



MH Series Motors

for Drive Controlled Pumps

Technical Manual

PVD 3680 – 04/2017





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EU DECLARATION OF CONFORMITY DICHIARAZIONE DI CONFORMITA' UE

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Noi,

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manufacturer, declare, under our sole responsibility that the following products:
produttori, dichiariamo, sotto la nostra responsabilità, che i seguenti prodotti:

BRUSHLESS SERVOMOTORS TYPE: MB / MH / SB / SMB / SME / SMH
SERVOMOTORI BRUSHLESS TIPO: MB / MH / SB / SMB / SME / SMH

are in conformity with the relevant Union harmonisation legislation:
sono conformi alle disposizioni armonizzate attinenti dell'Unione:

Directive 2014/35/EU : "Low Voltage Directive", LVD

The following harmonised standard and technical specifications have been applied:
Sono state applicate le seguenti norme armonizzate e specifiche tecniche:

EN 60034-1:2010/AC:2010 : Rotating electrical machines - Part 1 : Rating and performance.
Macchine elettriche rotanti. Parte 1: Caratteristiche nominali e di funzionamento

EN 60034-5:2001/A1:2007 : Rotating electrical machines - Part 5 : Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification.
Macchine elettriche rotanti. Parte 5: Gradi di protezione degli involucri delle macchine rotanti (progetto integrale) (codice IP) – Classificazione.

Additional information :
Altre informazioni:

SERVOMOTORS shall be mounted on a mechanical support providing good heat conduction and not exceeding 40 °C in the vicinity of the motor flange.
I SERVOMOTORI devono essere montati su un supporto che permetta una buona conduzione del calore e non superi i 40 °C nella vicinanza della flangia del motore

The product must be installed in accordance with the instructions and recommendations contained in the operating instructions supplied with the product.
Il prodotto deve essere montato secondo le istruzioni e le raccomandazioni contenute nel manuale operativo fornito con il prodotto

Last two digits of the year in which the CE marking was affixed: 94
Ultime due cifre dell'anno di applicazione della marcatura CE: 94

Cinisello Balsamo, February 1st 2017

In the name of Parker
F. ALPIOVEZZA
OPEX Manager

Ref : DC001-R0.9

CERTIFICATE OF COMPLIANCE

Certificate Number 20160630-E364045
Report Reference E364045-20160628
Issue Date 2016-JUNE-30

Issued to: PARKER HANNIFIN MANUFACTURING SRL
VIA GOUNOD 1
20092 CINISELLO BALSAMO MI ITALY

This is to certify that
representative samples of COMPONENT - SERVO AND STEPPER MOTORS
See next page for models.

Have been investigated by UL in accordance with the
Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 1004-1, Standard for Rotating Electrical Machines –
General Requirements
UL 1004-6, Standard for Inverter Duty Motors
CSA C22.2 No. 100, Standard for Motors and Generators

Additional Information: See the UL Online Certifications Directory at
www.ul.com/database for additional information

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Recognized components are incomplete in certain constructional features or restricted in performance
capabilities and are intended for use as components of complete equipment submitted for investigation rather
than for direct separate installation in the field. The final acceptance of the component is dependent upon its
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Bruce Mahewholz, Director North American Certification Program
UL LLC

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CERTIFICATE OF COMPLIANCE

Certificate Number 20160630-E364045
Report Reference E364045-20160628
Issue Date 2016-JUNE-30

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

USR, CNR – Recognized Component - "Class F" Insulated Servo Motors tabulated below.

Series MB, MH, ME, SB, SE, MBA, MBB, MHA, MHB, MEA, MEB, SBA, SBB, SEA, SEB, MBSV, MHSV, MESV, SBSV, SESV, MBASV, MBBSV, MHASV, MHBSV, MEASV, MEBSV, SBASV, SBBSV, SEASV, SEBSV, MBV, MHV, SBSV, MBAV, MBBV, MHAV, MHBV, SBAV, SBBV followed by 145 or 205, followed by additional letters and suffixes.



Bruce Meinholtz, Director North American Certification Program
UL LLC

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Note: MH Motors with UL certifications (according to CSA standards) shall be expressly requested in the order.

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1. INTRODUCTION

1.1. Purpose and intended audience

This manual contains information that must be observed to select, install, operate and maintain PARKER MH servomotors.

Installation, operation and maintenance of equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with:

- all information and established practices regarding safety,
- the installation process, operation, maintenance of equipment,
- all hazards involved.

Reading and understanding the information described in this document is mandatory before carrying out any operation on the motors. If any malfunction or technical problem occurs, that has not been dealt with in this manual, please contact PARKER for technical assistance. In case of missing information or doubts regarding the installation procedures, safety instructions or any other issue tackled in this manual, please contact PARKER as well.

PARKER's responsibility is limited to its servomotors and does not encompass the whole user's system. Data provided in this manual are for product description only and may not be guaranteed, unless expressly mentioned in a contract.



DANGER: PARKER declines responsibility for any industrial accident or material damage that may arise, if the procedures and safety instructions described in this manual are not scrupulously followed.

1.2. Safety

1.2.1. Principle

To operate safely, this equipment must be transported, stored, handled, installed and serviced correctly. Following the safety instructions described in each section of this document is mandatory. Servomotors usage must also comply with all applicable standards, national directives and factory instructions in force.



DANGER: Non-compliance with safety instructions, legal and technical regulations in force may lead to physical injuries or death, as well as damages to the property and the environment.

1.2.2. Safety Rules for Hydraulic Applications



DANGER: - Failure, improper selection or improper use of products described herein or related items can cause death, personal injury and property damage.
 - Installation, operation and maintenance of an HYDRAULIC EQUIPMENT should be carried out by qualified personnel, having technical expertise in this domain and aware of damages or injuries induced by failures on high pressure pumps, valves and leaks associated with an hydraulic system.

1.2.3. General Safety Rules

	Generality DANGER: The installation, commission and operation must be performed by qualified personnel, in conjunction with this documentation. The qualified personnel must know the safety (C18510 authorization, standard VDE 0105 or IEC 0364) and local regulations. They must be authorized to install, commission and operate in accordance with established practices and standards.
	Electrical hazard Servo drives may contain non-insulated live AC or DC components. Respect the drives commissioning manual. Users are advised to guard against access to live parts before installing the equipment. Some parts of the motor or installation elements can be subject to dangerous voltages, when the motor is driven by the inverter , when the motor rotor is manually rotated, when the motor is driven by its load, when the motor is at standstill or stopped. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product. Allow at least 5 minutes for the drive's capacitors to discharge to safe voltage levels (<50V). Use the specified meter capable of measuring up to 1000V dc & ac rms to confirm that less than 50V is present between all power terminals and between power terminals and earth. Check the drive recommendations. The motor must be permanently connected to an appropriate safety earth. The continuity of the grounding has to be checked on the complete circuit: the resistance between any conductive point and the grounding conductor shall not exceed more than 100 mΩ. To prevent any accidental contact with live components, it is necessary to check that cables are not damaged, stripped or not in contact with a rotating part of the machine. The work place must be clean, dry. General recommendations : - Check the wiring circuit - Lock the electrical cabinets - Use standardized equipment - To prevent any electric shock, never touch power contacts when the device is energized
	Mechanical hazard Servomotors can accelerate in milliseconds. Running the motor can lead to other sections of the machine moving dangerously. Moving parts must be screened off to prevent operators coming into contact with them. The working procedure must allow the operator to keep well clear of the danger area.
	Burning Hazard Always bear in mind that some parts of the motor surface can reach temperatures exceeding 100°C. Do not touch it!

2. PRODUCT DESCRIPTION

2.1. Quick URL

All information and data are available on :

<http://www.parker.com/eme/mh>

2.2. Overview

MH servomotors Series from PARKER is an innovative direct drive solution designed for industrial applications. MH Series brushless servomotors from Parker combine exceptional precision and motion quality, high dynamic performances and very compact dimensions.

A large set of torque / speed characteristics, options and customization possibilities are available, making MH Series servomotors the ideal solution for most servo systems applications.

Advantages

- High precision
- High motion quality
- High dynamic performances
- Low inertia
- Compact dimensions and robustness
- Large set of options and customization possibilities
- CE and UL marking certification available

2.3. Applications

Servo Hydraulic Pumps
Energy-Efficient Hydraulic System Solutions

2.4. Name plate

		Manufactured by Parker Hannifin Manufacturing S.r.l. Via Gounod, 1 20092 Cinisello Balsamo (MI) Italy		
Code	Vn	Vrms	ω	s ⁻¹
	To	Nm	In	A rms
	Pn	kW	Jm	m kgm ²
S/Nr.			IP	
Brake	Vdc		Adc	
www.parker.com				

Legend

Code: Reference of motor

Vn: Nominal Voltage phase to phase [Vrms]

Tn: Nominal Torque [Nm]

Pn: Nominal Power [kW]

S/Nr. Serial Number

Brake, Vdc, Adc: not used with DCP

ω : Nominal Speed [s⁻¹]

In: Nominal Current [Arms]

Jm: Rotor Inertia [kgm²*10⁻³]

IP: Ingress Protection code

2.5. General Technical Data



Technical Characteristics - Overview	
Motor Type	Motor Type Permanent magnets synchronous servo motor
Rotor Design	Rotor with surface rare earth magnets
Power supply	400 VAC
Operating temperature	-10/+40 °C
Storage temperature	-20/+60°C
Altitude	Up to 1000m (IEC 60034-1) (for higher altitude see §3.1.1 for derating)
Number of poles	8 for MH145 - MH205 - MH265
Type of construction	IM B5 – IM V1 – IM V3 (EN 60034-7)
Power Range	0.05...67 kW
Torque Range	0.2...285 Nm
Speed Range	Speed Range 0...3000 min ⁻¹
Mounting	Flange with smooth holes B14, B3 option
Shaft End	Suitable for pump coupling
Vibration severity	Grade A according to IEC 60034-14
Cooling	Cooling Natural ventilation Self-ventilation (option for size 145-205) Forced ventilation (option for size 145-205)
Protection Level (IEC60034-5)	IP64 (without fan)
Feedback sensor	Resolver (transformation ratio = 0.5 as standard) Sensorless (as an option)
Thermal protection	KTY as standard
Temperature Class – Insulation of stator winding	Class F according to IEC 60034-1 Winding class H
Connections	Connectors Terminal Box (see table option for combination)
Marking	CE / UL

2.6. Product Code

MH Series Motors

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Order example	MH			V	205	30	28	5	T7A		3I			64			4	

1	Type of Motor (mandatory field)	MH	MH Series Motor with Resolver for PSD/C3/AC30V
2	EX Protection	Empty field	Standard motor: No EX Certification
3	Brake Option	Empty field	No Brake Option
4	Cooling Option	Empty field	no cooling option
		V	Motor with shaft-drive fan cooling
		SV	Motor with (single-phase) motorized fan cooling
5	Motor Frame Size (mandatory field)	145	Torque range 4.5...28 Nm
		205	Torque range 15...90 Nm
		265	Torque range 75...265 Nm
6	Winding (mandatory field)	nn	min-1 (x100)
7	Motor Torque (mandatory field)	nnn	Torque in Nm
8	Flange (mandatory field)	5	B5 Flange
9	Shaft (mandatory field)	T7A	Shaft for model pump T7A
		T7B	Shaft for model pump T7B
		T7D	Shaft for model pump T7D
		T7BB	Shaft for model pump T7BB
		T7DD	Shaft for model pump T7DD
		T7DB	Shaft for model pump T7DB
10	Key Shaft option	Empty field	Shaft with key
		S	Shaft without key
11	Layout - Connectors (mandatory field)	3I	Terminal Box + Interconnectron 90° (not for size 265)
		3MBS	Terminal Box + Interconnectron fixed (only for size 265)
12	Female connectors option	Empty field	With Female / flying connectors
		W	Without Female / flying connectors
13	Form Option	Empty field	No Foot Mount Option
		3	B3 - Foot Mount Option
14	Protection Degree (mandatory field)	64	IP64 (without fan)
15	Feedback	Empty field	Resolver (Standard)
16	Option Inertia	Empty field	Standard Inertia
17	Voltage	4	380-400 V
18	Special option	Empty field	No Special Option

Note: All associations are not possible – Contact Parker for checking.

3. TECHNICAL DATA

3.1. Motor selection

3.1.1. Altitude derating

From 0 to 1000 m : no derating
 1000 to 4000 m: torque derating of 5% for each step of 1000 m for water cooled
 1000 to 4000 m: torque derating of 10% for each step of 1000 m for air cooled

3.1.2. Temperature derating

The maximal temperature for natural cooled motors is 40°C. But, it is possible to increase a little bit the ambient temperature above 40°C, with a torque reduction. The following formula gives an indicative about the torque derating at low speed. But in any case refer to PARKER technical department to know the exact values

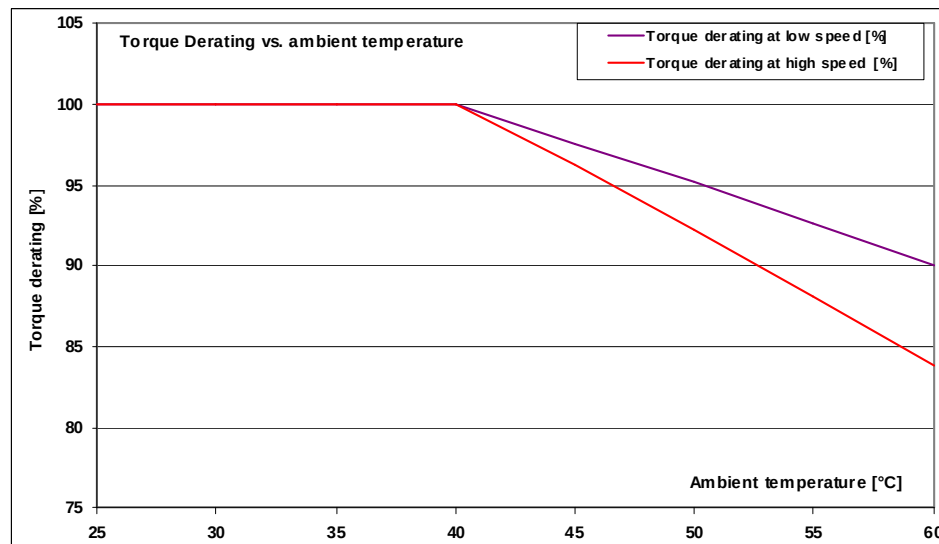
At low speed the torque derating is given by the following formula for an ambient temperature > 40°C.

$$\text{Torque_derating} = 100 * \sqrt{\frac{(145^{\circ}\text{C} - \text{Ambient_temperature } ^{\circ}\text{C})}{105^{\circ}\text{C}}} [\%]$$



At high speed, the calculation becomes more complex and the derating is much more important.
 Please refer to PARKER to know the precise data of Torque derating according to ambient temperature at high speed for a specific motor.

Illustration below is given as example. Please contact Parker technical department to know exact values.



3.1.3. Thermal equivalent torque (rms torque)

Please calculate rms torque M_{rms} only if DCP application needs heavy intermittent duty cycles. Otherwise, just compare needed torque with continuous torque provided by the motor at specified speed.

The calculation of M_{rms} (i.e. root mean squared torque, sometimes called equivalent torque) does not take into account the thermal time constant. It can be used only if the overload time is much shorter than the copper thermal time constant.

The rms torque M_{rms} reflects the heating of the motor during its duty cycle.

Let us consider:

- the period of the cycle T [s],
- the successively samples of movements i , characterized by the maximal torque M_i [Nm] reached during the duration Δt_i [s].

So, the rms torque M_{rms} can be calculated through the following basic formula:

$$M_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^n M_i^2 \Delta t_i}$$

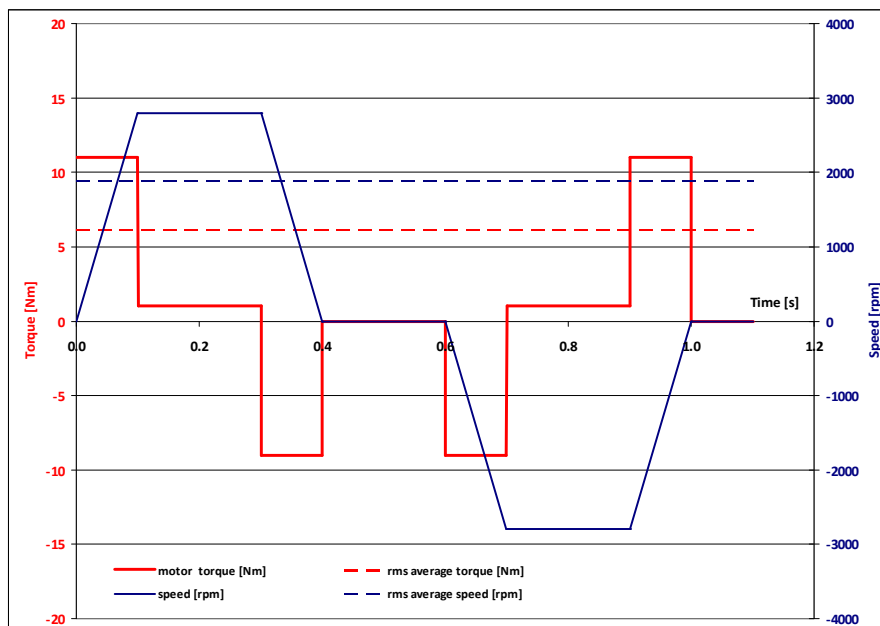
Example 1

Let us take a cycle showing 0 Nm during 2 s, 10 Nm during 2 s and 4 s as period, the rms torque reaches:

$$M_{rms} = \sqrt{\frac{1}{4} * 10^2 * 2} = 7,07 Nm$$

Example 2

Acceleration-deceleration torque:	10 Nm during 0,1 s
Resistant torque:	1 Nm when moving
Max-Min speed:	± 2800 rpm during 0,2 s
Max torque provided by the motor:	11 Nm
Average rms torque:	6.4 Nm



The maximal torque M_i delivered by the motor at each segment i of movement is obtained by the algebraic sum of the acceleration-deceleration torque and the resistant torque. Therefore, M_{max} corresponds to the maximal value of M_i .

MH Series – Motor Selection

To ensure that you select the correct motor, we recommend to consider following information:

- Diagram speed / time of load cycle to identify the type of the cycle (S1, S3 or others according to IEC 60034-1)
- Data about load inertia of system
- Check the duty cycle - acceleration/deceleration
- Calculate the rms torque and peak torque of the system
- Calculate the rms speed and maximum speed of the cycle
- Check the temperature and altitude of environment / application
- Check the mechanical compatibility

With these preliminary data, you can start choosing appropriate motor and drive for your application.

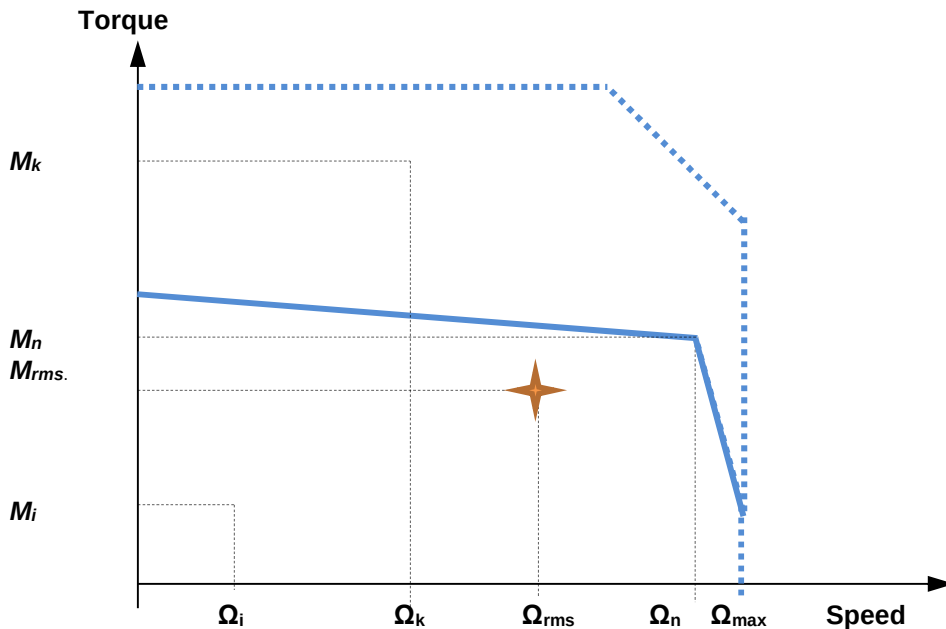
The motor adapted to the duty cycle has to provide the rms torque M_{rms} at the rms speed(*) Ω_{rms} and that without extra heating. This means that the torque margin between M_n and M_{rms} has to be sufficient. The rms operating point is illustrated on the graph below by a star: ★

(*) rms speed Ω_{rms} is calculated thanks to the same formula as that used for the rms torque:

$$\Omega_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^n \Omega_i^2 \Delta t_i}$$

N.B. The mean speed (average algebraic value) cannot be used because generally, its value is equal to 0. Therefore, only use the rms speed in such a kind of calculation.

Furthermore, each M_i and speed associated Ω_i of the duty cycle has to be located in the operational area of the torque vs speed curve.



Legend:

- Permanent duty cycle
- Intermittent duty cycle



3.1.4. Drive selection

Drive selection depends on several parameters: rated Input Voltage, rated Power, maximum Switching Frequency, Overload management which leads to the maximum allowable current duration.

	Please refer to the drive technical documentation to get any further information and to select the best motor - drive association.
---	---

Following data are given as example selecting the AC30V Drive Controller

Electrical Characteristics	
Power supply	400 V Nominal
Rated Input Voltage	3 x 380...480 VAC $\pm 10\%$
Input Frequency	45...65 Hz
Maximum Switching Frequency	4 kHz up to maximum of 12 kHz - de-rating may apply
Overload: Heavy Duty	150 % for 60 s - 180 % for 3 s
Overload: Normal Duty	110 % for 60 s - 180 % of HD FLC. for 3 s (HD FLC: Heavy Duty @ Full Load Current)
Output Frequencies	0...500 Hz at 4 kHz switching frequency 0...1000 Hz at 8 kHz switching frequency 0...1500 Hz at 12 kHz switching frequency
Environmental Characteristics	
Operating Temperature	0...+40 °C Normal Duty, 0...+45 °C Heavy Duty. Derating up to a maximum of +50 °C
Operating Humidity	Maximum 85 % relative humidity at 40 °C non-condensing
Protection class	IP 20
Altitude	1000 m ASL. Derating output by 1 % per 100 m to a maximum of 2000 m
Atmosphere	Non-flammable, non-corrosive and dust free
Climatic conditions	Class 3k3, as defined by EN60721-3-3

AC30V Model	AC30V Frame	Output Power [kW]	Output Current (400 VAC) [A]	AC30V View
D0005 – D0012	Frame D	1.5 - 5.5	4.5 - 12	
E0016 – E0023	Frame E	7.5 - 11	16 - 23	
F0032 – F0038	Frame F	15 - 18	32 - 38	
G0045 – G0073	Frame G	22 - 37	45 - 73	
H0087 – H0145	Frame H	45 - 75	87 - 145	

3.1.5. Current limitation at stall conditions (i.e. speed < 3 rpm)

Recommended reduced current at speed < 3 rpm:

$$I_{reduced} = \frac{1}{\sqrt{2}} * I_0 \cong 0.7 * I_0$$

	Warning: The current must be limited to the prescribed values. If the nominal torque has to be maintained at stop or low speed (< 3 rpm), imperatively limit the current to 70% of I_0 (permanent current at low speed), in order to avoid an excessive overheating of the motor.
	Please refer to the drive technical documentation for any further information and to choose functions to program the drive.

3.1.6. Sizing of a whole DriveControlledPump

Step	Phase	Data	Example
#1 §3.1.6.1	Collecting of Hydraulic Requirements	Flow rate Q Pressure p Duty cycle S1, S3,... Maximum speed allowable	Q=75 l/min p=100 bar Continuous duty Nmax=3000 rpm
↓			
#2 §3.1.6.2	Pump Selection	Main formula to be used: Flow rate Q [l/min] = Displacement [ml/rev]*Speed [rpm]/1000 Power P [W]=pressure [bar]*Flow rate [l/min]/600 Kind of pump Model Series Displacement Maximum speed Maximum Pressure S3 Maximum Pressure S1 Internal leakage Power loss hydromechanical	Vane pump T7B B09 28.0 ml/rev 3600 rpm 320 bar 290 bar 1.2 l/min @100 bar @24cSt 0.54 kW @ 3000 rpm @24 cSt
↓			
#3 §3.1.6.3	MH Motor Selection	Main formula to be used: Torque [Nm]=(Power + Power loss hydromechanical) [W]/Speed [rad/s] Kind of motor Model Series Nominal speed Nominal torque Nominal current Torque constant K_t	Brushless MH MH205 30 70 3000 rpm 52.3 Nm 33.7Arms 1.63 Nm/Arms
↓			
#4 §3.1.6.4	Servo Drive Selection	Main formula to be used: Output Current [Arms] = Torque [Nm]/ K_t [Nm/Arms] Kind of Servo drive Frame Model Continuous Power Continuous Output current S1 Intermittent Output current S3	AC30V F F0038 18 kW 38 Arms 57 Arms 150% for 60 s
↓			
#5 §3.1.6.5	DCP components validation	Final checking Rated flow rate reached Rated pressure obtained Max radial load on motor shaft Max radial load on pump shaft ...	Final checking 82.8 l/min p=100 bar 2791 N allowable 900 N allowable ...



Some tables given hereunder show needed calculations in order to determine a **DriveControlledPump** comprising {Pump - Motor - Servo drive}. These calculation steps must be followed for each application.

3.1.6.1. Collecting of Hydraulic Requirements

Type of operation needed by the application: *Continuous duty* and/or *Intermittent duty*

Continuous duty means most of the time a duty with a *Continuous Pressure* while *Intermittent duty* means a duty with a *Variable Pressure*.

Flow rate Q [l/min]

Pressure p [bar] taking account of possible pressure losses in circuit

Using same abbreviation given by IEC 60034-1):

Duty type S1 – means Continuous running duty and

Duty type S3 – means Intermittent periodic duty.

S3 10% 5 min means *Intermittent periodic duty* during 10%*(5*60)=30 s, period=5 min.

Maximum speed refers to the maximum speed allowable by the pump.

Minimum needed Displacement V_i can then be calculated.

Requirements – Example						
Duty cycle	Continuous duty			Intermittent duty		
Type of operation:	Continuous Pressure			Variable Pressure		
Flow rate Q [l/min]	75	50	25	50		
Pressure p [bar]	100			300	250	175
Duty cycle	S1			S3 10% 5 min	S3 20% 5 min	S3 50% 5 min
Maximum speed N [rpm]	3000	2500	2000	2000		
Minimum needed Displacement $V_i=1000*Q/N$ [ml/rev]	25	20	12.5	25		

3.1.6.2. Pump selection

Select the most adapted type of pump (T7 = vane pumps for MH Series).

Choice the displacement V_i directly greater than previous value calculated (25 ml/rev).

Let us take B09 = 28.0 ml/rev.

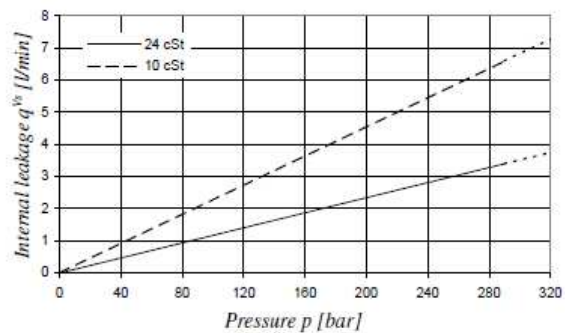
Theoretical flow rate Q_{theo} [l/min] = Displacement [ml/rev]*N [rpm]/1000

To be able to continue with calculations, following data (*Maximum Pressure, Maximum Speed, Internal leakage, Power loss hydromechanical, Permissible radial and axial load*) were obtained from catalogue HY29-0001 Industrial Hydraulic Pumps T7/T67/T6.

Maximum Pressure and Maximum Speed						
Model of pump	Series	Theoretical Displacement V_i [ml/rev]	Minimum Speed [rpm]	Maximum Speed HF-0, HF-1, HF-2 [rpm]	Maximum Pressure Intermittent HF-0, HF-2 [bar]	Maximum Pressure Continuous HF-0, HF-2 [bar]
T7B T7BS	B02	5.8	600	3600	320	290
	B03	9.8				
	B04	12.8				
	B05	15.9				
	B06	19.8				
	B07	22.5				
	B08	24.9				
	B09	28.0				
	B10	31.8		3000	300	275
	B11	35.0				
	B12	41.0				
	B14	45.0				
	B15	50.0			280	240

HF-0, HF-2 = Anti-wear Petroleum Base – HF-1 = Non Anti-wear Petroleum Base

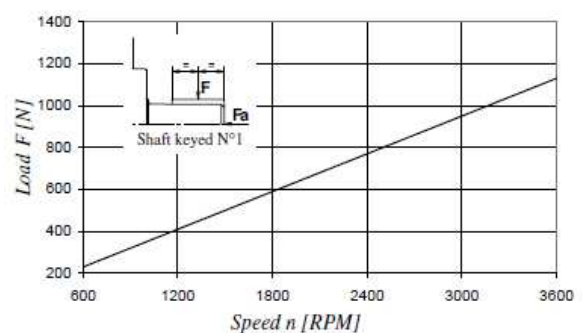
Internal Leakage q_{vs} [l/min] Typical @24 cSt



Following values are estimated from curve above $q_{vs}=f(p)$ @24 cSt.

Pressure [bar]	Internal Leakage [l/min]
100	1.2
175	2.0
250	3.0
300	3.5

Permissible radial and axial load

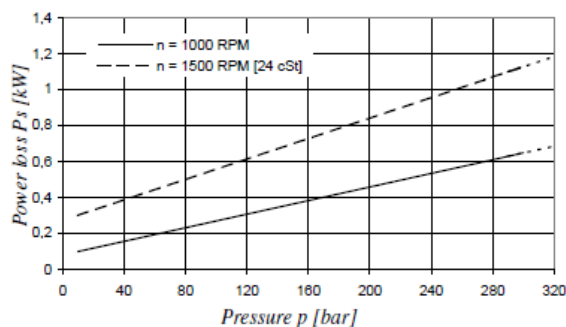


Following values are estimated from curve above $F=f(n)$.

Speed [rpm]	Permissible radial load [N]
1500	500
2000	700
2500	800
3000	900

Power loss hydro mechanical P_s [kW]

Typical @24 cSt & 1500rpm



Following values are estimated from curve above $P_s=f(p)$ @1500 rpm (24 cSt).

Pressure [bar]	100	175	250	300
Speed [rpm]	Power loss hydro mechanical [kW]			
1500	0.27	0.45	0.55	0.65
2000	0.36	0.60	0.73	0.87
2500	0.45			
3000	0.54			



Checking of intermittent pressure rating:

T7 units may be operated intermittently at pressures higher than the recommended continuous duty pressure rating. This intermittent pressure rating calculation is only valid when the other parameters: speed, fluid, viscosity and contamination level are respected. For total cycle longer than 15 minutes, please consult your local Parker representative.

Intermittent duty – Example			
S3 10% 5 min	S3 20% 5 min	S3 50% 5 min	S3 Dwell time
10%*(5*60)	20%*(5*60)	50%*(5*60)	
30 s	60 s	150 s	1560 s
300 bar	250 bar	175 bar	0 bar
56 l/min			

Average pressure p_{avg} and maximum pressure p_{max} reached during cycle:

$$p_{avg} = \frac{1}{T} * \sum_{i=1}^n p \Delta t$$

$T = (30+60+150+1560) = 1800 \text{ s} = 20 \text{ min} = \text{global period of cycle}$

$p_{avg} = (1/1800)*(300*30+250*60+175*150+0*1560)$

$p_{avg} = 28 \text{ bar}$ reflects the average pressure during intermittent duty cycle.

28 bar is lower than 290 bar allowed as continuous pressure for T7B-B09 with HF-0 fluid.

$p_{max} = 300 \text{ bar}$ is the maximum pressure during intermittent duty cycle.

300 bar is lower than 320 bar allowed as intermittent pressure for T7B-B09 with HF-0 fluid.

Checking of permanent pressure rating:

Continuous duty – Example		
S1 15 min	S1 15 min	S1 15 min
100%*(15*60)	100%*(15*60)	100%*(15*60)
900 s	900 s	900 s
	100 bar	
84 l/min	70 l/min	56 l/min

Continuous pressure p_{cont} during cycle:

$p_{cont} = 100 \text{ bar}$

100 bar is lower than 290 bar allowed as continuous pressure for T7B-B09 with HF-0 fluid.

Summary – Example						
Pump selection / Displacement	T7B B09					
Type of operation	Continuous duty			Intermittent duty		
Maximum authorized Speed HF-0,HF-1, HF-2	3600					
Pump rotation speed [rpm]	3000	2500	2000	2000		
Displacement Vi [ml/rev]	28.0					
Theoretical flow rate Q _{theo} [l/min] =Displacement [ml/rev]*N [rpm]/1000	84	70	56	56		
Pressure p during operation [bar]	100			300	250	175
Maximum authorized Pressure [bar]	290			320		
Internal leakage [l/min] (typical) @24 cSt q ^{vs}	1.2			3.5	3	2
Flow rate available Q _{eff} =Q _{theo} -Q _{vs} [l/min]	82.8	68.8	54.8	52.5	53	54
Flow rate required by application [l/min]	75	50	25	50		
Power loss hydromechanical [kW] (typical) @24 cSt &1500rpm	0.27			0.65	0.55	0.45
Power loss hydromechanical P _s [kW] (estimated @ N rpm) @24 cSt	0.54	0.45	0.36	0.87	0.73	0.60
Theoretical input power P _{theo} =Q _{theo} *p/600 [kW]	14.0	11.7	9.3	28.0	23.3	16.3
Necessary input power P _{eff} =P _{theo} +P _s [kW]	14.5	12.1	9.7	28.9	24.1	16.9
Torque required by application T _{eff} =P _{eff} *60/(2πN) [Nm]	46.3			137.8	114.9	80.9

3.1.6.3. Motor selection

Select the most adapted motor using *Electromechanical characteristics of MH Series* given page 23 and following. Candidate motor has to provide *Continuous torque* and *Intermittent torque* with a sufficient margin. Check the rms torque M_{rms} only if application needs heavy intermittent duty cycles. Otherwise (duty type S1), just compare needed torque with continuous torque provided by the motor at specified speed.

Intermittent duty S3 – Example			
S3 10% 5 min	S3 20% 5 min	S3 50% 5 min	S3 Dwell time
10%*(5*60)	20%*(5*60)	50%*(5*60)	1560 s
30 s	60 s	150 s	Period 1800 s
137.8 Nm	114.9 Nm	80.9 Nm	0 Nm
2000 rpm	2000 rpm	2000 rpm	2000 rpm

Calculation of rms torque does not take into account the thermal time constant of motor. It can be used only if the overload time is much shorter than the copper thermal time constant. The rms torque M_{rms} reflects the heating of the motor during its duty cycle. Let us consider for that:

- the period of the cycle T [s],
- the successively samples of movements i , characterized by the maximal torque M_i [Nm] reached during the duration Δt_i [s]. So, the rms torque M_{rms} is calculated as follows:

$$M_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^n M_i^2 \Delta t_i}$$

$T = (30+60+150+1560) = 1800$ s = 20 min = global period of cycle

$M_{rms} = ((1/1800)*(137.8^2*30 + 114.9^2*60 + 80.9^2*150 + 0^2*1560))^{0.5}$

$M_{rms} = 36.1$ Nm

M_{rms} has to be located inside the operational area of the torque vs speed curve.

In our example, it is obvious that $N_{rms} = 2000$ rpm. However in case of more complex cycles, Ω_{rms} rms speed is calculated thanks to the same formula as that used for the rms torque.

$$\Omega_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^n \Omega_i^2 \Delta t_i}$$

$N_{rms} = ((1/1800)*(2000^2*30 + 2000^2*60 + 2000^2*150 + 2000^2*1560))^{0.5}$

$N_{rms} = 2000$ rpm $\Rightarrow \Omega_{rms} = 2*\pi*2000/60 = 209.4$ rad/s

Furthermore, each operating couple (Torque, Speed) has to be located inside the operational area of the torque vs speed curve (S1 65K continuous rated).

Motor selection – Example					
Motor selection	Continuous torque available @ N [rpm]			Intermittent torque available @ N [rpm]	
	S1 65K ΔT			S3 10% 5 min	S3 20% 5 min
Duty cycle				S3 50% 5 min	
Speed [rpm]	3000	2500	2000	2000	
MH145 30 04					
MH145 30 08					
MH145 30 15					
MH145 30 22					
MH145 30 28					
MH205 30 15					
MH205 30 28					
MH205 30 50					
MH205 30 70	52.3	55	60	165	135
MH205 30 90					
MH265 30 75					
MH265 30 150					
MH265 30 220					
MH265 30 285					
Torque required by application [Nm]	46.3			137.8	114.9
				80.9	

3.1.6.4. Drive selection

				Output Current – Example		
Duty cycle	Continuous S1			Intermittent S3		
Torque [Nm] available @ speed N [rpm]	52.3	55	60	165	135	85
Speed N [rpm]	3000	2500	2000	2000		
Torque required by application [Nm] @speed N [rpm]	46.3			137.8	114.9	80.9
Torque constant K_t [Nm/Arms]	1.63 (data extracted from table §3.2.2 model MH205 30 70)					
Output Current required [Arms] $\approx$ Torque required/ K_t	28.4			84.5	70.4	49.6

Select the most adapted drive able to perform the work depending on duty cycle of application.

AC30V servo drive selection– Example		
AC30V servo drive selection	Output current [Arms] 400 VAC	
Overload heavy duty capability	150 % for 60 s – 180 % for 3 s	
Overload normal duty capability	110 % for 60 s – 180 % of Heavy Duty @ Full Load Current for 3 s	
Frame D		
D0005 1.5 kW	4.5 Arms continuous output current (400VAC)	
D0006 2.2 kW	5.5 Arms continuous output current (400VAC)	
D0008 3.0 kW	7.5 Arms continuous output current (400VAC)	
D0010 4.0 kW	10 Arms continuous output current (400VAC)	
D0012 5.5 kW	12 Arms continuous output current (400VAC)	
Frame E		
E0016 7.5 kW	16 Arms continuous output current (400VAC)	
E0023 11 kW	23 Arms continuous output current (400VAC)	
Frame F		
F0032 15 kW	32 Arms continuous output current (400VAC)	
F0038 18 kW	38 Arms continuous output current (400VAC)	
Frame G		
G0045 22 kW	45 Arms continuous output current (400VAC)	
G0060 30 kW	60 Arms continuous output current (400VAC)	
G0073 37 kW	73 Arms continuous output current (400VAC)	
Frame H		
H0087 45 kW	87 Arms continuous output current (400VAC)	
H0105 55 kW	105 Arms continuous output current (400VAC)	
H0145 75 kW	145 Arms continuous output current (400VAC)	

For an exclusive S1 duty cycle, the model F0032 already appears to be sufficient, while F0038 provides a better safety margin.

AC30V F0038 is able to supply:

- 18 kW as continuous power,
- 38 Arms** as continuous output current (400 VAC),
- $38 \times 1.5 = 57$ Arms as intermittent (overload duty during 60 s)
- $38 \times 1.8 = 68.4$ Arms as intermittent (overload duty @ full load current, during 3 s)

For mixed duty cycles S1 & S3, the model G0060 will perform the work satisfyingly.

AC30V G0060 is able to supply:

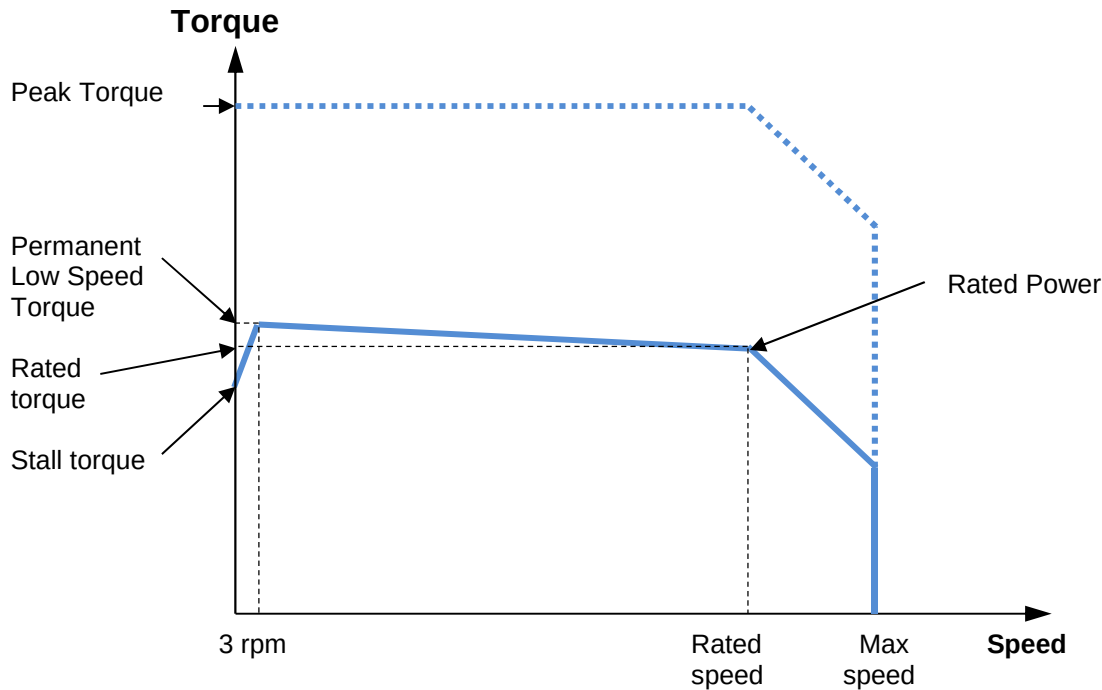
- 30 kW as continuous power,
- 60 Arms as continuous output current (400 VAC),
- $60 \times 1.5 = \mathbf{90}$ Arms as intermittent (overload duty during 60 s)
- $60 \times 1.8 = 108$ Arms as intermittent (overload duty @ full load current, during 3 s)

3.1.6.5. DCP components validation

A final checking will be performed to ensure the selection made for each component. Pay attention to the heating dissipation of motor and pump mounted together. Rated motor characteristics are given with a motor fixed on an aluminum flange (thickness of 20 mm, ambient temperature of 20°C and horizontal position).

3.2. MH Series Motors – Electromechanical characteristics

The torque vs speed graph below explains different intrinsic values given in the next tables. Data correspond to motors with Natural Air Cooling ; for self-ventilated and servo-ventilated motors (MHV & MHSV) please refer to §3.4. *Options*.



Legend used in following tables

Designation	Conditions	Designation
Model		MH aaa bb ccc (0)
DCP Code S		3 digits as nominal power indicator:
		4P2 $\Leftrightarrow$ 4.2 kW (winding 3000 rpm)
		016 $\Leftrightarrow$ 16 kW (winding 3000 rpm)
		2P9 $\Leftrightarrow$ 2.9 kW (winding 2000 rpm)
		005 $\Leftrightarrow$ 5 kW (winding 2000 rpm)
DCP Code S with special code extension XG		Side of the square □QF [mm] cf. §3.3.1
Size		T_{065} [Nm]
Stall Torque	$\Delta T=65K$	I_{065} [A _{rms}]
Stall Current	$\Delta T=65K$	T_{n65} [Nm] at nominal speed
Nominal Torque	$\Delta T=65K$	n [min ⁻¹]
Nominal Speed		I_{n65} [A _{rms}] at nominal torque
Nominal Current	$\Delta T=65K$	T_{max} [Nm] Max stall torque
Peak Torque	at S3 10%	J [kgmm ²]
Inertia		K_e [Vs] (2) (3)
E.m.f. constant		K_t [Nm/A _{rms}] (2) (3)
Torque constant		R [Ω] (2) (3)
Phase-phase Resistance		L [mH] (3)
Phase-phase Inductance		

(0) aaa = Size of MH Motor, bb = Nominal Speed $n/100$, ccc = Stall Torque T_{065} [Nm]

(1) Data referred to motor suspend in horizontal position in free still air, 20 °C ambient temperature

(2) Data measured at 20 °C. When "hot" consider 5 % derating

(3) Tolerance data $\pm 10\%$

ΔT Heating of motor



3.2.1. MH145 – 4.5...28 Nm – Mains voltage 400V

Natural Air Cooling												2000 rpm	
Model	DCP code S (XG)	Size	Stall		Nominal			Peak Torque ⁽¹⁾	Inertia	Ke ₍₂₎₍₃₎	Kt ₍₂₎₍₃₎	R _{ph-ph} ₍₂₎₍₃₎	L _{ph-ph} ₍₃₎
			Torque ₍₁₎	Current	Torque ₍₁₎	Speed	Current						
			T ₀₆₅ (T ₁₀₅) [Nm]	I ₀₆₅ [A]	T _{n065} [Nm]	n [min ⁻¹]	I _{n065} [A]	T _{max} [Nm]	J [kgmm ²]	Ke [Vs]	Kt [Nm/A _{rms}]	R [Ω]	L [mH]
MH 145 20 04	0P9	145	4.5 (9)	2.3	4.5	2000	2.3	28	780	1.2	2.03	8.51	93.6
MH 145 20 08	1P8		8.7 (16)	3.7	8.4	2000	3.5	49	1050	1.4	2.49	4.03	41.3
MH 145 20 15	2P9		15.0 (27)	6.2	13.7	2000	5.5	86	1600	1.5	2.59	1.64	14.4
MH 145 20 22	004		22.0 (37)	8.9	19.4	2000	7.6	117	2150	1.5	2.65	0.97	8.2
MH 145 20 28	005		28.0 (45)	11.3	23.9	2000	9.4	143	2700	1.5	2.65	0.68	5.4

Natural Air Cooling												3000 rpm	
Model	DCP code S	Size	Stall		Nominal			Peak Torque ⁽¹⁾	Inertia	Ke ₍₂₎₍₃₎	Kt ₍₂₎₍₃₎	R _{ph-ph} ₍₂₎₍₃₎	L _{ph-ph} ₍₃₎
			Torque ₍₁₎	Current	Torque ₍₁₎	Speed	Current						
			T ₀₆₅ (T ₁₀₅) [Nm]	I ₀₆₅ [A]	T _{n065} [Nm]	n [min ⁻¹]	I _{n065} [A]	T _{max} [Nm]	J [kgmm ²]	Ke [Vs]	Kt [Nm/A _{rms}]	R [Ω]	L [mH]
MH 145 30 04	1P4	145	4.5 (9)	3.4	4.3	3000	3.2	28	780	0.8	1.42	4.12	45.6
MH 145 30 08	2P5		8.7 (16)	5.4	7.9	3000	4.8	49	1050	1.0	1.70	1.94	19.3
MH 145 30 15	004		15.0 (27)	9.1	12.7	3000	7.5	86	1600	1.0	1.78	0.77	6.8
MH 145 30 22	5P4		22.0 (37)	13.1	17.3	3000	10.1	117	2150	1.0	1.80	0.46	3.8
MH 145 30 28	6P6		28.0 (45)	17.0	21.1	3000	12.5	143	2700	1.0	1.78	0.31	2.5

3.2.2. MH205 – 15...90 Nm – Mains voltage 400V

Natural Air Cooling												2000 rpm	
Model	DCP code S (XG)	Size	Stall		Nominal			Peak Torque ⁽¹⁾	Inertia	Ke ₍₂₎₍₃₎	Kt ₍₂₎₍₃₎	R _{ph-ph} ₍₂₎₍₃₎	L _{ph-ph} ₍₃₎
			Torque ₍₁₎	Current	Torque ₍₁₎	Speed	Current						
			T ₀₆₅ (T ₁₀₅) [Nm]	I ₀₆₅ [A]	T _{n065} [Nm]	n [min ⁻¹]	I _{n065} [A]	T _{max} [Nm]	J [kgmm ²]	Ke [Vs]	Kt [Nm/A _{rms}]	R [Ω]	L [mH]
MH 205 20 15	003	205	15 (22)	6.3	14.1	2000	5.9	69	3500	1.4	2.38	3.11	18.6
MH 205 20 28	5P7		28 (39)	13.0	27.3	2000	12.3	123	5000	1.3	2.31	0.93	8.9
MH 205 20 50	9P8		50 (70)	22.1	47.0	2000	20.1	222	8000	1.4	2.45	0.37	5.0
MH 205 20 70	013		70 (98)	30.7	62.9	2000	26.9	310	11 000	1.4	2.45	0.22	3.3
MH 205 20 90	016		90 (126)	44.3	78.3	2000	37.7	398	14 000	1.3	2.18	0.12	2.3

Natural Air Cooling												3000 rpm	
Model	DCP code S	Size	Stall		Nominal			Peak Torque ⁽¹⁾	Inertia	Ke ₍₂₎₍₃₎	Kt ₍₂₎₍₃₎	R _{ph-ph} ₍₂₎₍₃₎	L _{ph-ph} ₍₃₎
			Torque ₍₁₎	Current	Torque ₍₁₎	Speed	Current						
			T ₀₆₅ (T ₁₀₅) [Nm]	I ₀₆₅ [A]	T _{n065} [Nm]	n [min ⁻¹]	I _{n065} [A]	T _{max} [Nm]	J [kgmm ²]	Ke [Vs]	Kt [Nm/A _{rms}]	R [Ω]	L [mH]
MH 205 30 15	4P2	205	15 (22)	8.6	13.4	3000	7.7	69	3500	1	1.74	1.65	8.8
MH 205 30 28	008		28 (39)	20.1	25.7	3000	18.0	123	5000	0.9	1.50	0.39	3.5
MH 205 30 50	013		50 (70)	33.1	41.7	3000	26.8	222	8000	0.9	1.63	0.17	1.9
MH 205 30 70	016		70 (98)	46.1	52.3	3000	33.7	310	11 000	0.9	1.63	0.10	1.6
MH 205 30 90	019		90 (126)	59.0	61.6	3000	39.7	398	14 000	0.9	1.63	0.07	1.3

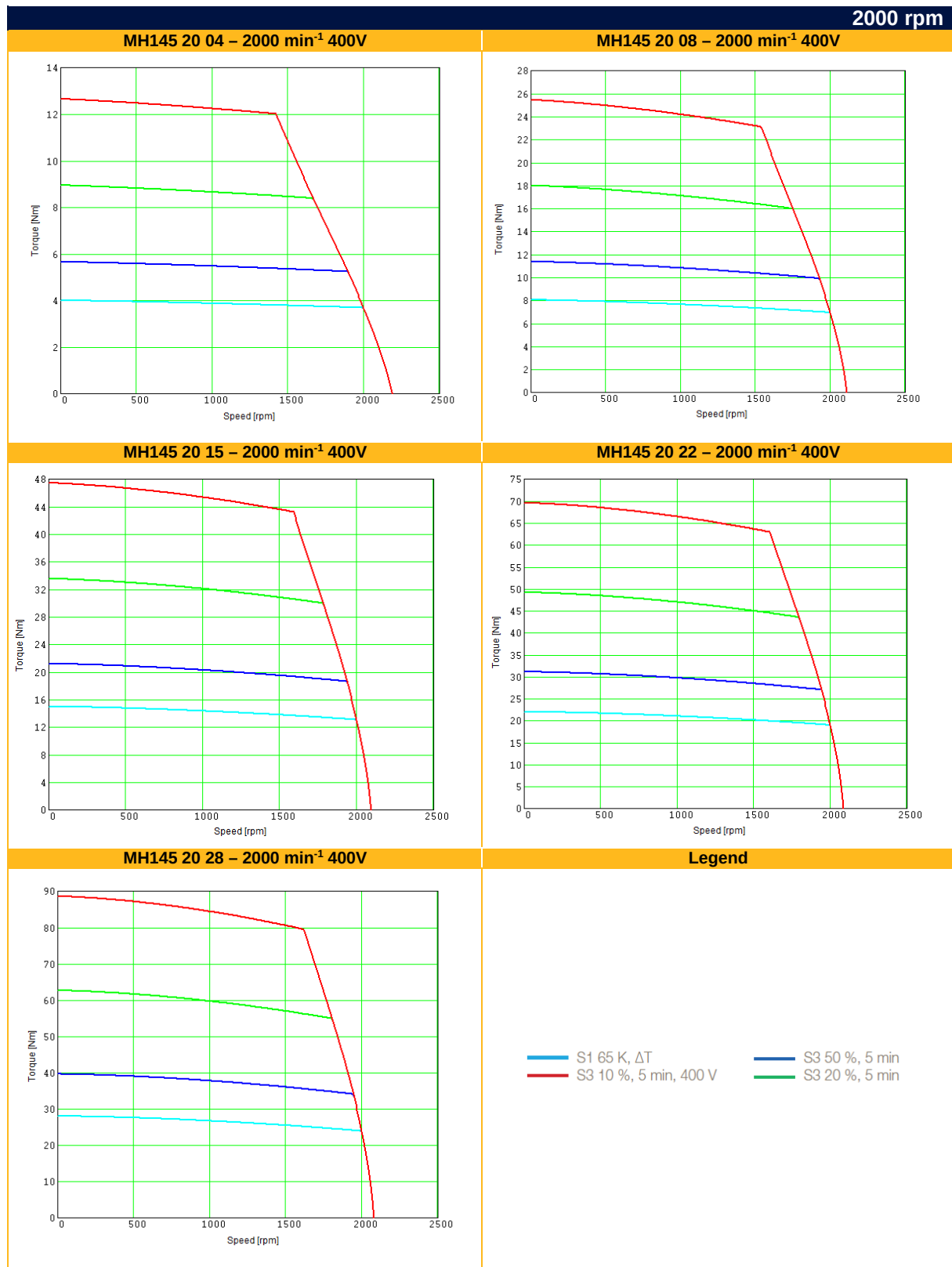


3.2.3. MH265 – 75...270 Nm – Mains voltage 400V

Natural Air Cooling											2000 rpm		
Model	DCP code S (XG)	Size	Stall		Nominal			Peak Torque ⁽¹⁾	Inertia	Ke ₍₂₎₍₃₎	Kt ₍₂₎₍₃₎	R _{ph-ph} ₍₂₎₍₃₎	L _{ph-ph} ₍₃₎
			Torque ₍₁₎	Current	Torque ₍₁₎	Speed	Current						
			T ₀₆₅ (T ₁₀₅) [Nm]	I ₀₆₅ [A]	T _{n065} [Nm]	n [min ⁻¹]	I _{n065} [A]	T _{max} [Nm]	J [kgmm ²]	Ke [Vs]	Kt [Nm/A _{rms}]	R [Ω]	L [mH]
MH 265 20 75	019	265	75 (95)	35.6	92	2000	34.5	240	22 000	1.54	2.67	0.29	5.4
MH 265 20 150	035		145 (175)	73.7	170	2000	71.6	480	36 000	1.37	2.37	0.07	2.1
MH 265 20 220	048		205 (255)	95.6	231	2000	86.6	695	49 000	1.54	2.67	0.05	1.8
MH 265 20 285	060		270 (330)	139	288	2000	121.4	900	63 000	1.37	2.37	0.02	1.1

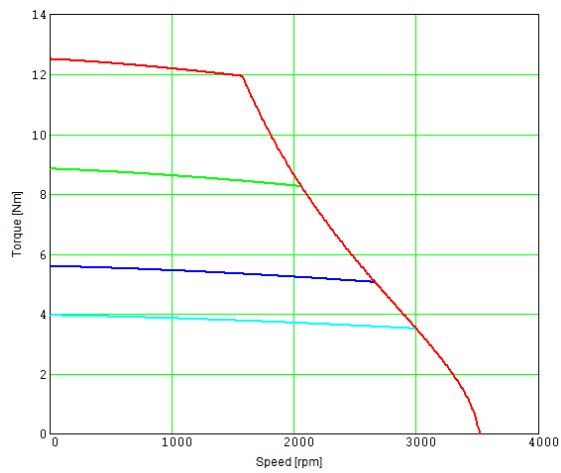
Natural Air Cooling											3000 rpm		
Model	DCP code S	Size	Stall		Nominal			Peak Torque ⁽¹⁾	Inertia	Ke ₍₂₎₍₃₎	Kt ₍₂₎₍₃₎	R _{ph-ph} ₍₂₎₍₃₎	L _{ph-ph} ₍₃₎
			Torque ₍₁₎	Current	Torque ₍₁₎	Speed	Current						
			T ₀₆₅ (T ₁₀₅) [Nm]	I ₀₆₅ [A]	T _{n065} [Nm]	n [min ⁻¹]	I _{n065} [A]	T _{max} [Nm]	J [kgmm ²]	Ke [Vs]	Kt [Nm/A _{rms}]	R [Ω]	L [mH]
MH 265 30 75	027	265	75 (95)	53.3	87	3000	48.8	240	22 000	1.03	1.78	0.12	2.4
MH 265 30 150	045		145 (175)	98.1	144	3000	80.7	480	36 000	1.03	1.78	0.04	1.2
MH 265 30 220	058		205 (255)	143	185	3000	103.7	695	49 000	1.03	1.78	0.02	0.8
MH 265 30 285	068		270 (330)	185	215	3000	120.5	900	63 000	1.03	1.78	0.01	0.6

3.2.4. MH145 Speed Torque Curves – Mains voltage 400V

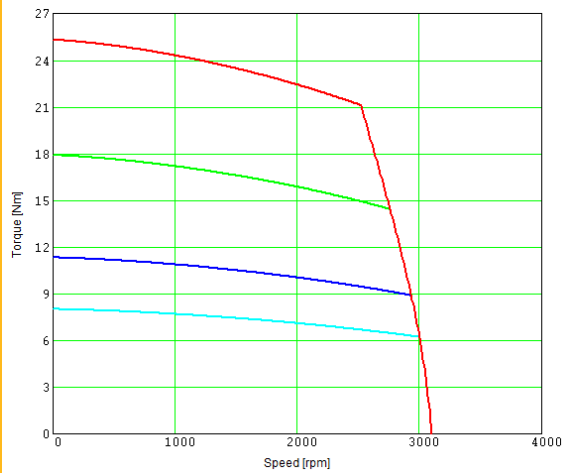


3000 rpm

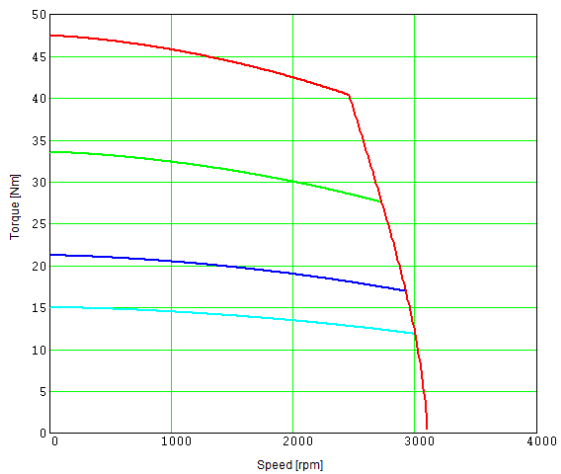
MH145 30 04 – 3000 min⁻¹ 400V



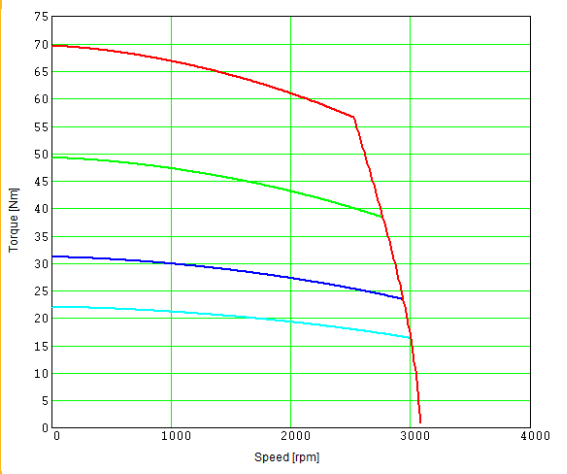
MH145 30 08 – 3000 min⁻¹ 400V



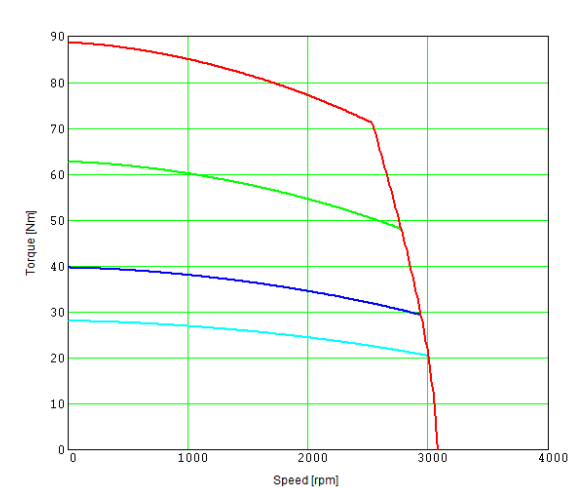
MH145 30 15 – 3000 min⁻¹ 400V



MH145 30 22 – 3000 min⁻¹ 400V



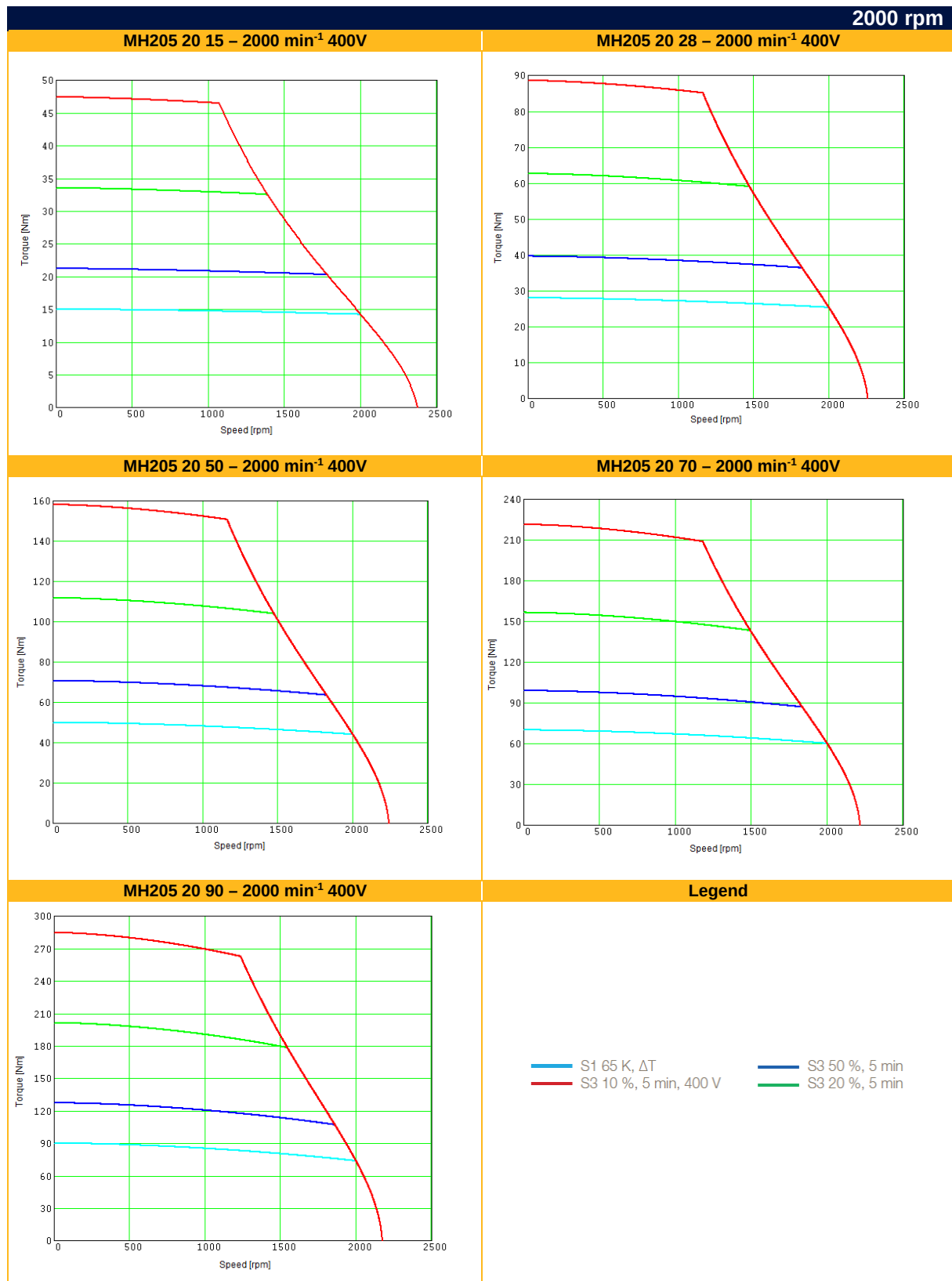
MH145 30 28 – 3000 min⁻¹ 400V



Legend

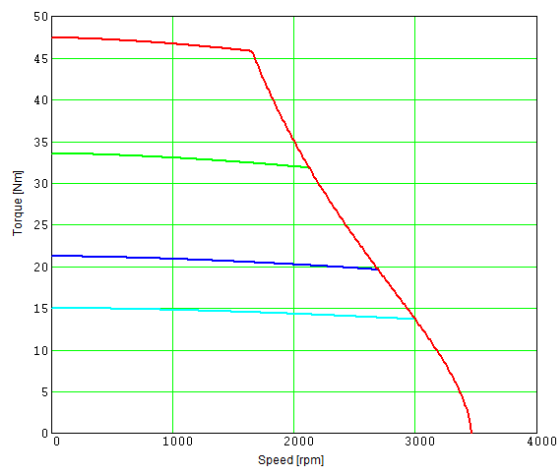
— S1 65 K, ΔT
— S3 10 %, 5 min, 400 V
— S3 50 %, 5 min
— S3 20 %, 5 min

3.2.5. MH205 Speed Torque Curves – Mains voltage 400V

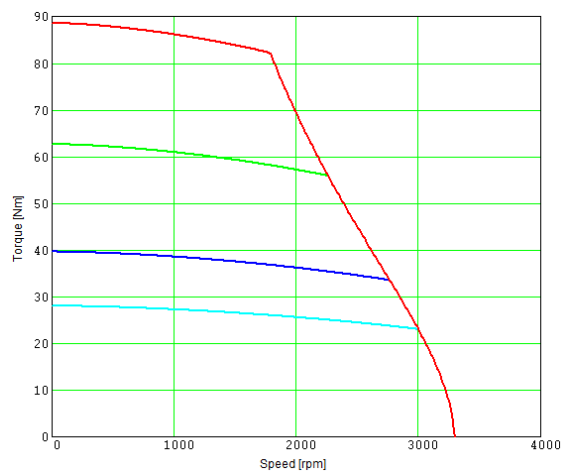


3000 rpm

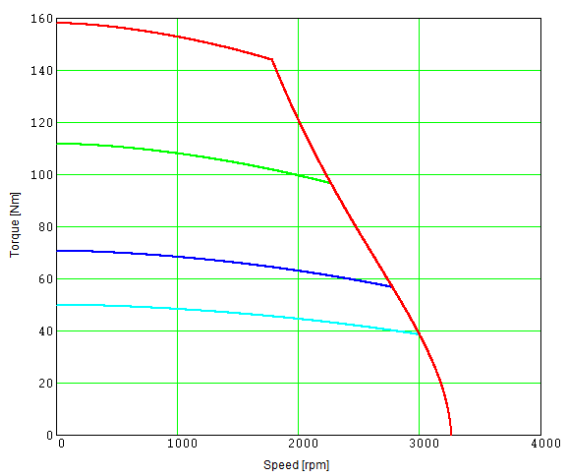
MH205 30 15 – 3000 min⁻¹ 400V



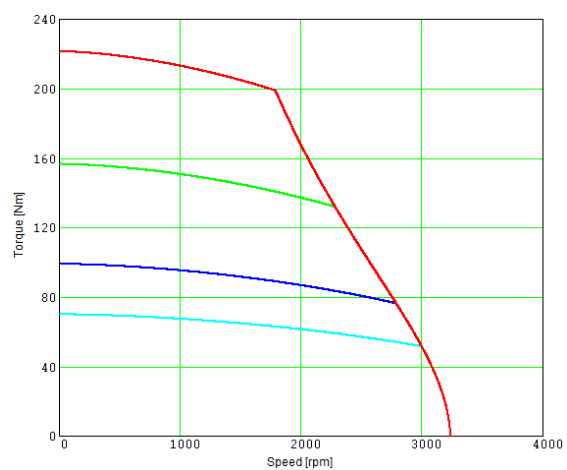
MH205 30 28 – 3000 min⁻¹ 400V



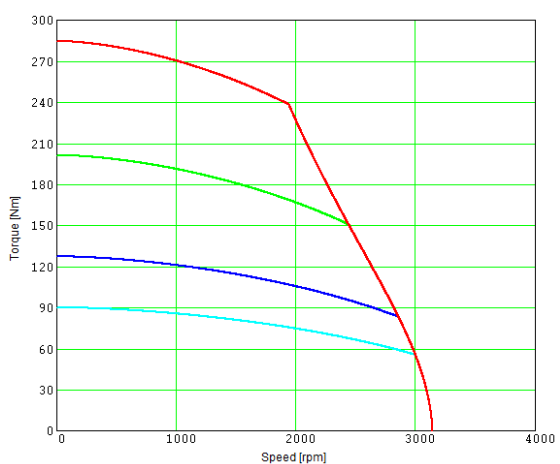
MH205 30 50 – 3000 min⁻¹ 400V



MH205 30 70 – 3000 min⁻¹ 400V



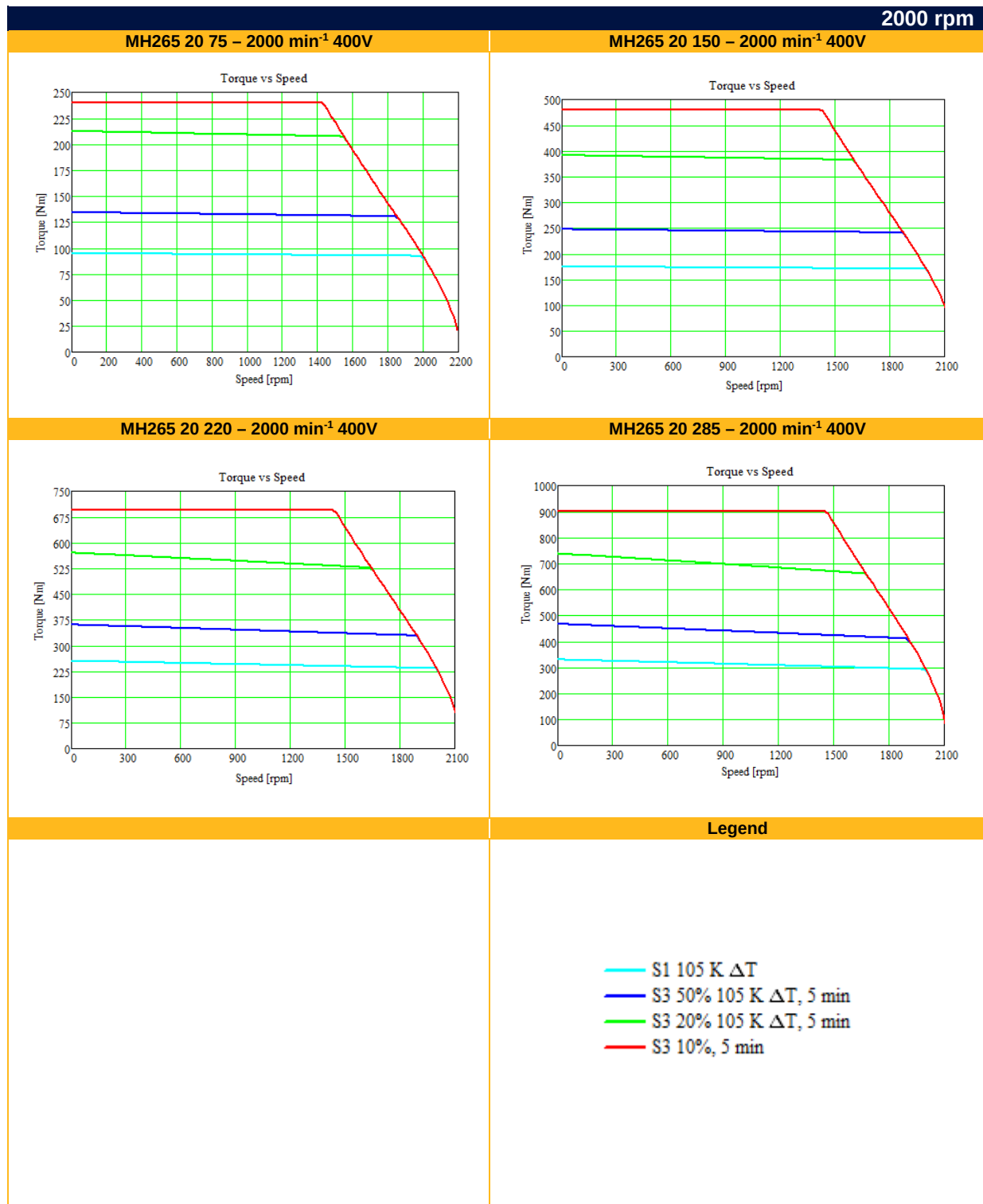
MH205 30 90 – 3000 min⁻¹ 400V



Legend

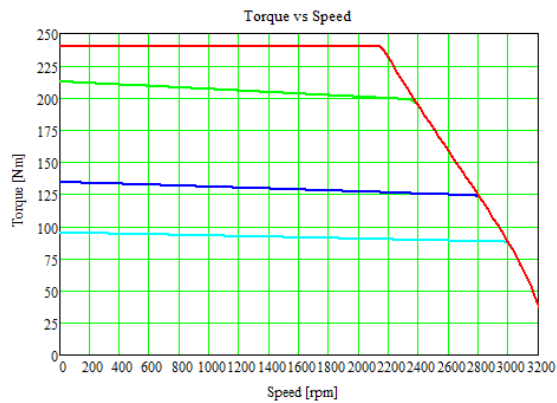
— S1 65 K, ΔT — S3 50 %, 5 min
— S3 10 %, 5 min, 400 V — S3 20 %, 5 min

3.2.6. MH265 Speed Torque Curves – Mains voltage 400V

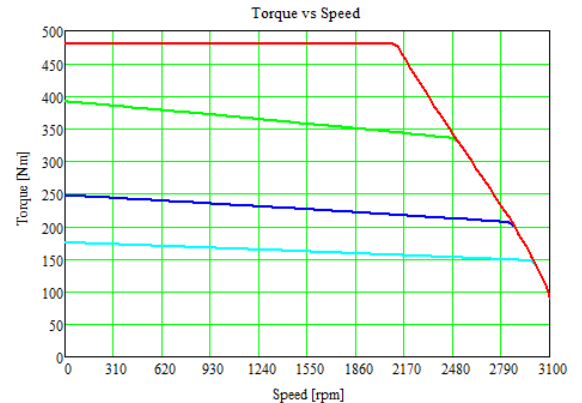


3000 rpm

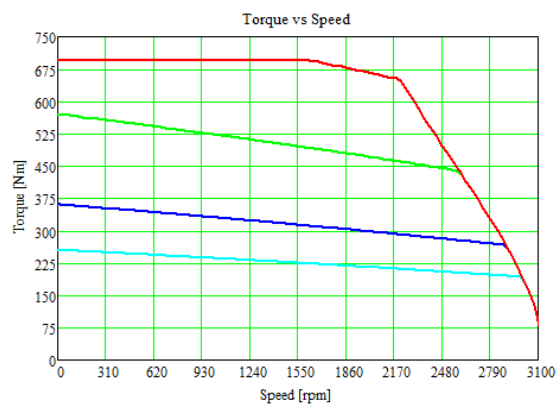
MH265 30 75 – 3000 min⁻¹ 400V



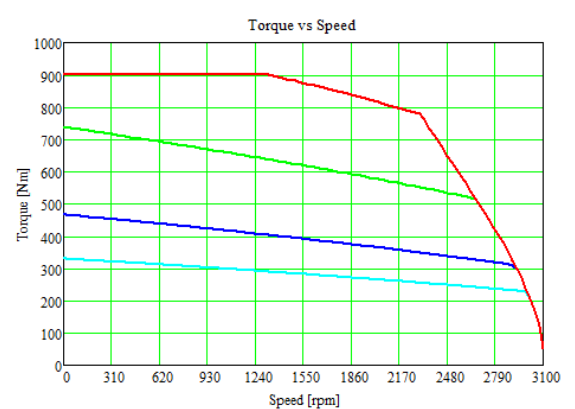
MH265 30 150 – 3000 min⁻¹ 400V



MH265 30 220 – 3000 min⁻¹ 400V



MH265 30 285 – 3000 min⁻¹ 400V



Legend

- S1 105 K ΔT
- S3 50% 105 K ΔT, 5 min
- S3 20% 105 K ΔT, 5 min
- S3 10%, 5 min

3.2.7. Rated data according to rated voltage variation

The nominal characteristics and especially the rated speed, maximal speed, rated power, rated torque, depend on the nominal voltage supplying the motor considered as the rated voltage. The rated data mentioned in the data sheet are given for each association of motor and drive. Therefore, if the supply voltage changes, the rated values will also change. As long as the variation of the rated voltage remains limited, for instance $\pm 10\%$ of the nominal value, it is possible to correctly evaluate the new rated values as illustrated below.

Example

Let suppose the rated voltage $U_n=400$ V_{rms} decreases of **10%**.
The new rated voltage becomes $U_{n2}=360$ V_{rms}.

Rated speed

Let suppose the rated speed $N_n=3000$ rpm is obtained with a rated voltage $U_n=400$ V_{rms} and an efficiency of $\eta=92\%$.
The new rated speed N_{n2} with $U_{n2}=360$ V_{rms} is given as follows:

$$N_{n2} = N_n * \frac{\frac{U_{n2}}{U_n} - 1 + \eta}{\eta}$$

$$N_{n2} = 3000 * \frac{\frac{360}{400} - 1 + 0.92}{0.92} = 2674 \text{ rpm}$$

Maximum speed

Let suppose the maximum speed $N_{\max}=3500$ rpm and $N_n = 3000$ rpm are obtained with $U_n=400$ V_{rms}.
The new maximum speed $N_{\max2}$ with $U_{n2}=360$ V_{rms} is given as follows:

$$N_{\max2} = N_{\max} * \frac{N_{n2}}{N_n}$$

$$N_{\max2} = 3500 * \frac{2674}{3000} = 3120 \text{ rpm}$$

N.B. If the rated voltage increases ($U_{n2} > U_n$), the new rated speed N_{n2} and the new maximum speed $N_{\max2}$ will be greater than the former ones N_n and $N_{\max}$. Moreover you will have to check that the drive still shows able to deal with the new maximum electric frequency.

Rated power

Let suppose the rated power $P_n=2520$ W is obtained with $U_n=400$ V_{rms}.
The new rated power P_{n2} with $U_{n2}=360$ V_{rms} is given as follows:

$$P_{n2} = P_n * \frac{U_{n2}}{U_n}$$

$$P_{n2} = 2520 * \frac{360}{400} = 2268 \text{ W}$$

Rated torque

Let suppose the rated torque $M_n=8.02$ Nm is obtained with $U_n=400$ V_{rms}.
The new rated torque M_{n2} with $U_{n2}=360$ V_{rms} is given as follows:

$$M_{n2} = \frac{P_{n2}}{\frac{2 * \pi * N_{n2}}{60}}$$

$$M_{n2} = \frac{2268}{\frac{2 * \pi * 2674}{60}} = 8.1 \text{ Nm}$$

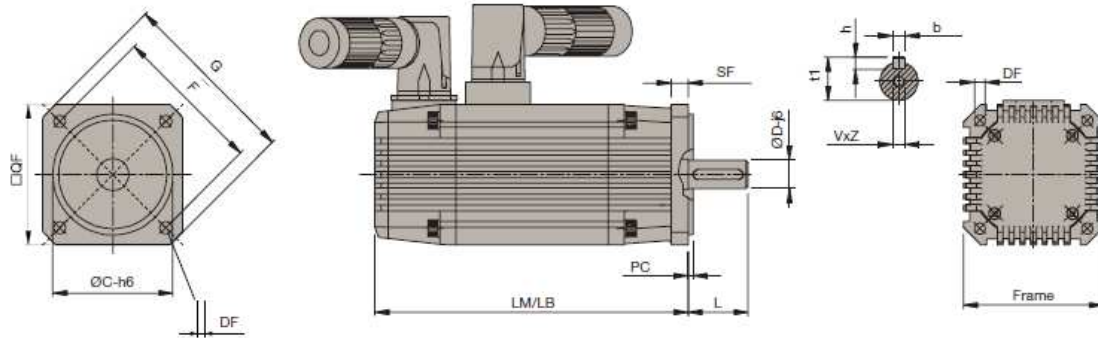


Warning: If the main supply decreases, you must reduce the maximum speed accordingly in order to avoid damage of the motor.
In case of doubt, consult Parker.

3.3. Dimension drawings

3.3.1. Dimensions

Dimensions



Dimensions														Order code QF
Motor Size	[Nm]	LM/LB	Weight	B x h	t1	V x Z	C	F	DF	G	SF	PC	QF	
145	04	200/274	8	6x6 8x7	21.5 27 31	M6x16 M8x19 M10x22	130	165	11.5	200	12	3.5	145	5
	08	231/305	12											
	15	292/366	18											
	22	354/428	23											
	28	416/490	28											
205	15	239/338	20	10x8 12x8	41 45	M12x32 M16x40	180	215	14	250	18	4	205	5
	28	273/372	29											
	50	342/441	44											
	70	411/510	59											
	90	480/579	74											
265	75	340/475	89	14x9	51.5	M16x40	250	300	19	342	35	4	264	5
	150	447/582	126											
	220	554/689	164											
	285	661/796	203											

LM: Motor length without brake with resolver
LB: Motor length with brake with resolver
bxh: Key
t1: Overall shaft height
VxZ: Shaft hole depth
C: Center

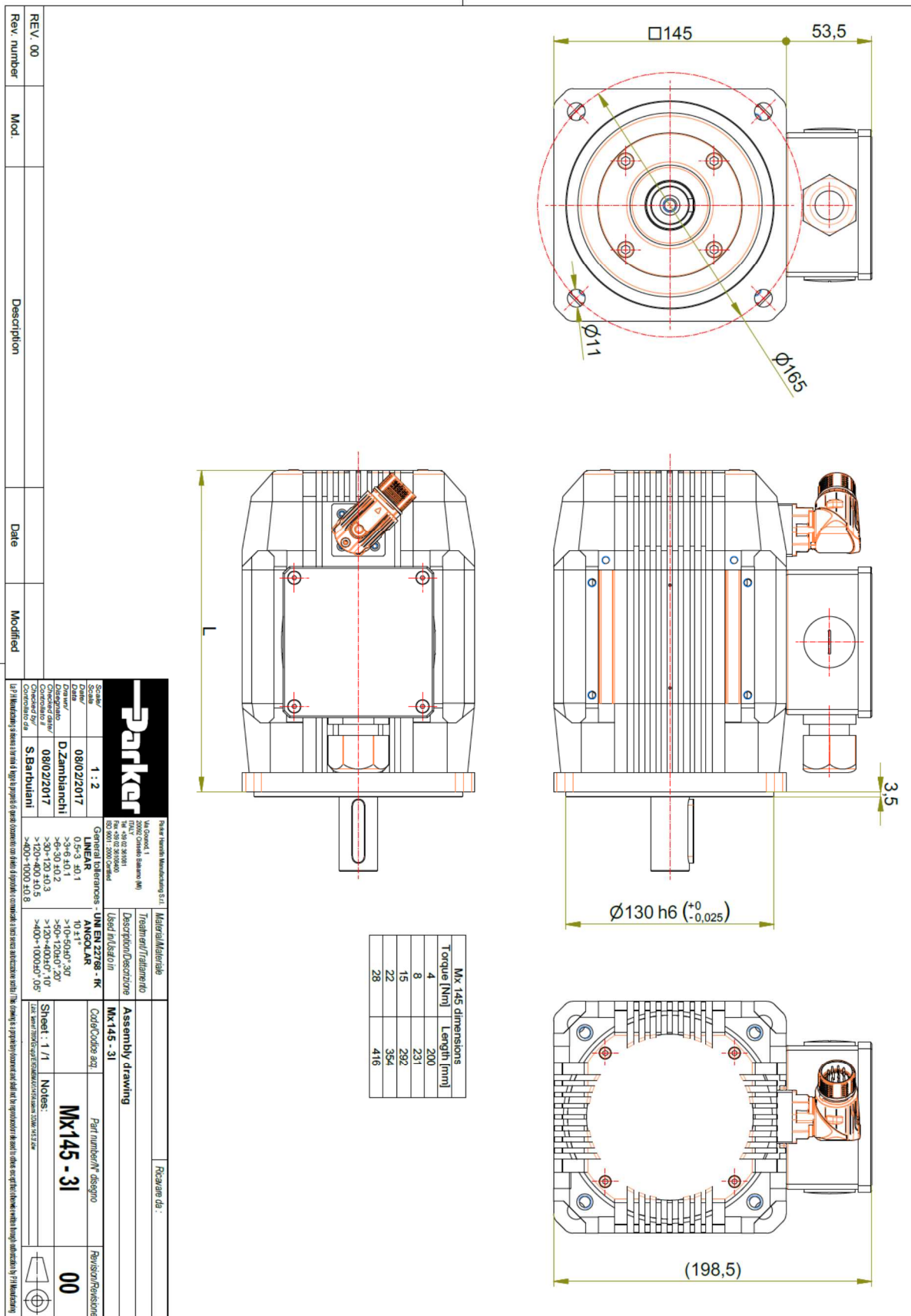
F: Distance between center of holes clamp
DF: Fixing holes
G: Dimension in diagonal
SF: Flange thickness
PC: Centering depth
QF: Flange square

Dimensions are given in [mm] and weights in [kg].

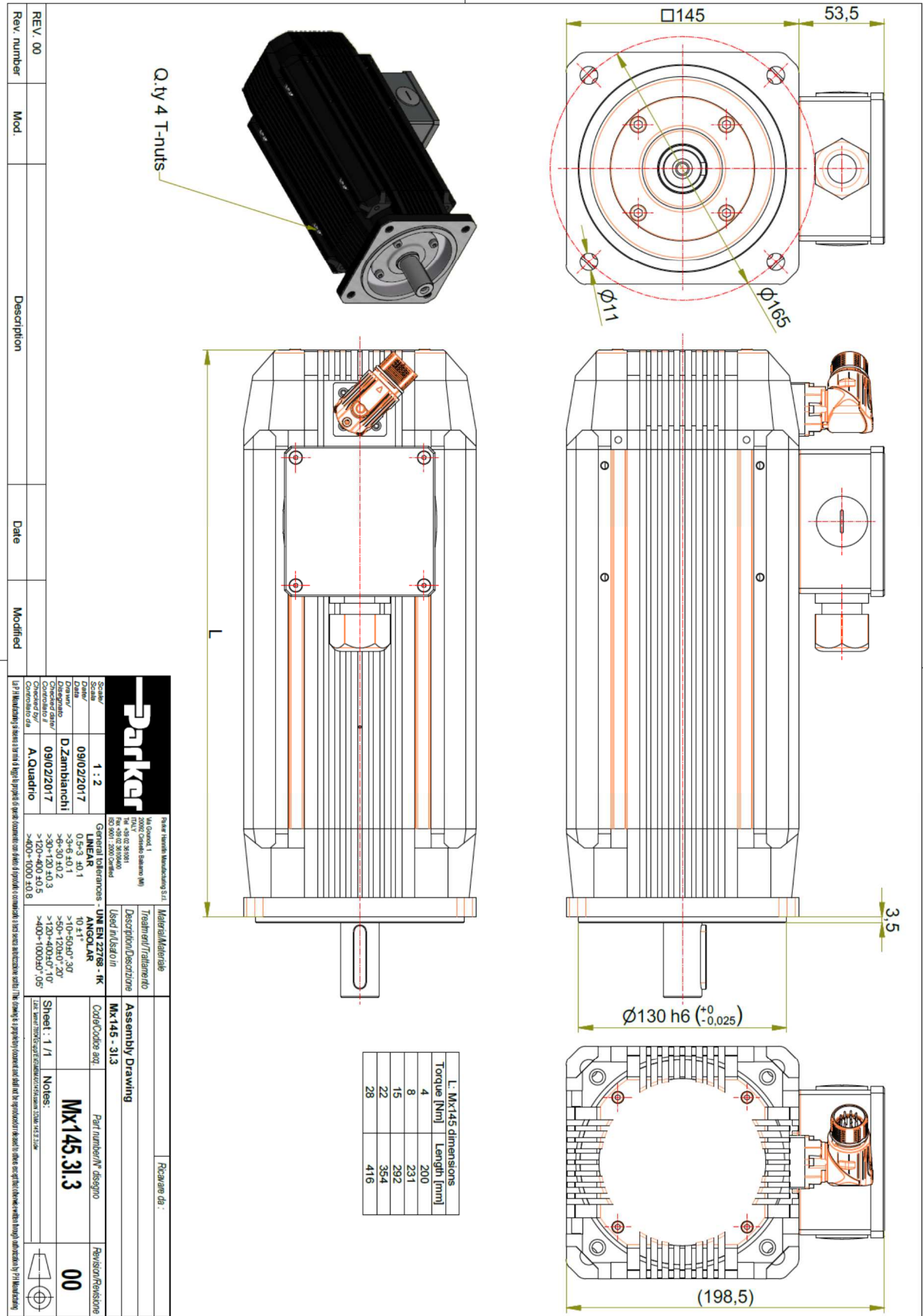
3.3.2. Outline drawings - Note

Hereunder are given some outline drawings of various motor sizes. Those allow to show global dimensions with a standard not quoted key shaft. Be free to contact your local Parker representative to get all needed information required to integrate the set motor-pump within your design, especially using a splined shaft.

3.3.3. Outline drawing Mx145.3I

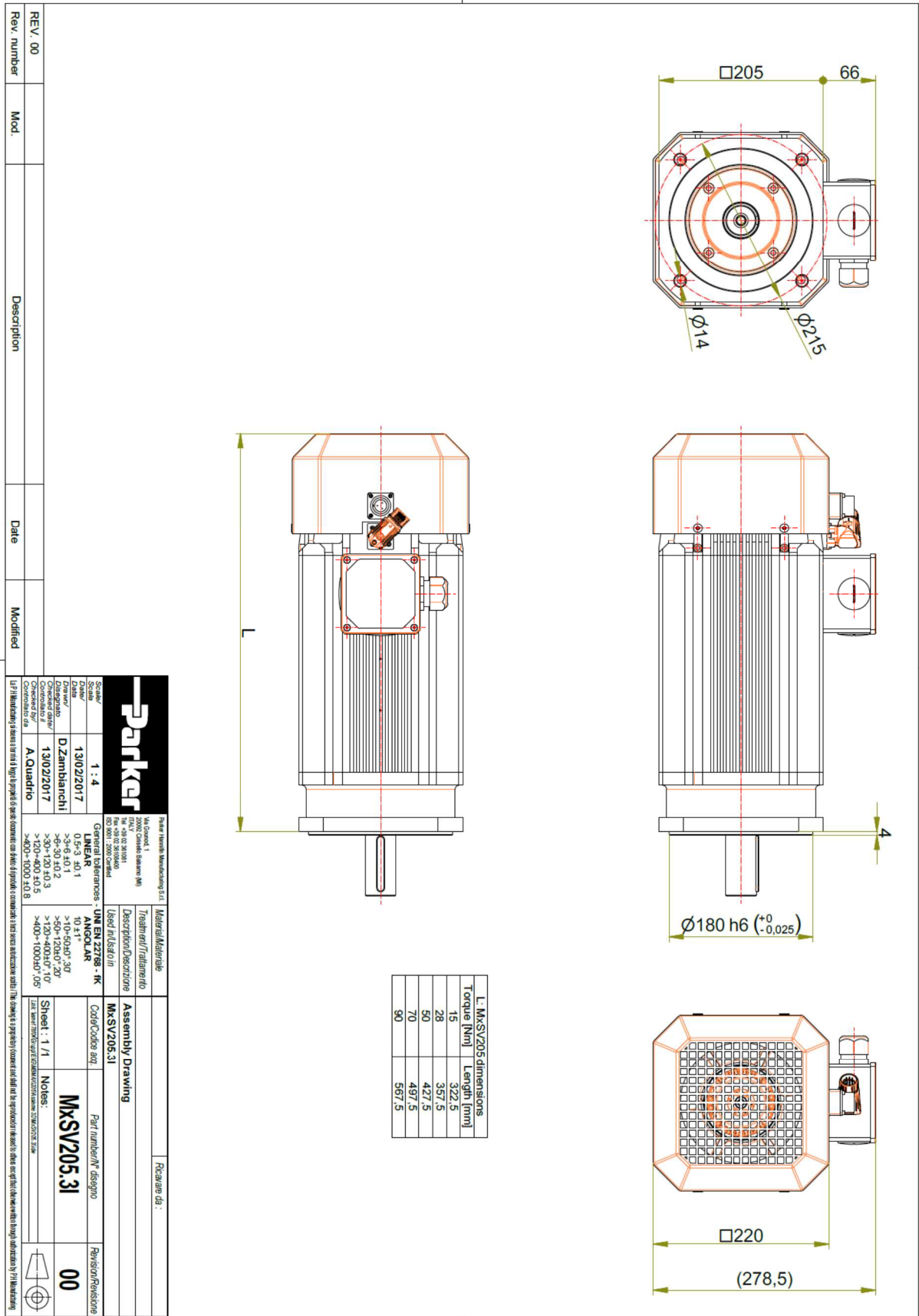


3.3.4. Outline drawing Mx145.3I.3





3.3.7. Outline drawing MxSV205.3I



3.4. Options

3.4.1. Fan cooling

For high duty cycle applications with servo-pumps, Parker offers two various types of cooling option: servo-ventilated and self-ventilated.

- With the servo-ventilated option (Order code **SV**),
 - an increase of **25 %** torque and current, based on nominal values (except for the maximum torque and current data), is provided.
 - an increase of **30 %** torque and current, based on nominal values (except for the maximum torque and current data), is provided for the size **MH265SV**.
 - the servo-ventilated MH205 motor is equipped with an external condenser for starting the fan.
- With the self-ventilated option (Order code **V**), the torque is increased dependent on the nominal speed.

3.4.2. Data with option SV or V

MH Motor Size	Option (1)	Option SV & V						
		Voltage [V]	Current [A]	Frequency [Hz]	Speed [min ⁻¹]	Added Length [mm]	Added Weight [kg]	Torque increasing of motor [%]
145	SV	230 VAC ±10 % Single Phase	0.35	50	3000	97	2	25 %
	V	n.a.	n.a.	n.a.	n.a.	44	0.55	Depending on speed
205	SV	230 VAC ±10 % Single Phase	0.22	50	3000	109	2.2	25 %
	V	n.a.	n.a.	n.a.	n.a.	54	1.1	Depending on speed
265	SV	230 VAC ±10 % Single Phase	0.66	50/60	3000	140	15	30 %

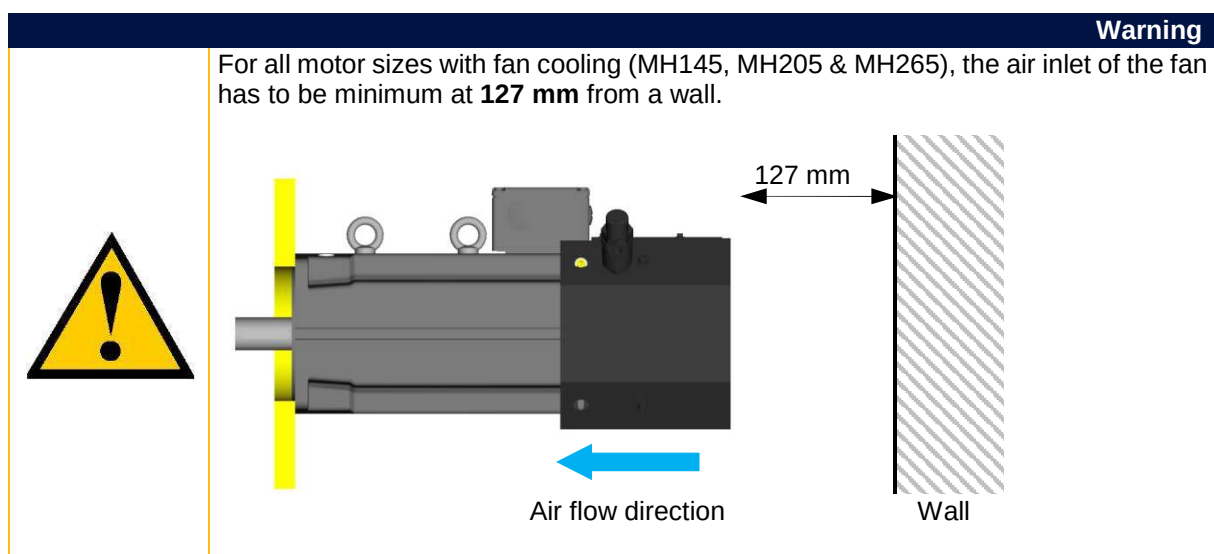
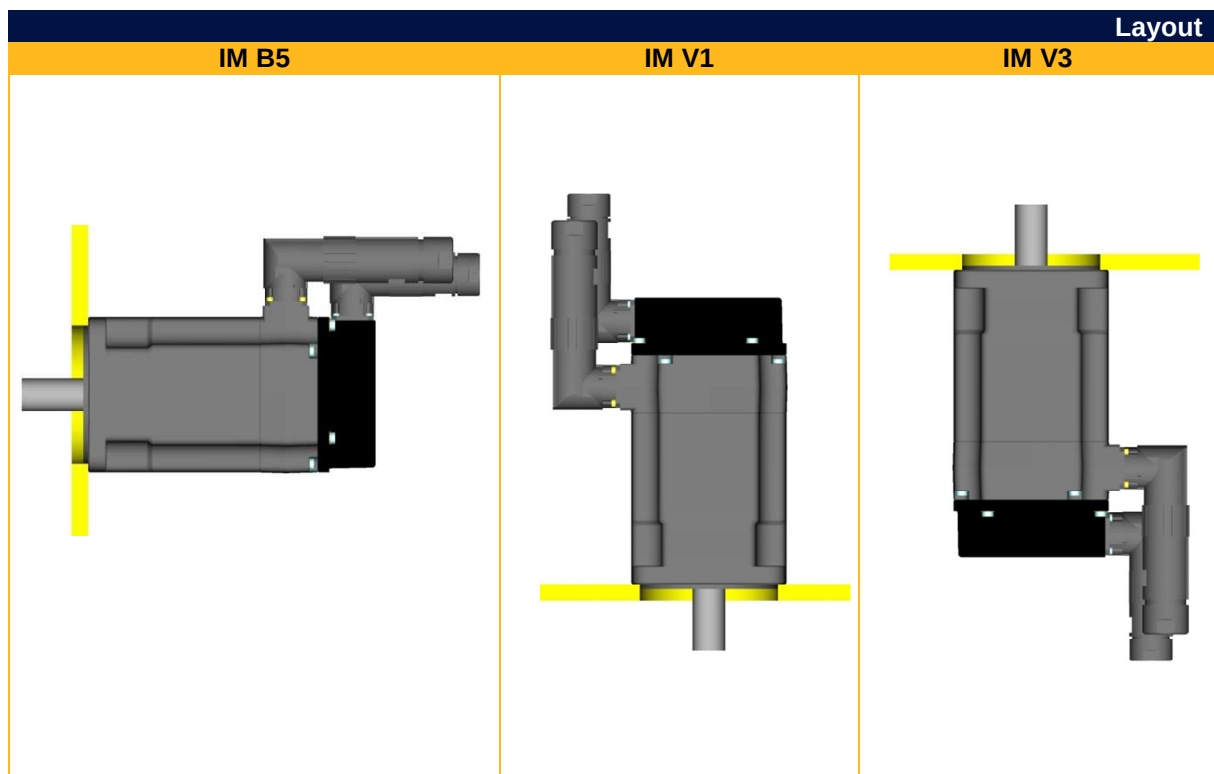
⁽¹⁾ If more than one option is required, please check the feasibility with our technical department.
n.a: not applicable

3.5. Motor Mounting

3.5.1. Motor mounting

By flange in any direction.

Code letters IM - International mounting - (EN60034-7) :



3.5.2. Frame recommendation

	<u>Warning</u> : The user bears the entire responsibility to design and to prepare the support, coupling device, shaft line alignment and shaft line balancing.
---	--

Foundation must be even, sufficiently rigid and shall be dimensioned in order to avoid vibrations due to resonances.

The servomotors need a rigid support, machined and of good quality.

The maximum flatness of the support has to be lower than 0.05 mm.

The motor vibration magnitudes in rms value are in accordance with IEC 60034-14 – grade A:

- Maximum rms vibration velocity of MH Series is 1.3 mm/s with a rigid mounting.

	<u>Warning</u>: A grade A motor (according to IEC 60034-14) well-balanced, may exhibit large vibrations when installed in-situ arising from various causes, such as unsuitable foundations, reaction of the driven motor, current ripple from the power supply, etc. Vibration may also be caused by driving elements with a natural oscillation frequency very close to the excitation due to the small residual unbalance of the rotating masses of the motor. In such cases, checks should be carried out not only on the machine, but also on each element of the installation. (See ISO 10816-3).
---	--

	<u>Warning</u>: Maladjustments of electronic controls (gain in close loop too high, incorrect filtering,...) can result in instability of the shaft line, vibration or/and breakdown. Please consult Parker in such cases.
---	---

3.6. Shaft Loads

3.6.1. Vibration resistance to shaft end

Frequency domain :10 to 55 Hz according to EN 60068 -2-6

Vibration resistance to the shaft end :

- radial 3 g
- axial 1 g

3.6.2. Motor life time with horizontal mounting

	The bearing arrangement is made with 2 ball bearings (one on the shaft end + another on the rear). The rear bearing is blocked in axial translation and the front one is free in translation to avoid any stress from the shaft thermal expansion during the running. So the shaft expansion must never be blocked in translation by any extra bearing or similar device.
---	--

	<u>Notice:</u> Values given in table below are valid only for horizontal mounting and for a life time L10 of 20 000h at constant speed in accordance with ISO281. <u>Notice:</u> Radial and Axial Loads are not additive.
--	---

3.6.3. Permissible radial load on motor shaft

Maximum radial load														
MH Motor Size	F _{max} : Maximum radial load on motor shaft [N]													SHAFT
	[rpm]	250	500	750	1000	1500	2000	2500	3000	4500	6000	7500	10000	DxL
	[Nm]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[mm]
MH 145	04	1962	1557	1360	1236	1080	981	911	857	749	-	-	-	28x60
	08	2107	1673	1461	1328	1160	1054	978	920	804	-	-	-	
	15	2294	1821	1590	1445	1262	1147	1065	1002	875	-	-	-	
	22	2412	1914	1672	1519	1327	1206	1119	1053	920	-	-	-	
	28	2492	1978	1728	1570	1371	1246	1157	1088	951	-	-	-	
MH 205	15	4816	3822	3339	3034	2650	2408	2235	2103	-	-	-	-	42x110
	28	5219	4142	3618	3287	2872	2609	2422	2279	-	-	-	-	
	50	5772	4581	4002	3636	3177	2886	2679	2521	-	-	-	-	
	70	6135	4869	4254	3865	3376	3067	2848	2680	-	-	-	-	
	90	6391	5072	4431	4026	3517	3195	2966	2791	-	-	-	-	
MH 265	All	6646	5485	4817	4376	3695	3290	3098	2839	-	-	-	-	48x114

F_{max} = maximum permissible radial load [N], D = shaft diameter [mm], L = standard shaft length [mm]



The data relate to the permissible radial load, considering a bearing life of 20.000 hours and load capacity applied to the center of shaft end. The maximum permissible radial load will determine the service life. The maximum axial load cannot exceed 10% of the maximum permissible radial load. IMPORTANT: Avoid axial impacts to the shaft during motor installation and use.

The radial load applied to the motor shaft F_A shall satisfy the inequality shown below.

$$F_A \leq F_{max} * \frac{(BB + \frac{L}{2})}{(BB + X)}$$

Where:

F_{max} = maximum radial load (see table) [N]

F_A = application load [N]

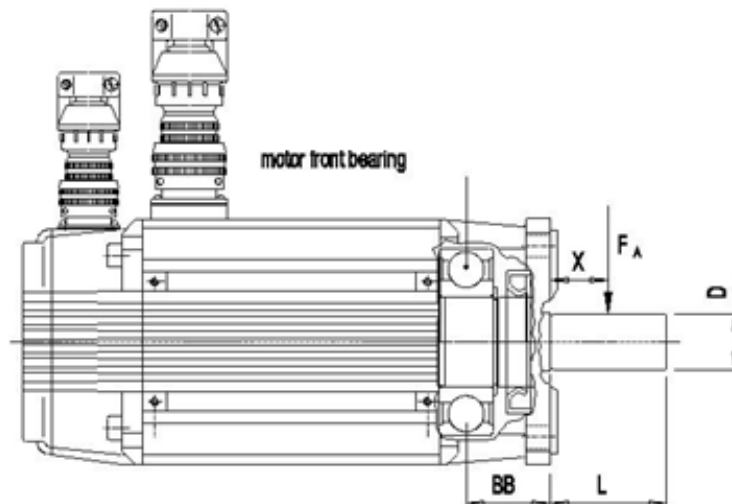
X = distance of F_A load application point from flange surface [mm]

L = standard shaft length (see table) [mm]

D = shaft diameter [mm]

BB = distance from the front bearing center line to the flange surface [mm]

BB = 26 mm (MH145), BB = 34,5 mm (MH205), BB = 31.5 mm (MH265)



3.7. Cooling

In compliance with the IEC 60034-1 standards, MH Series Motors can be proposed with Natural ventilation, Self-ventilation or Forced ventilation.

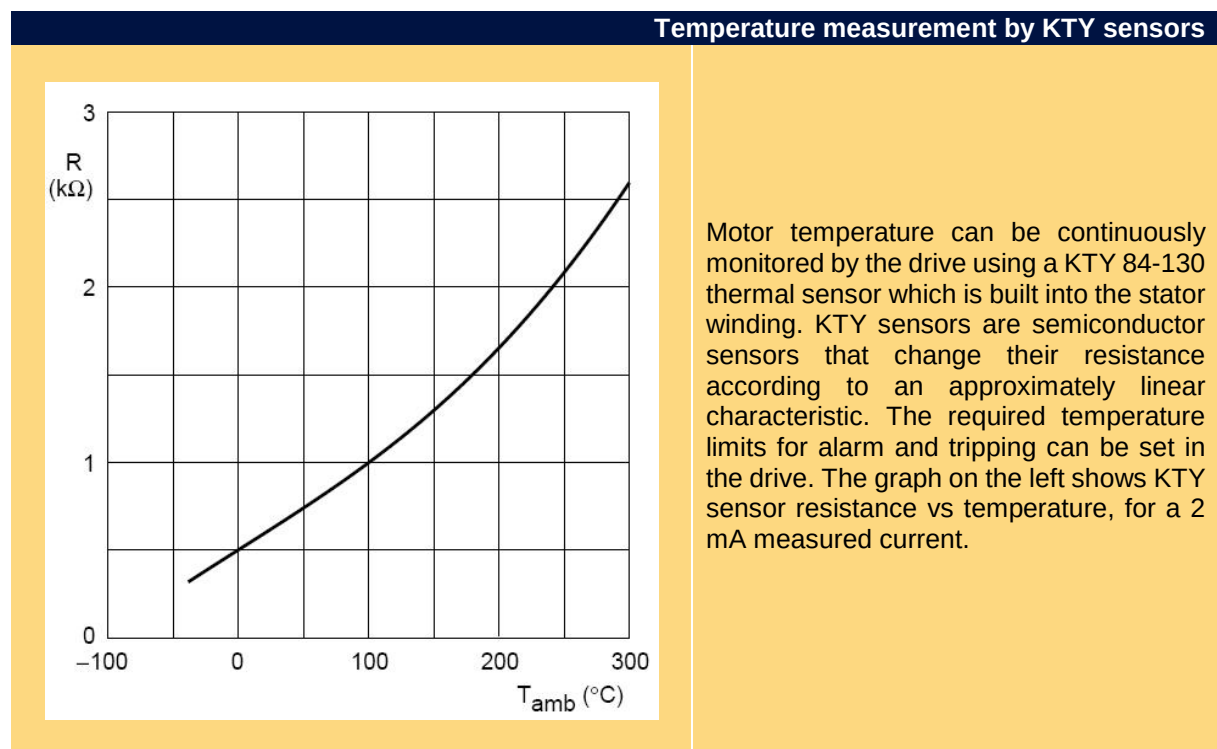
Ambient air temperature shall not be less than -10°C and not more than 40°C.

	<u>Warning:</u> It is possible to use the motors at a higher ambient temperature but with an associated derating of motor performances.
	<u>Warning:</u> To reach calculated motor performances, the motor must be thermally well connected to an aluminum flange with dimensions of 400 mm x 400 mm x 12 mm of thickness and without external heat source.
	<u>Caution:</u> Ambient air temperature shall not exceed 40°C in the vicinity of the motor flange.
	<u>Warning:</u> A significant part of the heat produced by the motor is evacuated through the flange. The motor has to be used at a torque less than the rated torque if: • the air is not able to circulate freely around the motor, • the motor is mounted on a surface which insufficiently dissipates the heating (surface with little dimensions for instance), • the motor is thermally isolated, • the motor is mounted on a warm surface (mounted on a gearbox for instance).

3.8. Thermal Protection

Protection against thermal overloading of MH motors is proposed by KTY temperature sensor built into the stator winding. Please note that thermal sensors, due to their thermal inertia, are unable to follow very fast winding temperature variations. They reach their thermal steady state after a few minutes.

	Warning: To protect the motor properly against very fast overload, please refer to 3.1.6. Peak current limitations.
---	---



	Warning: KTY sensor is sensitive to electrostatic discharge. So, always wear an antistatic wrist strap during KTY handling.
	Warning: KTY sensor is polarized. Do not invert the wires.
	Warning: KTY sensor is sensitive. Do not check it with an Ohmmeter or any measuring or testing device.

3.9. Power Electrical Connections

3.9.1. Wires sizes

	You must comply in any country, with all local electrical installation regulations and standards. Not limiting example: NFC 15-100 in France or IEC 60364 in Europe.
	Cable selection depends on the cable construction, so refer to the cable technical documentation to choose adequate wire sizes.
	Some drives show cable limitations or recommendations; please refer to the drive technical documentation for any further information.

Cable selection	
	At standstill, the current must be limited to 80% of the low speed current I_0. As the cable has to support peak current for a long period, the current considered to size the wire when the motor works at standstill will be: $\sqrt{2} \times 0.8 I_0 \approx 1,13 \times I_0$.

Sizes for H07 RN-F cable	
For a 3 cores in a cable tray at 30°C max	

Section	Max Current I_{max}
[mm ²]	[A _{rms}]
1.5	17
2.5	23
4	31
6	42
10	55
16	74
25	97
35	120
50	146
70	185
95	224
120	260
150	299
185	341
240	401
300	461

Example of sizes for H07 RN-F cable

Conditions of use:

Case of 3 conductors type H07 RN-F:

Maximum temperature:	60°C maximum
Ambient temperature:	30°C
Type of cable laying:	Cable runs on dedicated cables ways
Current limitation:	Current limited to 80% of I_0 at low speed or at motor stall

Example:

Permanent low speed current:	$I_0=100$ Arms
Permanent current at standstill:	$80\%*100 = 80$ Arms
Max permanent current in the cable:	$80*\sqrt{2} = 113$ Arms
Cable section selection →	$= 35 \text{ mm}^2$ for a 3 cores in a cable tray at 30°C max

You also have to respect the Drive commissioning manual, the cables current densities and voltage specifications.

3.9.2. Conversion Awg / kcmil / mm²:

Awg	kcmil	mm ²
	500	253
	400	203
	350	177
	300	152
	250	127
0000 (4/0)	212	107
000 (3/0)	168	85
00 (2/0)	133	67.4
0 (1/0)	106	53.5
1	83.7	42.4
2	66.4	33.6
3	52.6	26.7
4	41.7	21.2
5	33.1	16.8
6	26.3	13.3
7	20.8	10.5
8	16.5	8.37
9	13.1	6.63
10	10.4	5.26
11	8.23	4.17
12	6.53	3.31
14	4.10	2.08
16	2.58	1.31
18	1.62	0.82
20	1.03	0.52
22	0.63	0.32
24	0.39	0.20
26	0.26	0.13

3.9.3. Motor cable length

For motors windings which present low inductance values or low resistance values, the own cable inductance, respectively own resistance, in case of large cable length can greatly reduce the maximum speed of motor. Please contact PARKER for further information.

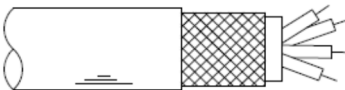
	<u>Caution:</u> It might be necessary to fit a filter at the servo-drive output if the length of cable exceeds 25 m. Consult Parker where applicable.
---	--

3.9.4. Order code of complete cables

In order to connect **MH** Series motors in connector version to PARKER drives, you can use complete cables. Be free to contact your local Parker representative to get the order codes for cables associated with your drive. Parker is able to provide cables both in regard to power and resolver.

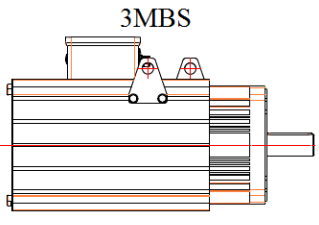
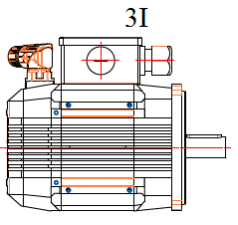
3.9.5. Color of conductors (cable inside terminal boxes)

Information regarding color conductors are given hereunder to help customer during the installation of motor and pump even if a dedicated label already surrounds each cable.

Color of conductors				
	POWER			GND 
	U	V	W	Yellow/Green
	White	Green	Blue	
	White	Red	Black	
	White	Red	Green	
	White	Red	Blue	
	White	White/Rosso	White/Black	

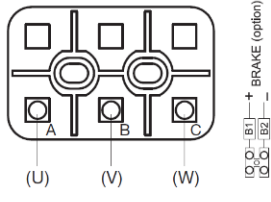
3.9.6. Layout and connectors

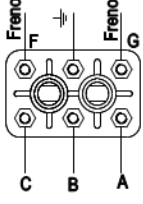
MH Series motors are available with various combinations of connectors and layout, depending on the size of the motor and the application.

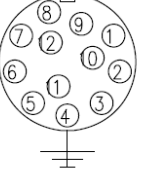
Layout		
Overview		
	Terminal box – forward facing	Terminal box – forward facing
	3MBS	3I
	N	Y
	N	Y
	Y	N

Y: Possible without motor length increment

N: Layout not possible

Order code: 3MBS	POWER Terminal Box connections	
	Terminal Box Code 3MBS for MH size 265	
	A	U
	B	V
	C	W
	B1	BRAKE +
	B2	BRAKE -

Order code: 3I	POWER Terminal Box connections	
	Terminal Box POWER Code 3I for MH size 145 & 205	
	A	U
	B	V
	C	W
	F	BRAKE 0Vdc
	G	BRAKE +24Vdc
	GND	

Code: 3I – 3MBS	FEEDBACK connections			
	Connector FEEDBACK Code 3I-3MBS for MH size 145-205-265			
	1	SIN -	7	EXCT -
	2	SIN +	8	KTY
	3	N.C.	9	KTY
	4	Shield	10	EXCT +
	5	N.C.	11	COS +
	6	N.C.	12	COS -

N.C.: Not Connected

3.10. Feedback system

3.10.1. Direction of shaft rotation regarding electrical connections

Let us suppose that all connections are achieved as explained in this documentation and with a positive speed setpoint coming to the drive, the motor shaft will turn clockwise (seen from the end of customer shaft).

3.10.2. Resolver (standard)

Resolver	
For Motor Size MH145, MH205, MH265	
Parker part number	RES10526
Product code (cf. page 11, line 15 "Feedback")	"Empty field"
Electrical specification	Values @ 8 kHz
Polarity	2 poles
Input voltage	11.3 Vrms
Input current	50 mA nominal
Resolver accuracy	$\pm 10'$ maxi
Ratio	$0,5 \pm 10 \%$
Output impedance (primary in short circuit whatever the position of the rotor)	Typical $135 + 265j \Omega$
Dielectric rigidity (50 – 60 Hz)	500 V – 1 min
Insulation resistance	$\geq 100M\Omega$ – DC 500 V
Weight	0.28 kg nominal
Operating temperature range	-50 to +150 °C

4. COMMISSIONING, USE AND MAINTENANCE

4.1. Instructions for commissioning, use and maintenance

4.1.1. Equipment delivery

All servomotors are strictly controlled during manufacturing, before shipping. When receiving it, it is absolutely necessary to check motor condition and to control it has not been damaged during transport. Remove it carefully from its packaging. Verify that the data written on the label are the same as the ones on the acknowledgement of order, and that all documents or needed accessories for user are present in the packaging.



Warning:

In case of damaged material during the transport, the recipient must **immediately** make reservations to the carrier through a registered mail within 24 h..

4.1.2. Handling

Servomotors are equipped with two lifting rings intended for handling.



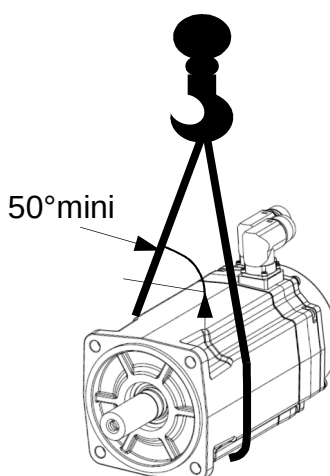
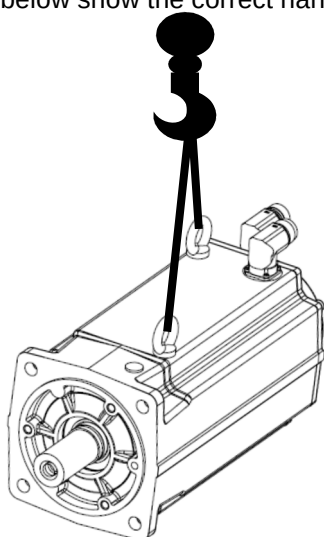
Caution: Use only servomotors lifting rings, if present, or slings to handle the motor. Do not handle the motor with the help of electrical cables, connectors and water inputs/outputs, or use any other inappropriate method.



WARNING

Handle the motor carefully.
Use proper gloves to protect your hands and avoid lifting heavy motors manually.
Use proper lifting mechanisms.
If the motor is not handled carefully, it can cause cuts and abrasions.

The drawings below show the correct handling procedure.



DANGER: Choose the correct slings for the motor weight. The two slings must have the same length and a minimum angle of 50° has to be respected between the motor axis and the slings.

4.1.3. Storage

Before being mounted, the motor has to be stored in a dry place, without rapid or important temperature variations in order to avoid condensation.

During storage, the ambient temperature must be kept between -20 and +60°C.

If the torque motor has to be stored for a long time, verify that the shaft end, feet and the flange are coated with corrosion proof product.

After a long storage duration (more than 3 month), run the motor at low speed in both directions, in order to blend the bearing grease spreading.

4.2. Installation

4.2.1. Mounting

Foundation must be even, sufficiently rigid and shall be dimensioned in order to avoid vibrations due to resonance. Before bolting the motor, the foundation surface must be cleaned and checked in order to detect any excessive height difference between the motor locations. The surface variation shall not exceed 0,1 mm.



Caution:

The user bears the entire responsibility for the preparation of the foundation.

The table below gives the average tightening torques required regarding the fixing screw diameter. These values are valid for both motor's feet and flange bolting.

Screw diameter	Tightening torque	Screw diameter	Tightening torque
M2 x 0.35	0.35 N.m	M9 x 1.25	31 N.m
M2.5 x 0.4	0.6 N.m	M10 x 1.5	40 N.m
M3 x 0.5	1.1 N.m	M11 x 1.5	56 N.m
M3.5 x 0.6	1.7 N.m	M12 x 1.75	70 N.m
M4 x 0.7	2.5 N.m	M14 x 2	111 N.m
M5 x 0.8	5 N.m	M16 x 2	167 N.m
M6 x1	8.5 N.m	M18 x 2.5	228 N.m
M7 x 1	14 N.m	M20 x 2.5	329 N.m
M8 x 1.25	20 N.m	M22 x 2.5	437 N.m
		M24 x 3	564 N.m



Warning:

After 15 days, check all tightening torques on all screws and nuts.

4.2.2. Preparation

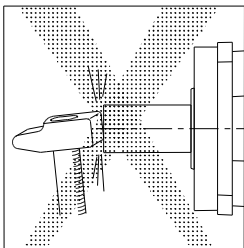
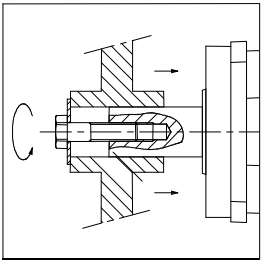
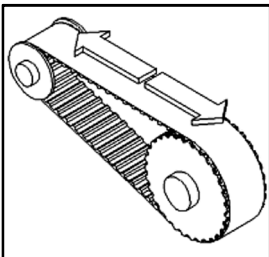
Once the motor is installed, it must be possible to access the wiring and to read the manufacturer's plate. Air must be able to circulate around the motor for cooling purposes.

Clean the shaft using a cloth soaked in white spirit or alcohol. Make sure that the cleaning solution does not get on to the bearings.

The motor must be in a horizontal position during cleaning or running.

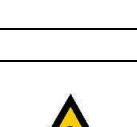
	<u>Caution:</u> Do not step on the motor, the connector or the terminal box
	<u>Caution:</u> Always bear in mind that some parts of the surface of the motor can reach temperatures exceeding 100°C

4.2.3. Mechanical installation

Recommendations	
Bearings life time of servomotor largely depends on care and attention given to the mechanical installation.	
	- When the servomotor shaft has a cotter pin, make sure that the coupling components have been properly balanced without the cotter pin, whereas the servomotor will have been balanced with its cotter pin. - Prohibit any impact on the shaft and avoid press fittings which could mark the bearing tracks. If press fitting cannot be avoided, it is advisable to immobilize the shaft in motion; this solution is nevertheless dangerous as it puts the resolver at risk
	- Use the thread at the end of the shaft in accordance with the diagram for fitting pulleys or accessories. It is possible to put pressure on the shoulder of the shaft located in front of the bearing. - When the front bearing block is sealed by a lip seal which rubs on the rotating section (version IP65), we do recommend you to lubricate the seal with grease to lengthen its operational life.
	- When the drive system uses pulleys and belt, the drive pulley must be fixed as close as possible to the flange. The pulley diameter has to be selected so that the radial load does not exceed the limits given in the catalog.

	<u>Warning</u> : A misalignment of the coupling device makes stress and load on the motor shaft depending the rigidity of the installation. The variations of the temperature makes stress and load due to the dilatation. These loads (axial and radial) do not exceed the maximum permissible value (§ 3.6.3).
	<u>Warning</u> : The misalignment of the coupling device provokes vibrations which can destruct the motor shaft.
	We cannot be held responsible for the wear of drive shaft resulting from excessive strain.

4.3. Electrical connections

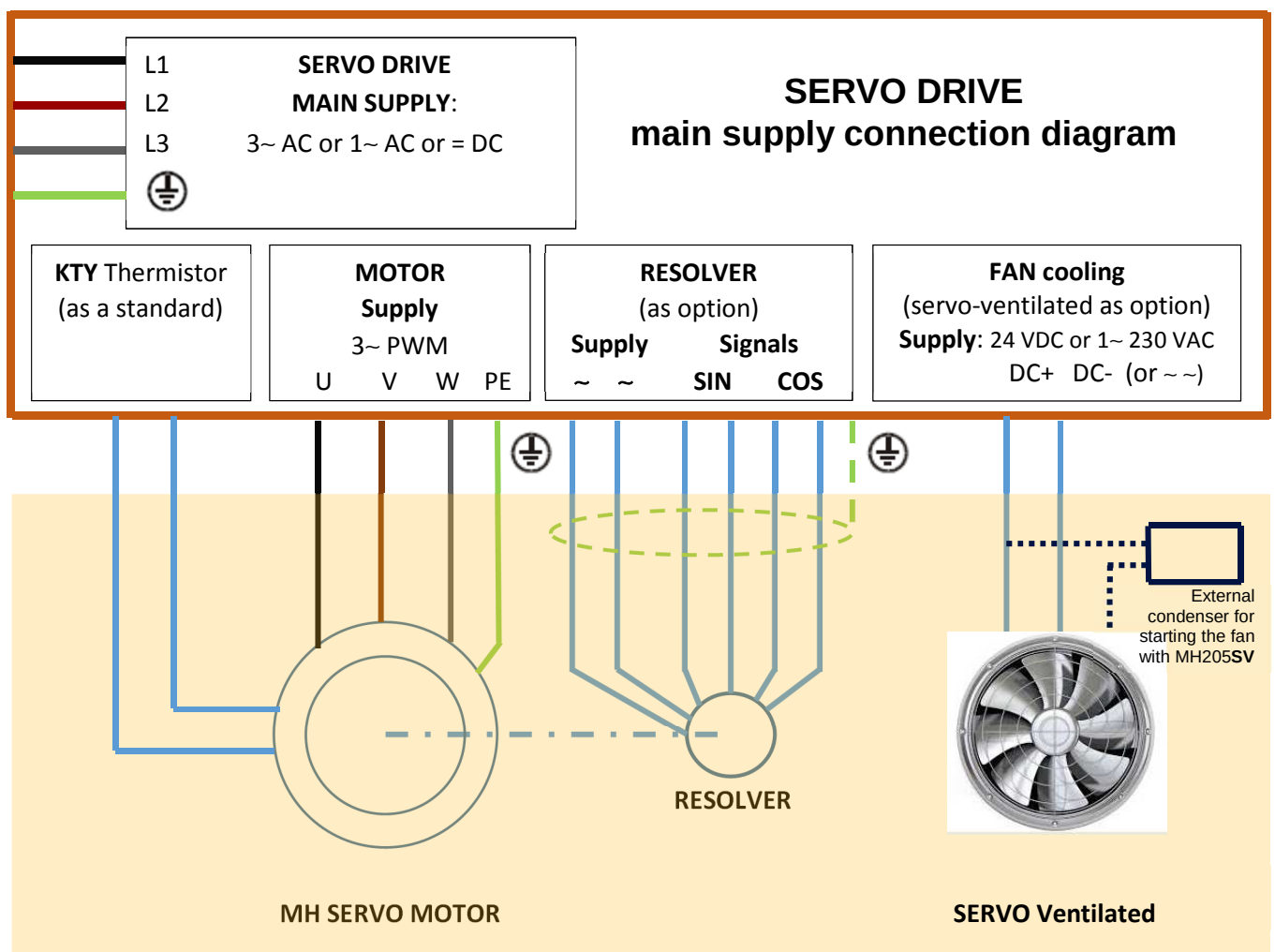
	<u>Danger</u>: Make sure that the power on the electrical cabinet is off prior to making any connections.
	<u>Caution</u>: The wiring must comply with the drive commissioning manual and be achieved with the recommended cables.
	<u>Danger</u>: The motor must be grounded through connection to an unpainted section of the motor.
	<u>Caution</u>: After 15 days, check all tightening torques on cable connections.

4.3.1. Cable connection

Please, refer to paragraph §3.9 *Power Electrical Connections* to get information about cable connection. Additional useful information is still available in the *Drive Controller* documentations.

4.3.2. Wiring diagram

	Caution: The wiring must comply with the drive commissioning manual and be achieved with the recommended cables.
	Warning: Maladjustments of electronic controls (gain in close loop too high, incorrect filtering,...) can result in instability of the shaft line, vibration or/and breakdown. Please consult Parker in such cases.



4.4. Maintenance Operations

	Generality <u>Danger:</u> The installation, commission and maintenance operations must be performed by qualified personnel, in conjunction with this documentation. The qualified personnel must know the safety standards (C18510 authorization, standard VDE 0105 or IEC 0364) and local regulations. They must be authorized to install, commission and operate in accordance with established practices and standards. Please contact PARKER for technical assistance.
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	<u>Danger:</u> Before any intervention the motor must be disconnected from the power supply. Due to the permanent magnets, a voltage is generated at the motor terminals when shaft is rotating.
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Summary of maintenance operations	
Operation	Periodicity
Clean the motor	Every year
Motor inspection: • vibration changes, • temperature changes, • tightening torques on all screws.	Every year
Bearing replacement	Every 20 000h

4.5. Troubleshooting

Some troubleshooting and possible causes are listed below. This list is not comprehensive. Whenever an operating incident occurs, consult the relevant servo drive installation instructions (the troubleshooting display indications will help you in your investigation) or contact Parker at: <http://www.parker.com/eme/repairservice>.

You notice that the motor cannot be turned by hand when not connected to the drive.	Check that there is no mechanical blockage or that the motor terminals are not short-circuited.
You encounter troubles starting the motor or maintaining rotation.	- Check the fuses, the voltage at the terminals (there could be an overload or the bearings could be jammed), also check the load current. - Check thermal protection, its connection and how it is set in the drive. - Check the servomotor insulation (in case of doubt, carry out hot and cold measurements). The minimum insulation resistance value measured under a maximum voltage of 50V DC is 50 MΩ: - Between the phase and the housing - Between the thermal protection and the housing - Between the resolver coils and the housing.
You notice that the motor speed is drifting	Reset the offset of the servo amplifier after having given a zero instruction to the speed setpoint input.
You notice that the motor is racing	- Check the speed setpoint of the servo drive. - Check you are well and truly in speed regulation (and not in torque regulation). - Check the servomotor phases order: U, V, W
You notice vibrations	- Check the resolver connections. - Check carefully the earth connections and the grounding of earth wire. - Check the setting of servo drive: speed loop gain, filtering. - Check the stability of the secondary voltages. - Check the rigidity of the frame and motor support.
You notice the motor is becoming unusually hot.	- It may be overloaded or the rotation speed is too low : check the current and the operating cycle of the motor. - Check if the mounting surface is sufficient or if this surface is not a heat source – see §3.7 Cooling. - Friction in the machine may be too high : - Test the motor current with and without a load. - Check that the motor does not present a thermal insulation. - Check the operating of fan (if existing).
You notice that the motor is too noisy.	Several possible explanations : - Unsatisfactory mechanical balancing - Defective coupling - Loosening of several pieces - Incorrect adjustment of servo drive: if possible, check the rotation of motor in open loop.

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