	3,3	7,6
	DR2C 112MA 6	9,8	0,4	1,2	5,0	1,1	2,0	6,0	2,9	6,8
	DR2C 132SA 6	13,2	0,3	1,0	4,0	1,2	2,0	5,2	3,0	6,2
3000	DR2C 71MSA 4	1,1	1,9	2,1	6,2	3,4	4,5	12,2	6,4	14,2
	DR2C 71MA 4	1,7	1,4	2,8	8,8	2,8	4,3	10,3	6,2	12,4
	DR2C 80MKA 4	2,4	1,0	2,2	7,3	2,1	3,4	9,2	4,9	11,0
	DR2C 80MA 4	3,6	0,8	1,8	6,5	2,0	3,1	7,9	4,5	9,6
	DR2C 90SA 6	5,8	0,4	1,3	5,2	1,6	2,5	6,7	3,9	8,1
	DR2C 90LA 6	7,1	0,3	1,1	4,5	1,6	2,4	6,2	3,9	7,6
	DR2C 100LSA 6	9,4	0,4	1,2	4,6	1,2	2,1	5,8	3,2	6,9
	DR2C 100LA 6	11	0,3	0,9	3,7	1,5	2,2	5,3	3,5	6,6
	DR2C 112MA 6	15	0,2	0,8	3,5	1,2	1,9	4,9	3,0	6,0
	DR2C 132SA 6	17,0	0,2	0,6	2,5	1,5	2,0	4,1	3,5	5,7

Absolute power losses in W:

Speed class	motor	P_{IE5} kW	0;25	0;50	0;100	50;25	50;50	50;100	90;50	90;100
2000	DR2C 71MSA 4	0,69	19,8	32,0	96,6	29,3	40,1	98,7	56,5	117,3
	DR2C 71MA 4	1,0	19,2	36,0	115,9	34,9	52,5	135,4	68,5	152,4
	DR2C 80MKA 4	1,5	23,8	48,2	153,4	37,2	62,4	170,6	77,7	193,0
	DR2C 80MA 4	2,3	22,7	54,5	193,1	47,7	80,8	224,8	104,0	253,8
	DR2C 90SA 6	3,6	27,4	71,7	266,5	60,8	106,6	307,0	143,7	345,2
	DR2C 90LA 6	4,7	22,6	73,2	285,7	73,5	126,9	356,2	180,3	410,7
	DR2C 100LSA 6	5,9	33,6	94,6	362,4	78,4	142,5	422,9	191,9	475,0
	DR2C 100LA 6	7,2	27,6	95,0	382,8	95,9	167,5	472,2	237,5	546,0
	DR2C 112MA 6	9,8	35,3	120,0	491,6	109,2	199,3	592,6	280,7	672,2
	DR2C 132SA 6	13	38,8	129,2	526,1	161,0	258,7	684,5	394,1	820,1
3000	DR2C 71MSA 4	1,1	21,3	24,0	69,8	37,8	50,6	136,7	71,9	159,4
	DR2C 71MA 4	1,7	23,9	47,4	146,3	47,5	71,4	172,0	102,9	207,9
	DR2C 80MKA 4	2,4	24,0	51,7	175,1	50,2	81,4	218,8	118,8	262,6
	DR2C 80MA 4	3,6	26,8	64,7	232,3	71,4	110,0	280,2	161,2	340,7
	DR2C 90SA 6	5,8	22,3	75,2	303,4	91,5	148,1	391,5	228,0	472,1
	DR2C 90LA 6	7,1	20,7	76,4	317,7	111,6	172,7	435,2	272,7	538,0
	DR2C 100LSA 6	9,4	33,0	108,6	430,8	117,3	198,7	544,4	300,1	652,7
	DR2C 100LA 6	11	27,7	99,2	394,9	156,4	236,7	567,9	373,8	710,4
	DR2C 112MA 6	15	31,9	122,7	523,3	184,5	286,2	730,0	446,7	885,8
	DR2C 132SA 6	17	25,8	101,5	418,7	248,3	335,2	697,9	592,6	974,5

5.4.2 Power losses related to the thermally permissible operating point

Relative Power Losses in %:

Speed class	motor	P_{th} kW	0;25	0;50	0;100	50;25	50;50	50;100	90;50	90;100
2000	DR2C 71MSA 4	0,90	4,8	6,5	15,7	5,7	8,3	21,3	10,2	23,2
	DR2C 71MA 4	1,4	2,1	4,8	17,3	2,8	5,6	18,6	6,8	19,9
	DR2C 80MKA 4	1,9	1,5	3,9	15,7	2,6	5,0	16,8	6,0	18,0
	DR2C 80MA 4	2,7	1,5	3,7	13,7	2,3	4,6	14,6	5,5	15,9
	DR2C 90SA 6	4,1	0,8	2,3	9,2	1,8	3,3	10,4	4,3	11,4
	DR2C 90LA 6	5,2	0,6	1,9	7,9	1,6	3,0	9,4	4,1	10,5
	DR2C 100LSA 6	6,3	0,7	2,0	7,8	1,5	2,9	8,9	3,8	9,9
	DR2C 100LA 6	7,7	0,5	1,7	6,8	1,4	2,7	8,2	3,7	9,2
	DR2C 112MA 6	9,8	0,4	1,2	5,0	1,1	2,0	6,0	2,9	6,8
	DR2C 132SA 6	13	0,3	1,0	4,0	1,2	2,0	5,2	3,0	6,2
3000	DR2C 71MSA 4	1,4	2,8	2,7	9,7	3,4	4,1	14,3	7,3	76,7
	DR2C 71MA 4	2,1	1,2	2,9	10,9	2,5	4,3	12,6	5,9	14,4
	DR2C 80MKA 4	2,8	1,0	2,5	9,8	2,1	3,7	11,2	5,2	12,9
	DR2C 80MA 4	4,1	1,0	2,4	8,3	2,0	3,4	10,0	4,8	11,4
	DR2C 90SA 6	6,1	0,5	1,6	6,6	1,8	3,0	8,5	4,5	10,0
	DR2C 90LA 6	7,9	0,4	1,4	5,7	1,7	2,9	7,7	4,4	9,2
	DR2C 100LSA 6	9,4	0,4	1,2	4,6	1,2	2,1	5,8	3,2	6,9
	DR2C 100LA 6	12	0,3	1,2	4,9	1,6	2,6	6,6	3,9	8,1
	DR2C 112MA 6	15	0,2	0,8	3,5	1,2	1,9	4,9	3,0	6,0
	DR2C 132SA 6	20	0,2	0,8	3,5	1,5	2,2	5,2	3,7	6,9

Absolute power losses in W:

Speed class	motor	P_{th} kW	0;25	0;50	0;100	50;25	50;50	50;100	90;50	90;100
2000	DR2C 71MSA 4	0,90	43,5	58,6	141,6	51,1	74,7	191,6	92,1	208,6
	DR2C 71MA 4	1,4	29,9	67,5	242,3	38,8	78,2	260,1	94,8	278,9
	DR2C 80MKA 4	1,9	28,2	73,7	295,3	48,0	93,8	316,4	112,8	338,8
	DR2C 80MA 4	2,7	41,5	101,6	371,9	63,4	124,0	396,2	150,0	432,1
	DR2C 90SA 6	4,1	33,5	95,3	375,5	71,6	135,4	423,8	176,6	467,0
	DR2C 90LA 6	5,2	30,2	101,3	415,4	83,3	159,1	491,7	215,9	550,9
	DR2C 100LSA 6	6,3	42,1	124,8	486,9	96,2	182,9	560,9	240,1	622,2
	DR2C 100LA 6	7,7	37,0	130,1	527,8	109,6	209,5	633,9	286,8	716,1
	DR2C 112MA 6	9,8	35,3	120,0	491,6	109,2	199,3	592,6	280,7	672,2
	DR2C 132SA 6	13	38,8	129,2	526,1	161,0	258,7	684,5	394,1	820,1
3000	DR2C 71MSA 4	1,4	38,0	36,6	130,9	46,1	55,6	193,2	99,2	225,4
	DR2C 71MA 4	2,1	24,3	60,3	228,9	52,1	89,9	265,6	123,1	301,5
	DR2C 80MKA 4	2,8	28,9	71,1	278,2	60,7	104,3	317,3	146,0	366,2
	DR2C 80MA 4	4,1	42,7	96,2	337,3	79,7	139,8	407,0	193,9	467,0
	DR2C 90SA 6	6,1	29,2	98,0	407,5	108,8	184,2	520,1	277,1	611,7
	DR2C 90LA 6	7,9	31,0	109,2	449,1	136,2	223,9	602,2	341,8	722,6
	DR2C 100LSA 6	9,4	33,0	108,6	430,8	117,3	198,7	544,4	300,1	652,7
	DR2C 100LA 6	12	29,9	133,7	573,2	185,5	297,6	770,7	450,6	942,0
	DR2C 112MA 6	15	31,9	122,7	523,3	184,5	186,2	730,0	446,7	885,8
	DR2C 132SA 6	20	47,4	166,0	690,2	289,5	427,7	1029,9	730,2	1357,8

6 Dynamic and thermal limit characteristics

6.1 General information

The effective operating point resulting from the travel cycle must be below the thermal limit curve. It consists of the effective torque and the mean speed.
With DR2C..A, a distinction is made between IE5 operation and the maximum permitted thermal operation.

The IE5 operating point is below the thermally maximum permitted characteristic curve and the IE5 limit torque applies from the rated speed to the intersection point with the thermal permitted limit characteristic curve.

The dynamic operating points resulting from the travel cycle must be below the dynamic limit characteristic curve. The dynamic limit characteristic depends on the inverter size used.

In ELSM operating mode (encoderless), the dynamic limit characteristic curve is reduced due to controlled operation at low speeds.

Motor-specific dynamic and thermal limit characteristic curves are included in the SEW Workbench project planning tool or in the online characteristic curve generator in the Online Support at Online Support (sew-eurodrive.co.uk)

The following boundary conditions apply to the displayed limit curves:

- Motor design in thermal class 155 (F)
- Motors with TF temperature protection or equivalent temperature detection
- Startup on the inverter with suitable inverter settings (nominal motor current is used as a reference for setting the inverter and does not exceed the nominal current of the motor in the constant torque range)
- Operation on approved SEW inverters in ELSM, PMVC or CFC operating mode (for operation on inverters from other manufacturers, check their suitability for operation of synchronous motors with encoders or encoderless control mode)
- Maximum ambient temperature of +40 °C.
- Frequency inverter 4 kHz
- The displayed characteristic curves apply self-ventilated or non-ventilated. A forced cooling fan can be selected. Currently, there is no thermal characteristic curve with forced cooling fan

NOTE

Observe the maximum limit speeds in the current motor catalog (DR..56-315 chapter "limit speeds") as well as the project planning notes for motors and installed options.

Please observe the notes and explanations for inverter operation from the current motor catalog (DR..56-315, chapter 5). These also apply without restriction to the operation of DR2C..A series motors on the frequency inverter.

NOTE

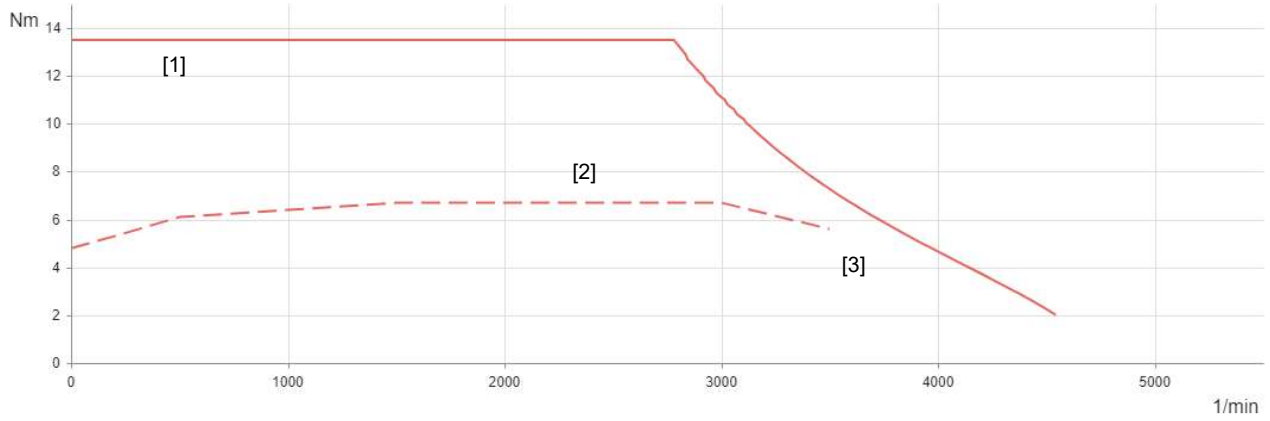
Observe the operating instructions of the inverter when operating DR2C..a motors on inverters from other manufacturers.
The corresponding wiring instructions of the inverter manufacturer must be observed. Furthermore, the inverter must be suitable for controlling permanent magnet synchronous drives with encoder or without encoder.

6.2 DR2C..A motors in CFC operating mode (only with motor encoder)

This chapter shows an example of the dynamic and thermal limit characteristic curve for a DR2C71MA4 in combination with an MDX9_a-055.
Link to the SEW-EURODRIVE Online Support for Motors/inverter characteristic curves
sew-eurodrive.co.uk/os/motorcharacteristics/

Example self-ventilated:

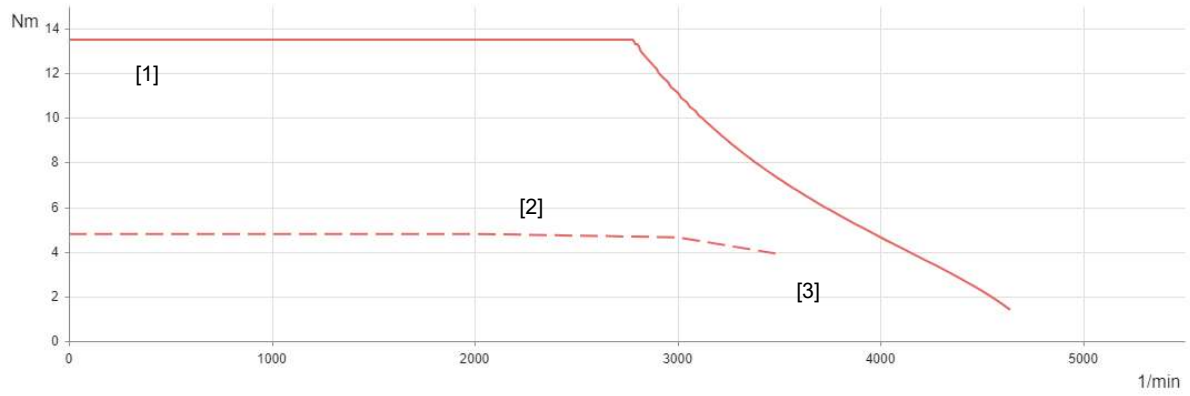
Dynamic and thermal limit characteristics DR2C71MA4, rated speed 3000 rpm, 400 V, self-ventilated, MOVIDRIVE® system MDX9_a-055, 3x400 V AC, CFC (only with motor encoder), 4 kHz.



[1] Dynamic limit characteristic curve
[2] Thermal limit characteristic curve
[3] Operation > 3000 rpm → consult SEW-EURODRIVE

Example non-ventilated:

Dynamic and thermal limit characteristics DR2C71MA4, rated speed 3000 rpm, 400 V, non-ventilated, MOVIDRIVE® system, 3x400 V AC, CFC (only with motor encoder), 4 kHz.



[1] Dynamic limit characteristic curve
[2] IE5 operating point with constant torque characteristic
[3] Operation > 3000 rpm → consult SEW-EURODRIVE

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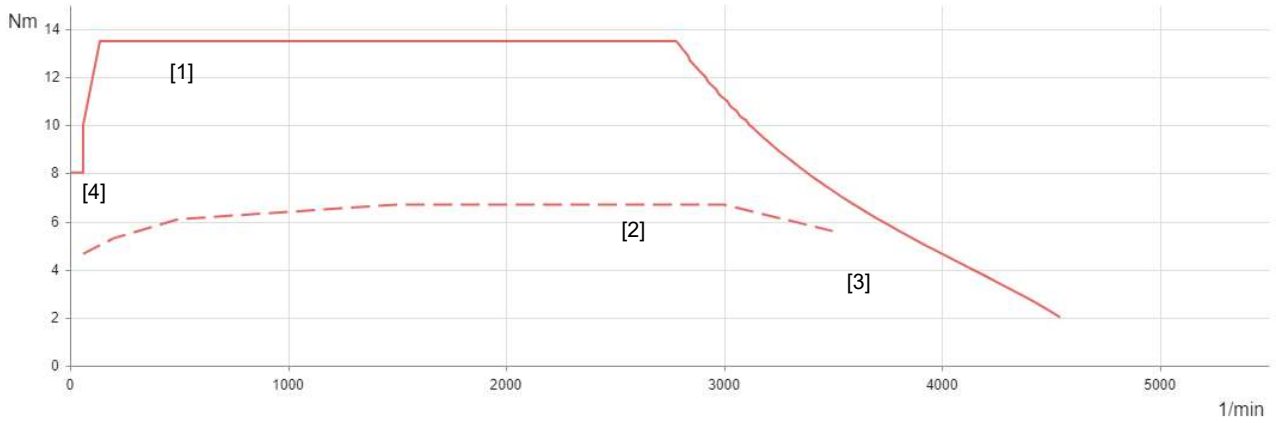
6.3 DR2C..A motors in ELSM operating mode (without motor encoder)

This chapter shows an example of the dynamic and thermal limit characteristic curve for a DR2C71MA4 in combination with an MDX9_a-070.
Link to the SEW-EURODRIVE Online Support for Motors/inverter characteristic curves
sew-eurodrive.co.uk/os/motorcharacteristics/

Example self-ventilated:

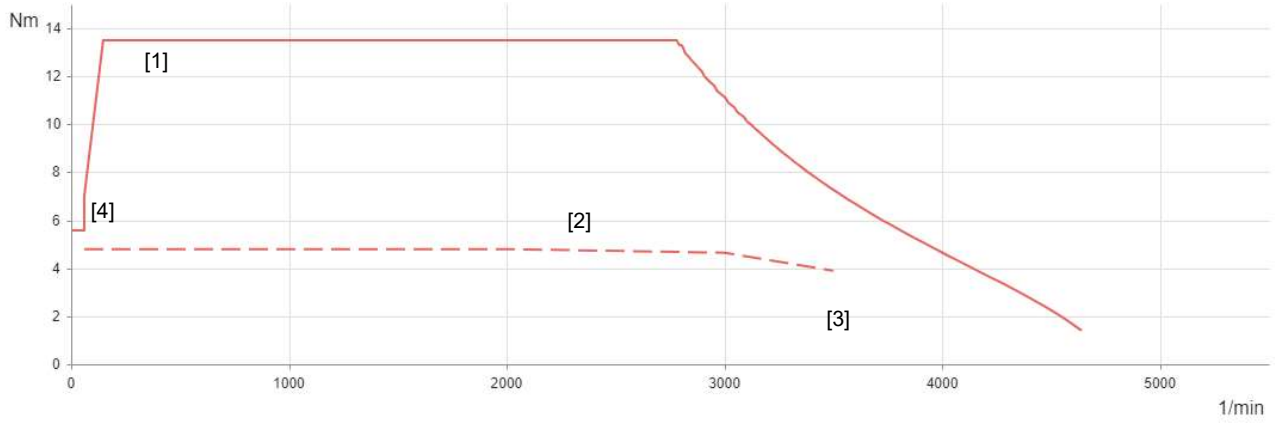
Dynamic and thermal limit characteristics DR2C..a, rated speed 3000 rpm, 400 V, self-ventilated, MOVITRAC® advanced, 3x400 V AC, ELSM, 4 kHz



[1] Dynamic limit characteristic curve
[2] Thermal limit characteristic curve
[3] Operation > 3000 rpm → consult SEW-EURODRIVE
[4] Reduction in ELSM operation

Example non-ventilated:

Dynamic and thermal limit characteristics DR2C..a, rated speed 3000 rpm, 400 V, non-ventilated, MOVITRAC® advanced, 3x400 V AC, ELSM, 4 kHz



[1] Dynamic limit characteristic curve
[2] IE5 operating point with constant torque characteristic
[3] Operation > 3000 rpm → consult SEW-EURODRIVE
[4] Reduction in ELSM operation

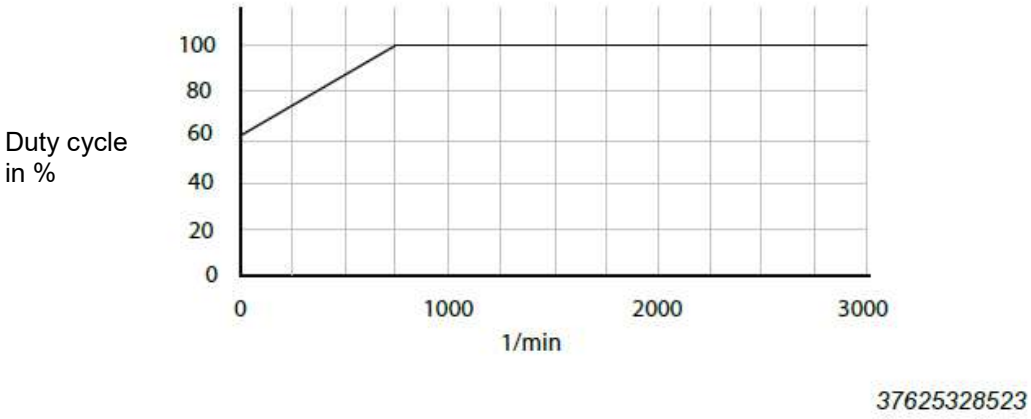
6.4 Brakemotors

Due to the increased motor operating temperature and reduced ventilation at variable speed in inverter operation, brake motors must not be operated continuously at low speeds below 750 rpm.

For DR.. brakemotors the thermally permitted torques in the lower speed range apply under the following conditions:

- Operation of the brake with a brake voltage tolerance of maximum ±5%
- Brake operation only with brake rectifier in the control cabinet

The following diagram shows the permitted duty cycle in periodic intermittent duty S3 (IEC 60034-1) for DR2C..A.. brakemotors the maximum time interval (100%) corresponds to one hour. To ensure sufficient cooling of the brake at low speed, operate the drive at high speed again after 60% of the switch-on time at the latest or switch off the brake.



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