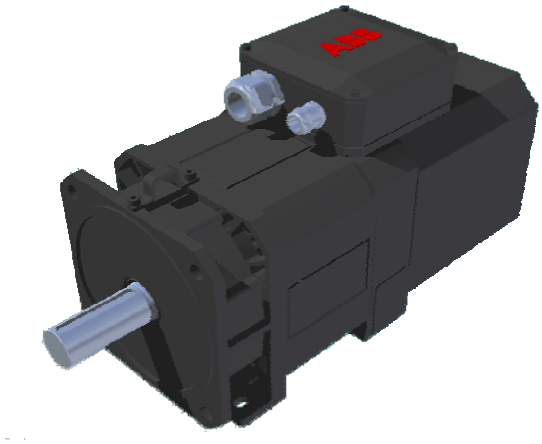
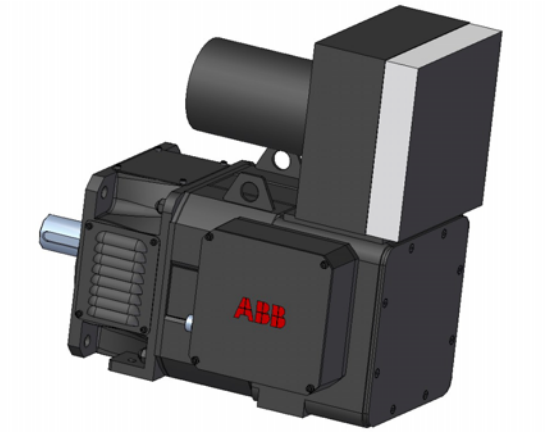
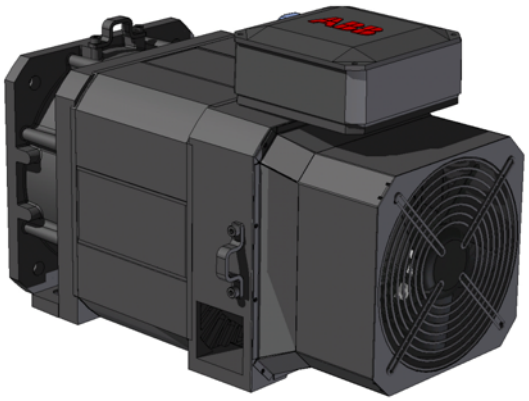
ABB Sace

High Dynamic Performance AC Induction Servomotors

Technical Manual







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Technical Manual

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Safety Instructions

Introduction

This chapter states the safety instructions that must be followed when installing High Dynamic Performance (**HDP**) AC Induction servomotors manufactured by ABB Sace – Line S. The material in this chapter must be studied before attempting any work on, or with, the servomotor.

Warnings and Notes

This manual distinguishes two sorts of safety instructions. Warnings are used to inform of conditions that can, if proper steps are not taken, lead to a serious fault condition, physical injury and death. Notes are used when the reader is required to pay special attention or when there is additional information available on the subject. Notes are less crucial than Warnings, but should not be disregarded.

Warnings

Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with the following symbols:

WARNING! Dangerous Voltage: warns of situations in which a high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.

WARNING! General Warning: warns of situations that can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.

Notes

Readers are notified of the need for special attention or additional information available on the subject with the following symbol:

CAUTION! **Caution** aims to draw special attention to a particular issue.

Note **Note** gives additional information or points out more information available on the subject.

Intended Use

HDP servomotors are electrical rotating machines intended for industrial installations as components as defined in the Machinery Directive (MD) 98/37/EC.

All operations serving transport, storage, installation, connection, commissioning, operation and maintenance shall be carried out by responsible skilled persons, in conformity with local and international standards.

WARNING! Improper handling may cause serious personal injury and damage to property.

HDP Servomotors are intended to be coupled to ABB Converters of the ACS800 Series, or, to frequency converters in general.

General Safety Instructions

WARNING! The contents of this guide refer to HDP Series Servomotors correctly installed as described in this Manual.

Only properly qualified electricians who are familiar with operation on motors are allowed to perform the commissioning and operation activities of the Servomotors described in this Manual.

WARNING! For no reason should any person access the terminals of the servomotor, before at least eight minutes from the power outage.

However this time strongly depends on the converter type connected to the motor.

Proper electrical installation of the drive and compliance to EMC Directives depends on the converter specifications. Therefore, before any actions on or with the drive equipment, study the complete documentation of the frequency converters to be used.

WARNING! The machine manufacturer, who commissions the servomotor, must install proper additional protection functions to avoid damages to health or equipment when the machine is operating.

Neglecting these instructions can cause physical injury and death.

More Warnings and Notes are printed at appropriate instances along the text.

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Chapter 1 – Introduction to this Manual

Introduction

This document "*Manual for HDP AC Induction Servomotors"* may be part of other Converters manual suites, like ACS800, provided by ABB. In this case the material contained in those manuals must be studied before attempting any work on, or with, the motors.

In any case, since motors can be used also with other converters than ABB ACS800, it can be used without consulting the other manuals of the ABB suite. However it is strongly recommended to study the manuals of those converters in any case, before attempting any work on, or with, the motors.

Before You Start

The reader is expected to have an appropriate knowledge of electrical fundamentals, electrical wiring practices and, in general, of the drive.

What This Manual Contains

The aim of this manual is to provide the reader with all the necessary information for a proper installation of the motors, both mechanical and electrical.

Safety Instructions are featured in the first few pages of this Manual. Safety Instructions describe the formats for various warnings and notations used within this Manual. Other instructions are given in the *Installation Manual*.

Chapter 1 – Introduction to this Manual, contains a short description of this Manual.

Chapter 2 – HDP Servomotors, describes the main characteristics of the servomotors, their main components and available accessories.

Chapter 3 – Mechanical Installation, shows how to deal with mechanical installation of the servomotors.

Chapter 4 – Electrical Installation, shows how to deal with electrical installation of the motors.

Chapter 5 – Servomotors Ratings, shows the main parameters and electromechanical data of the servomotors.

Appendix A – Motor Code, describes the coding method used to identify the servomotors.

Appendix B – Standards and Safety, lists the norms that the motor complies to that have been used in design and must be followed in installation.

Related Publications

In addition to this Manual, please consult the ABB ACS800 complete user documentation.

Conventions used in this Manual

Listed below are the terms and conventions which have special meaning throughout this Manual.

Definitions

Some of the definitions used in this manual are here listed

ServoDrive A Servodrive is a system made of a converter coupled with a servomotor.

DE and NDE According to IEC 60034-7, the two ends of a motor are defined as follows:

- DE: Drive End of the motor
- NDE: Non Drive End of the motor

On the DE typically the shaft has its extension to transmit the torque to a load.

In HDP servomotors, on the NDE typically there is the position transducer.

The optional parking brake of the motor is also mounted on the NDE.

Symbols

The following symbols are used in this manual.

n_N	Rated speed
N_{MAX}	Maximum speed
P_N	Rated power (power at rated speed)
M_N	Rated Torque (torque at rated speed)
U_N	Rated voltage (to be supplied to the motor)
I_N	Rated current (current at rated speed)
$\cos \phi$	Power factor
f_N	Rated frequency (frequency at rated speed)
J	Rotor inertia

Chapter 2 – HDP Servomotors

Introduction

This chapter gives general information on HDP High Dynamic Performance Square Induction Servomotors manufactured by ABB Sace – Line S, their main characteristics, components and accessories.

Main characteristics

The HDP Motor series is the ABB solution for the High Dynamics Performances application with induction servomotors.

HDP Series Servomotors are AC three phase, induction, squirrel cage, 4 or 6 poles, high performance servomotors, available into 4 sizes, h100, h132, h160 and h200, made into two main different configurations, IP54 (“C” type) or IP23 (“V” type).

HDP servomotors are designed for industrial applications where high speed, high dynamics and in general high performances are required.

Main characteristics of HPD series servomotors are:

- Frameless square shape made of laminated electrical steel
- Compact, lightweight and robust construction
- High efficiency
- High dynamic response due to low inertia rotors
- High power to size ratio

Each of these HDP Servomotors is, or may be, equipped with:

- position transducer (integrated into the motor, typically an encoder)
- normally two temperature switches (integrated into the motor)
- optionally additional temperature sensors or switches
- mechanical parking brake
- oil seal on the drive end side
- heaters for demoisturing
- air filters (for IP23 versions only)
- silencers (for some IP23 versions only)
- improved insulation system
- other accessories on request

For more information on the available accessories, please contact ABB Sace – Line S Customer Service.

Rotor

HDP Servomotors are equipped with rotors done by pressure die cast aluminium, of the squirrel cage type.

Rotor slots are appropriately shaped and skewed, along the rotor length, to allow smooth operation with minimum torque ripple even at the lowest possible speed, while simultaneously allowing for the maximum possible performances.

The inertia of the rotor is reduced by introducing suitable holes in the rotor, that are also used for forced air cooling of the rotor to further improve performances, and by the use of low inertia short circuit rings at the two ends of the rotor.

The usage of die cast aluminium structure, coupled with the proper balancing degree, allows also for high speed operation in safe conditions.

Stator

HDP Servomotors are equipped with stators done by low loss, low thickness, insulated on both sides, magnetic sheets to reduce stator losses even at the highest operational frequency, i.e. at the highest possible speed.

To improve mechanical robustness of the stator, and improve motor stiffness, the sheets are welded together and reinforced with lateral iron plates.

Windings and insulation system

The winding coils are made with class H doubly varnished wires.

The impregnation is done by resins.

The coils are insulated against stator core with aramid paper with a polyester or polyamide plastic film. Special care is taken in the overhangs to improve phase to phase insulation.

This insulation system ensures adequate dielectric strength in the most critical applications with frequency inverters.

The connections from the windings to the terminal box are done with flexible cables insulated by class H material.

Bearings HDP servomotors are usually manufactured with double shield, self lubricated ball bearings.

Bearings are designed to withstand, given a certain shaft height, the maximum torque of the motor and simultaneously allow for the highest operational speed foreseen for that shaft height, together with a given maximum radial load.

With this configuration the bearings are foreseen to last 20.000 hours.

If there is a particularly heavy radial load due to a belt the motors can be equipped with a roller bearing at the DE side.

For all the details of the bearings available please consult Chapter 3 “Mechanical installation”.

Note. Other special bearings may be mounted upon request to improve lubrication or for particularly high operational speed.

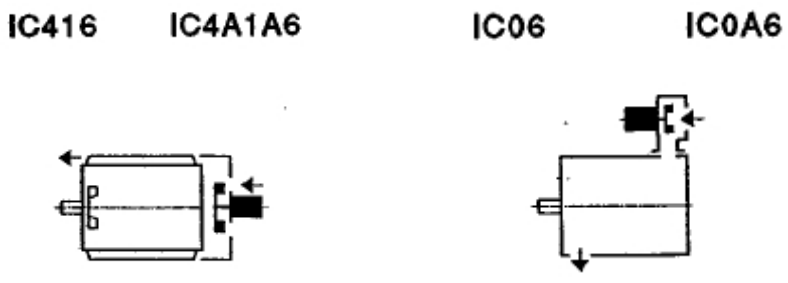
For the options available please contact ABB Sace – Line S – Customer Service.

Cooling HDP series servomotors are forced-air cooled by means of either axial servo-fans (IP54 version) or radial fans (IP23 version).

According to IEC 60034-6 Ed. 2.0 1991-10 they are therefore identified by the code IC416 for IP54 version and IC06 for IP23 version that means the coolant is drawn from the surrounding medium, passes through the machine and is than discharged in open circuit.

The coolant is Air and is moved by a component mounted on the machine, the power of which is obtained in such a way that it is independent of the rotational speed of the machine.

The figure shows the schematic arrangement of these motors.



HDP Servomotors are not presently foreseen for other coolants than air.

Thermal Protection

Inside the motor two temperature sensors of the thermal switch type (normally closed contact) are mounted to provide the converter's control circuit with information on a motor over-temperature event.

Upon request it is possible to add other thermal sensors or replace the thermal switches with PTC thermal sensors.

In some cases it is possible to mount temperature sensors with lower reference temperatures to handle heating warnings before overheating tripping.

Terminals of the two thermal sensors are available inside the motor terminal box, so that the sensors can be connected in parallel or in series at user's choice. See Chapter 4, *Overview of the Terminal Box*.

WARNING! Omitting the connection of the thermal switches usually inhibits the drive operation.

Please consult the manual of the converter used to drive the motor to check both connection of the thermal switches and alarm thresholds.

Thermal Switch

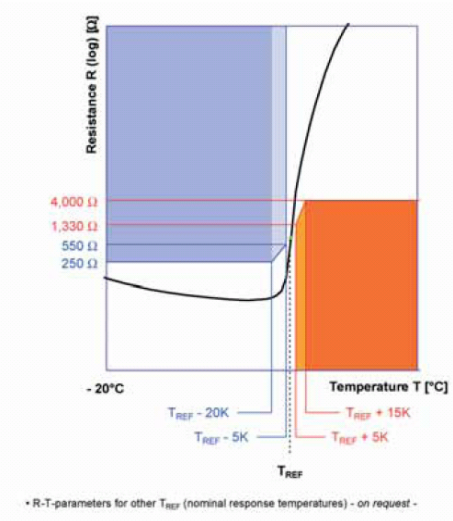
The thermal switches built into HDP Servomotors by default are bimetal, normally closed, current-sensitive contacts. After reaching a fixed nominal switching temperature, the contacts open by direct disconnection.

The nominal switching temperature of the thermal switches integrated into the motor is 140°C with ± 5°K tolerance range. After cooling down the contacts reclose turning back to the initial position.

PTC Thermal Sensor

PTC sensors are temperature sensitive semiconductors resistors. The change of resistance vs. temperature is the information used from the control circuit to handle alarms on current levels and to avoid overheating of the motor.

The typical temperature-resistance diagram of the PTC used in HDP motors is here illustrated (courtesy: Thermik Geraetebau Gmbh).



GENERAL CHARACTERISTICS

T_{REF} = Nominal Response Temperature
T_{REF} = 90°C up to 160°C in steps of 10K i.e. 5K

Temperature T [°C]	Resistance R acc. to DIN 44081 (value per Sensor)	Measuring-Voltage [DC]
-20°C up to T_{REF} - 20K	20 Ω up to 250 Ω -Standard- ≤ 100 Ω -on request-	≤ 2.5 V-
T_{REF} - 5K	≤ 550 Ω	≤ 2.5 V-
T_{REF} + 5K	≥ 1,330 Ω	≤ 2.5 V-
T_{REF} + 15K	≥ 4,000 Ω	≤ 7.5 V- pulsed

max. allowable Supply-voltage : U_{max} = 30 V-
max. recommended Sensor-voltage : U_{meas} = 7.5 V-
High voltage insulation : U_{eff} = 2.5 kV

$T_{NF} \Leftrightarrow T_{NAT} \Leftrightarrow T_{REF}$

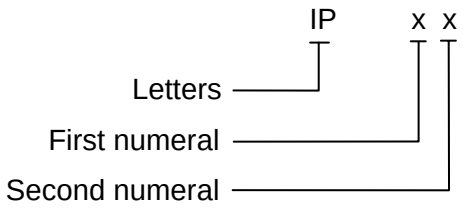
Other types of PTC sensors may be mounted upon request.

Protection Degree

HDP series servomotors are protected according to the indications given in IEC 60034-5 Ed. 4.0 2000-12.

Definition of IP protection degree

The protection degree according to the specified norm is indicated by the IP letters followed by two numerals.



The first numeral indicates the degree of protection given by the enclosure to both people and motor itself; in particular the objects, tools, wires, that, handled by a person can enter into the motor or, in case they enter the motor they do not cause damages to the motor itself, are indicated.

First numeral	Description	Examples of motor protection
0	Non protected motor	No particular protection.
1	Motor protected against solid objects having dimensions greater than 50 mm	For example parts of the body like hands or objects with dimensions greater than 50 mm cannot contact or enter into the motor or close to live parts, either accidentally or inadvertently.
2	Motor protected against solid objects having dimensions greater than 12 mm	For example parts of the body like fingers or objects like screwdrivers with length greater than 80 mm or objects with dimensions greater than 12 mm cannot contact or enter into the motor or close to live parts.
3	Motor protected against solid objects having dimensions greater than 2.5 mm	For example objects like small tools, wires or objects with dimensions greater than 2.5 mm cannot enter into the motor or close to live parts.
4	Motor protected against solid objects having dimensions greater than 1 mm	For example objects like wires, strips of 1 mm thickness, or objects with dimensions greater than 1 mm cannot enter into the motor.
5	Motor protected against the dust	Some dust can enter into the motor but its amount does not compromise the correct operation of the motor.
6	Motor totally protected against the dust	No dust can enter into the motor at all.

The second numeral indicates the degree of protection offered by the enclosure to prevent the dangerous effects of the penetration of water into the motor.

Second numeral	Description	Examples of motor protection
0	Non protected motor	No particular protection.
1	Motor protected against water drops	Protection against vertically falling water.
2	Motor protected against falling water at up to 15° from the vertical	Protection against vertically falling water at any angle up to 15° from the vertical to the motor normal position.
3	Motor protected against sprayed water	Protection against water sprayed to the motor at up to 60° from the vertical to its normal position.
4	Motor protected against splashed water	Protection against water splashed onto the motor from any direction.
5	Motor protected against water jets	Protection against water jets created by a nozzle in any direction.
6	Motor protected against powerful jets	Protection against water created by powerful jets or by sea waves.
7	Motor protected against the immersion	The motor is protected from water when the submersed according to predefined conditions
8	Motor protected against the effects of a prolonged immersion	A prolonged immersion in water under specified conditions, for example because the motor is totally sealed or because if the water enters it does not create damages.

Standard Degree of Protection

This standard degree of protection is valid for servomotors that are not mounted according to the IMV3 or IMV19 configuration.

HDP Series servomotors can be manufactured according to two standard IP protection degrees:

- IP54, or
- IP23

These degrees are related to the motor body only. The terminal box may have different degrees of protection.

For the shaft end (Drive end side) the degree of protection is:

- IP54 with oil seal installed
- IP41 without oil seal

This protection is intended for the interface shaft - motor body.

IP protection in IMV3 configuration

In IMV3 or other vertical configuration the protection degree on the drive end can be dramatically lowered, both in case of motor without oil seal and in case of standard oil seal.

HDP Servomotors are provided in the standard configurations with double shielded bearings; therefore the motors cannot prevent dangerous fluids to seep into from the shaft end, unless particular special oil seals are used.

When the motor is going to be mounted in critical configurations like IMV3 or IMV19, or equivalent vertical configuration with shaft drive-end up, it is necessary to manufacture the motor with special oil seals, which guarantee a protection degree IP x4-x7, i.e. motor protected against fluids seepage.

In these cases the motors must be ordered by a special ordering code (for ordering support see the *HDP Series Servomotors Catalog* or contact ABB Sace Line S – Customer Service).

Radial oil seal (option)

All HDP series servomotors are mechanically arranged to allow for a radial oil seal on the rotating shaft; in the standard version, this oil seal is not mounted; it can be pre-mounted upon request.

The radial oil seal may improve the capacity of withstanding leakage of fluids into the motor, in particular oil. Its function is therefore to protect insulation and rotor from potentially dangerous fluids.

It is an additional device to be mounted for sealing the motor.

The usage of the oil seal improves the IP protection degree of the motor on the shaft drive-end.

Normally, the servomotor arranged with the oil seal has a protection degree of IP54 at the DE side.

The oil seal used by ABB Sace – Line S in the HDP series is usually done with Viton® material.

This oil sealer shall be installed (by the user or by ABB Sace – Line S upon request) **only** if the motor shaft and the oil sealer itself are actually wet by oil. If lubricating fluids other than common mineral and synthetic oils are used and in case of over-pressure of these fluids, ABB Sace – Line S Customer Service should be contacted for support.

We suggest to avoid mounting the oil seal if a dry operation on drive end side is foreseen: the material of the device will be quickly damaged and, possibly, damaging the bearing itself.

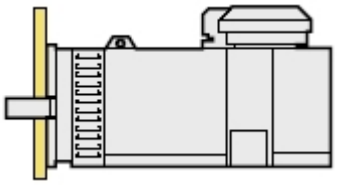
Types of construction and mounting arrangements

The servomotors of this series can provide for both flange installation and feet installation.

The strict definitions of the IM code numbers are laid down in IEC 60034-7 (1993), number 2179 E; the practical meaning is provided below for the most common mountings that are implemented in the HDP servomotors.

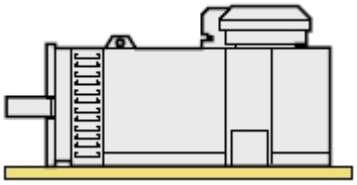
- IMB5 Flange mounted with passing holes on the flange, horizontal.

IM 3001 - B5



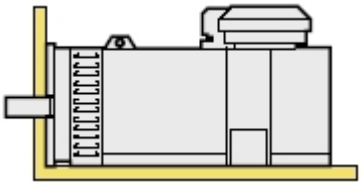
- IMB3 Mounted by feet and the feet are down on the floor. The motor is not flanged.

IM 1001 - B3



- IMB35 Mounted by feet plus an additional mounting by flange on the DE side.

IM 2001 - B35



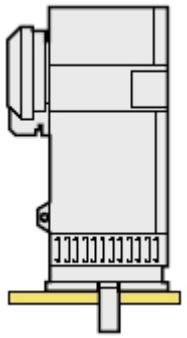
Note. HDP Servomotors are intrinsically IMB35, and they can therefore be mounted either in B3, B5 or B35 configuration without changes in the design.

Upon request, HDP servomotors are also available with IMV1 and IMV3 design. The request for these configurations must be done explicitly in the ordering code.

CAUTION! Do not forget the important notice regarding the IP protection when mounting in these or other vertical configurations (see paragraph “IP protection in IMV3 configuration”).

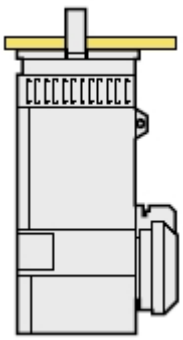
- IMV1 Flange mounted with passing holes on the flange, vertical, shaft down.

IM 3011 - V1



- IMV3 Flange mounted with passing holes on the flange, vertical, shaft up.

IM 3031 - V3



Note. The IEC 60034-7 standard foresees many other possible ways of mounting. For different mountings, and in particular for vertical mounting configurations with drive-end up, please contact ABB Sace - Line S Customer Service.

Transducers

HDP servomotors are usually equipped with a position transducer that is an encoder transducer.

Encoder

If no specification is done by the Customer, one of the following encoders is mounted by default:

- Leine & Linde RHI 503, supply voltage 10/30 Vdc, output A/A-, B/B-, Zero, 1024 pulses/turn; vibration withstand < 300m/s2 (according to IEC 60068-2-6). Protection IP 67 (IP 66 shaft DE).
- Stegmann DGS66-HAZ0-S02, 12/30 Vdc, HTL/push pull interface; output A/A-, B/B-, Z/Z-, 1024 pulses/turn; vibration withstand 20/10 to 2000 g/HZ (according to IEC 60068-2-6). Protection IP 66.

The encoder type mounted is stated on the motor plate.

More Options

In principle, HDP servomotors can be provided with almost every kind of encoder or resolver transducer, or also without a transducer, or with more than one, if necessary.

For all the possible solutions of transducer types available, please contact ABB Sace – Line S Customer Service.

Optional Brake For particular applications, the motor can be arranged with an electrically driven brake that mechanically acts on the servomotor shaft; when mounted, the brake is fully integrated into the motor frame.

Note. Do not confuse this mechanical brake with the electronic, dynamic braking unit of the frequency converter, that allows dissipation of the electric power re-generated by the servomotor on a braking resistor; this part of the electronic circuit is generally referred to as “braking circuit”.

The servomotor’s mechanical brake shall be used as a “parking brake”; in fact its main function is to lock the motor shaft when the converter is discharged.

Note. The mechanical brake cannot be used as emergency brake, nor to brake the motor during normal operation. As a standard procedure, before switching-off the drive system, the converter must first stop the motor and then lock the mechanical brake.

Spring Brakes HDP Servomotors are equipped by default with spring brakes. The brake is unlocked when powered with 24VDC, regardless of the polarity, and locked when discharged.

The table below provides the specifications of standard and increased mechanical brakes available for HDP Servomotors.

SERVOMOTOR	**Standard brake** Holding torque [Nm]	**Maximum speed** [rpm]	**Special brake** Holding torque [Nm]
CH [H100 IP54]	40	8000	80
CM [H132 IP54]	90	7900	180
CN [H160 IP54]	200	7000	400
CR [H200 IP54]	400	6000	700
VH [H100 IP23]	80	7000	125
VM [H132 IP23]	150	5500	300
VN [H160 IP23]	300	5500	600
VR [H200 IP23]	-	-	-

Note. The brakes maximum speed is reduced according to the motors mechanical speed limits.

Upon request, different holding torques are available.

Moreover, spring brakes may be optionally replaced with permanent magnet brakes. Contact ABB Sace - Line S, Customer Service, for more options and special applications.

Brake Operation

When the motor is provided with mechanical brake, the following must be observed:

The brake management is fully under care and responsibility of the user and manufacturer of the electrical control cabinet. The brake is **operating (i.e. it brakes) when it is not powered**.

Therefore, the logic of the electrical control cabinet **must absolutely power (i.e. unlock) the brake before running the motor**, and keep on checking that the brake is continuously powered during the motor operation.

Neglecting this can cause damage to the motor.

Note. The power supply of the brake must come from a separate circuit.

Moreover, if a permanent magnet brake is used, **the power supply polarity must be respected.**

Permanent Magnet Brakes

If permanent magnet brakes are used a special care must be taken.

In case of axial loads on the motor shaft, please contact the Customer Service.

Permanent magnet brakes are typically disc brakes and therefore they may be sensitive to axial movements of the shaft.

It is normally a good practice avoid hitting on the DE shaft, since this may compromise bearings integrity.

When using a permanent magnet brake this becomes even more important.

In fact permanent magnet brake operation is heavily affected by the precise alignment of the braking disc (anchor) and the brake core.

Hitting on the DE shaft may alter the right alignment, and the brake therefore may not properly lock the motor shaft.

The user may not notice this problem until the first time the brake has been supplied and switched off for braking.

Overall Dimensions

The overall dimensions drawings of HDP Servomotors are shown in the next figures, both for the IP54 and IP23 versions; the external dimensions of each motor type are shown in the further tables.

Note. The motor code (or better, the motor assembly code) is a 17-digit identification code.

The first digit (**C** or **V**) indicates the series, i.e. HDP Asynchronous, square frame, squirrel cage, IP54 (“C”) or IP23 (“V”) servomotors.

The second digit indicates the axis height:

- H = 100 mm
- M = 132 mm
- N = 160 mm
- R = 200 mm

The third digit indicates the motor size (**1, 2**, etc.) referred to the axial length (LB).

Other numbers or letters are used to identify other characteristics of the motor. See *Appendix A* for a quick key to HDP Servomotors’ codes.

External Dimensions Overview

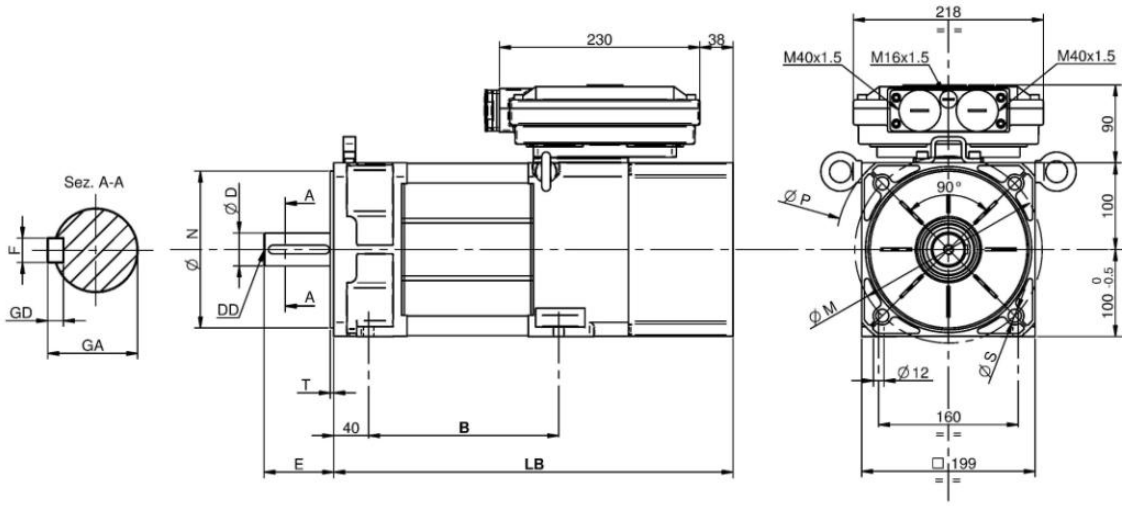
Note that servomotor types have fixed standard dimensions, except for the foundation length (LB) of the motor that changes with the motor size, and optionally with brake.

Note that all the servomotors dimensions are IEC72-1 compliant, as well as the letter-symbols used in the drawings.

See Chapter 5 for details on the servomotors ratings by type and size.

CH [H100 IP54]

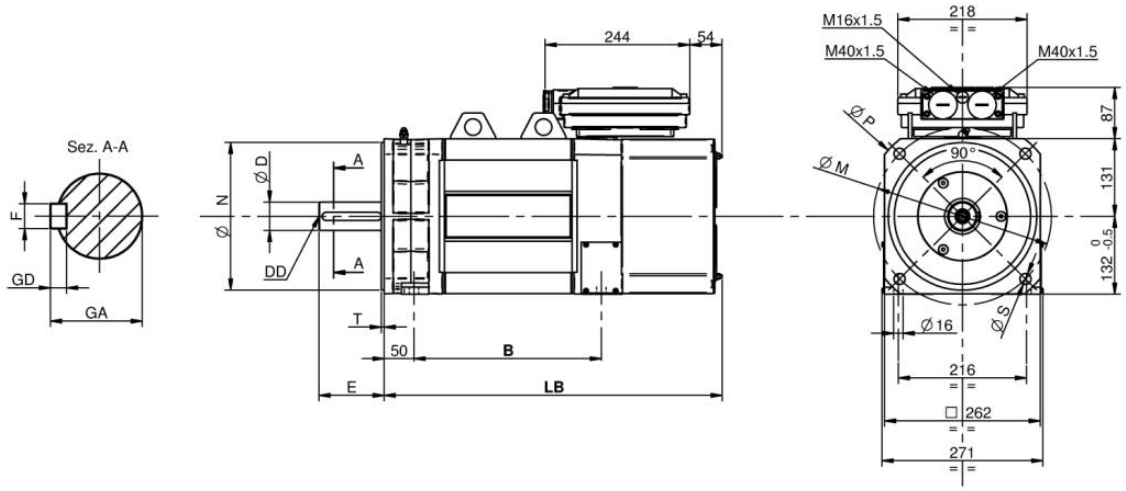
Overall dimensions of HDP Servomotors, size H100 type IP 54.



SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B[1]	LB[2]	Weight	B	LB	Weight	M[3]	N[4]	P[5]	S[6]	T[7]	D[8]	DD[9]	E[10]	F[11]	GA[12]	GD[13]
CH1	158	461	35	158	398	30	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
CH2	183	486	41	183	423	36	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
CH3	218	521	49	218	458	44	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
CH4	268	571	61	268	508	56	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
CH5	308	611	70	308	548	65	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
CH6	353	656	81	353	593	76	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8

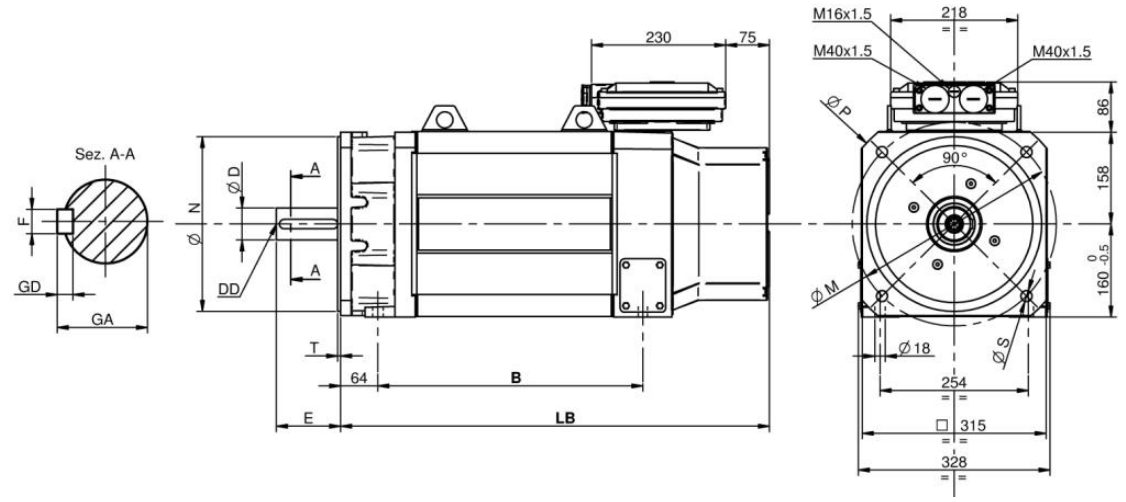
1 B - center distance of the feet holes
2 LB - foundation length
3 M - center diameter of the flange-fixing holes
4 N - diameter of the flange centering
5 P - external diameter of the flange
6 S - diameter of the flange-fixing holes
7 T - depth of the flange centering
8 D - shaft diameter at D-end
9 DD - thread of the shaft hole
10 E - shaft extension
11 F - width of the shaft keyway
12 GA - width of the shaft end
13 GD - depth of the shaft keyway

CM [H132 IP54] Overall dimensions of HDP Servomotors, size H132 type IP 54.



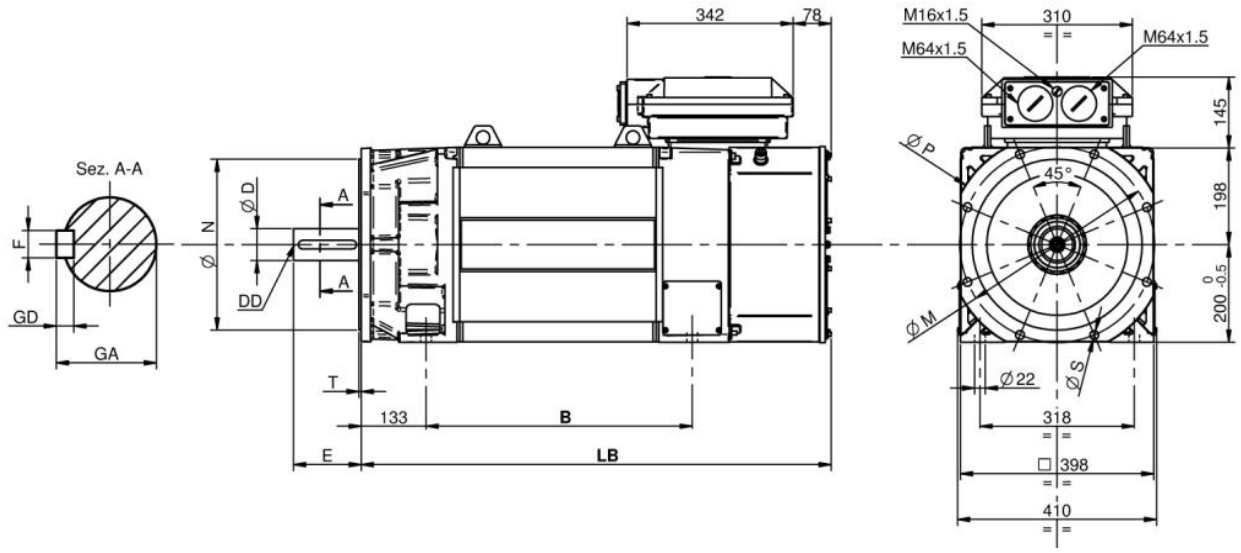
SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
CM1	236	600	101	236	490	91	300	250 h6	336	18,5 H14	5	48 k6	M16	110	14	51,5	9
CM2	281	645	119	281	535	109	300	250 h6	336	18,5 H14	5	48 k6	M16	110	14	51,5	9
CM3	316	680	133	316	570	123	300	250 h6	336	18,5 H14	5	48 k6	M16	110	14	51,5	9
CM4	386	750	161	386	640	151	300	250 h6	336	18,5 H14	5	48 k6	M16	110	14	51,5	9
CM5	456	820	189	456	710	179	300	250 h6	336	18,5 H14	5	48 k6	M16	110	14	51,5	9

CN [H160 IP54] Overall dimensions of HDP Servomotors, size H160 type IP 54.



SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
CN1	344	755	203	344	625	183	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
CN2	394	805	232	394	675	212	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
CN3	454	865	267	454	735	247	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
CN4	514	925	302	514	795	282	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
CN5	574	985	337	574	855	317	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10

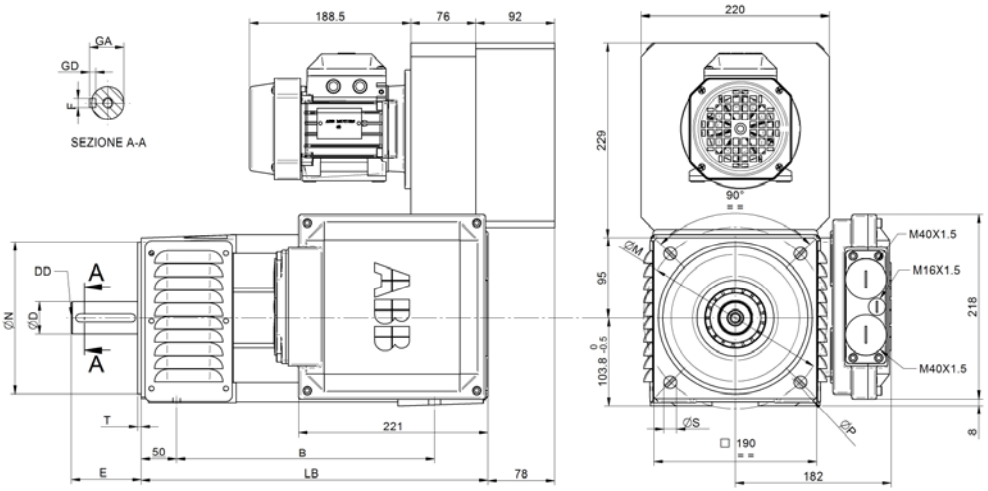
CR [H200 IP54] Overall dimensions of HDP Servomotors, size H200 type IP 54.



SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
CR1	389	958	399	389	808	359	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
CR2	429	998	436	429	848	396	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
CR3	479	1048	483	479	898	443	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
CR4	549	1118	549	549	968	509	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
CR5	649	1218	643	649	1068	603	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11

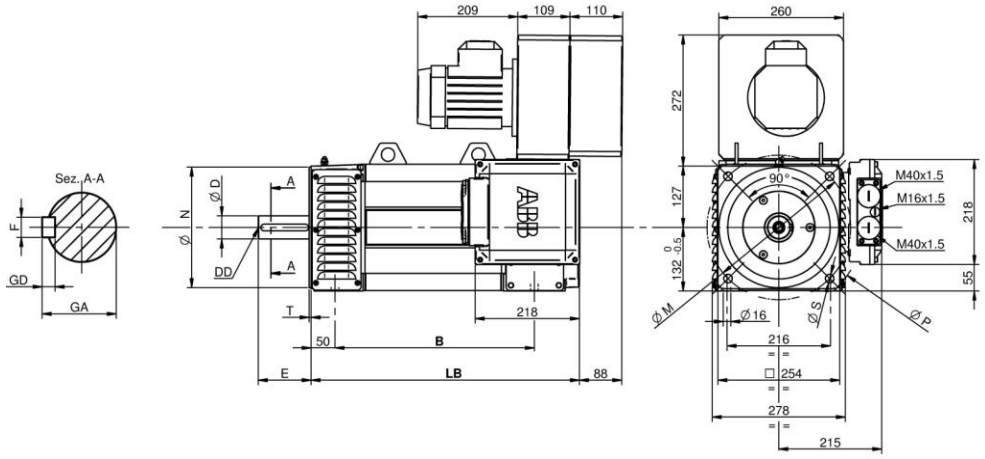
Note. ABB Sace operates in a policy of continuous improvement. Therefore overall dimensions and drawings, proposed so far, may be reviewed for special projects and special arrangements, as well as for general changes in design, without prior notice.

VH [H100 IP23] Overall dimensions of HDP Servomotors, size H100 type IP 23.



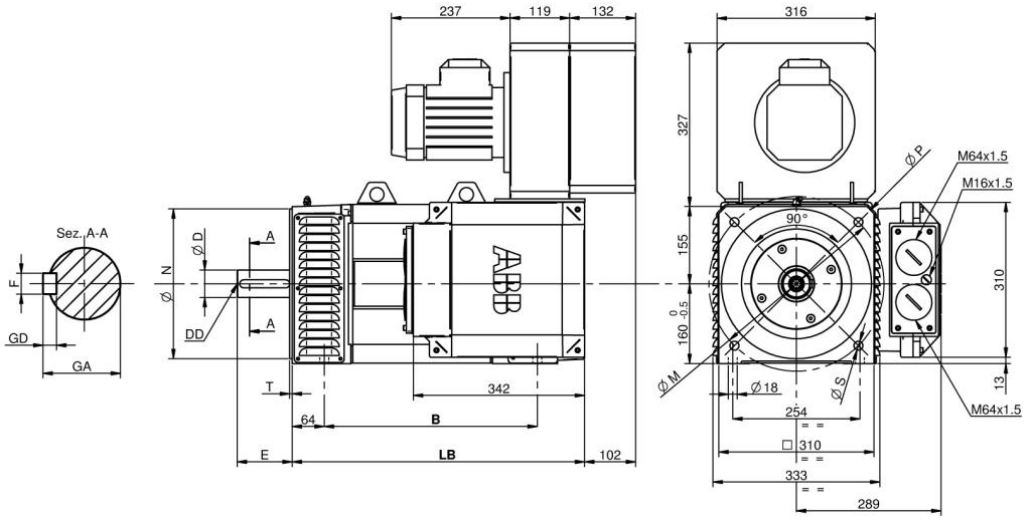
SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
VH1	190	385	44	190	295	39	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
VH2	215	410	48	215	320	43	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
VH3	250	445	54	250	355	49	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
VH4	300	495	62	300	405	57	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
VH5	340	535	70	340	445	65	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8
VH6	385	580	81	385	490	76	215	180 j6	260	14,5 H14	4	38 k6	M12	80	10	41	8

VM [H132 IP23] Overall dimensions of HDP Servomotors, size H132 type IP 23.



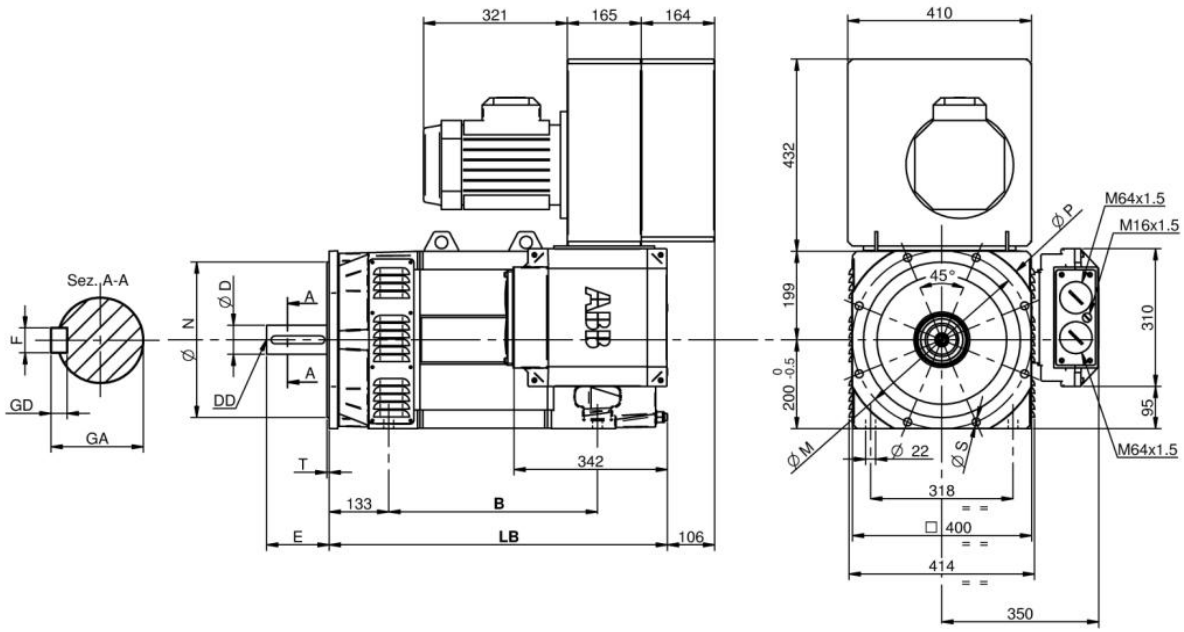
SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
VM1	266	520	114	266	410	104	300	250 h6	348	18,5 H14	5	48 k6	M16	110	14	51,5	9
VM2	311	565	132	311	455	122	300	250 h6	348	18,5 H14	5	48 k6	M16	110	14	51,5	9
VM3	346	600	146	346	490	136	300	250 h6	348	18,5 H14	5	48 k6	M16	110	14	51,5	9
VM4	416	670	174	416	560	164	300	250 h6	348	18,5 H14	5	48 k6	M16	110	14	51,5	9
VM5	486	740	201	486	630	191	300	250 h6	348	18,5 H14	5	48 k6	M16	110	14	51,5	9

VN [H160 IP23] Overall dimensions of HDP Servomotors, size H160 type IP 23.



SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
VN1	376	664	219	376	534	199	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
VN2	426	714	248	426	584	228	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
VN3	486	774	283	486	644	263	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
VN4	546	834	318	546	704	298	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10
VN5	606	894	353	606	764	333	350	300 h6	410	18,5 H14	5	55 m6	M20	110	16	59	10

VR [H200 IP23] Overall dimensions of HDP Servomotors, size H200 type IP 23.



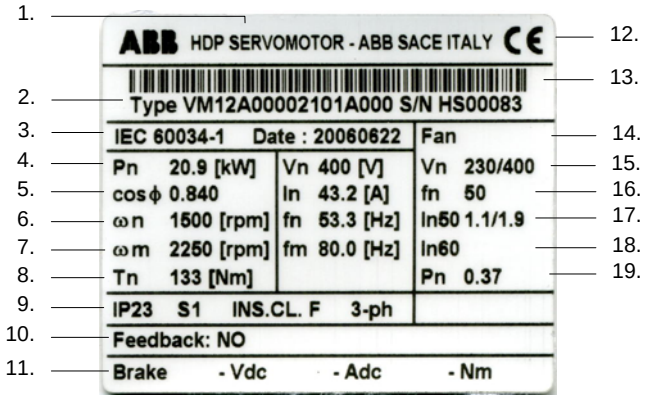
SIZE CODE	With brake			Without brake			Front Flange					Shaft					
	B	LB	Weight	B	LB	Weight	M	N	P	S	T	D	DD	E	F	GA	GD
VR1	n.a.	n.a.	n.a.	426	715	385	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
VR2	n.a.	n.a.	n.a.	466	755	422	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
VR3	n.a.	n.a.	n.a.	516	805	469	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
VR4	n.a.	n.a.	n.a.	586	875	535	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11
VR5	n.a.	n.a.	n.a.	686	975	629	400	350 h6	450	18,5 H14	5	65 m6	M20	140	18	69	11

Note. ABB Sace operates in a policy of continuous improvement. Therefore overall dimensions and drawings, proposed so far, may be reviewed for special projects and special arrangements, as well as for general changes in design, without prior notice.

Motor Plate

A steel-sheet adhesive plate is attached to the servomotor frame, and it must not be removed. The rating plate is typically located on the right end side of the servomotor.

The rating plate indicates the motor identification, ratings, mechanical and electrical information.



1. Motor Definitition (*HDP Servomotor*) and Manufacturer (*ABB Sace - Italy*)
2. Motor identification code (*Type*) and serial number (*S/N*)
3. Manufacturing standards (*IEC 60034-1*) and date (*Date*)
4. Rated power (*Pn*) and voltage (*Vn*)
5. Power factor (*cosϕ*) and rated current (*In*)
6. Rated speed (*ωn*) and frequency (*fn*)
7. Maximum speed (*ωm*) and frequency (*fm*)
8. Rated torque (*Tn*)
9. Manufacturing details
10. Feedback type (*ENCODER* or *RESOLVER* or *NO* feedback)
11. Mechanical brake rated- voltage (*24 Vdc*), current (*Adc*), torque (*Nm*)
12. CE marking
13. Motor Bar Code
14. Fan Type
15. Fan rated voltage (*Vn*)
16. Fan rated frequency (*fn*)
17. Fan rated current at 50 Hz frequency (*In50*)
18. Fan rated current at 60 Hz frequency (*In60*)
19. Fan rated power (*Pn*)

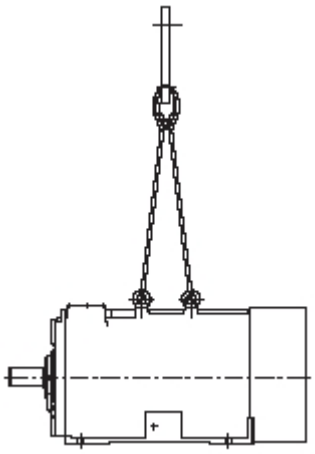
Chapter 3 – Mechanical Installation

Introduction

This chapter provides information on mechanical installation of the HDP Servomotors manufactured by ABB Sace S.p.A.

Lifting the motor

The servomotor should be lifted by a suitable crane from the lifting eyes located on the motor frame.



Carefully place and mount the servomotor on the machine. During this procedure avoid collision with any other equipment or damaging of any part of the motor.

Finish installation: fix the motor to the mounting flange or foundation, and couple to the load.

Note. Proper mechanical installation includes correct alignment between motor and load to avoid vibrations and consequently shaft, bearing failures.

Usage notes

A particular care from the mechanical point of view must be devoted when using any kind of servomotor.

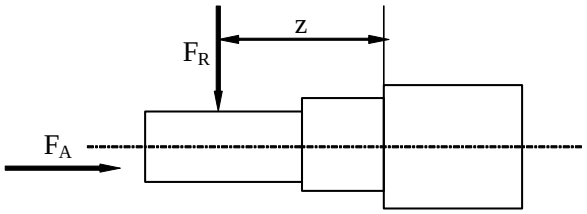
Since the most delicate part of a servomotor are bearings and shaft, information on mounting constraints and on the usage of the coupling of the motor to its load through the DE shaft will be in particular given.

On the other hand, for what concerns mounting of the motor to the mechanical body of the machine there are not particular instructions or recommendations, but the normal professional competence of the installer.

For the best use of HDP Series servomotors, table below indicates axial and radial loads for each servomotor, which must not be exceeded in order to guarantee a regular lifetime of 20,000 hours in continuous duty of the bearings with permanent lubrication. In general, the locked bearing is mounted on the motor front-side. The configuration related to the load application is shown in figure.

Loads on DE shaft

This figure shows schematically the loads that can be acting on the DE shaft.



Where:

- Fr = Radial load [N]
- Fa = Axial load [N]
- Z = distance between centers of DE bearing and pulley

Bearing lifetime calculation

Radial loads occur on the shaft DE when a pulley is applied to it.

In this case, to calculate the radial force acting on the DE bearing, and to therefore check if this force is compatible with the acceptable loads on the bearing (provided that the rated lifetime is needed), the following formula can be used:

$$F_r = 19.5 \times 10^6 \times \left(\frac{P_n}{n \times D} \right) \times K$$

Where:

- Fr = Radial load [N]
- Pn = Rated motor power [kW]
- n = rated motor speed [RPM]
- D = external pulley diameter
- K = coefficient depending on belt type
  - K = 1.2 (cogged belt)
  - K = 2.3 (V-belt)
  - K = 3.8 (flat belt)

Pulleys and couplings

Couplings, sheaves and pinions must be assembled using adequate tools, **absolutely avoiding the use of a hammer**, which could cause serious damage to the motor.

Once the assembly has been completed, the shaft should be greased in order to avoid oxidation.

Mounting according to IMVx configuration

In vertical mounting due to the different kind of mechanical loads, due to the vertical forces acting on the motor, it is necessary to consider the effect of these loads on the bearings life.

In these cases ABB Sace recommends to contact the Customer Service.

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Chapter 4 – Electrical Installation

Introduction

This chapter contains the instructions for electrical installation of HDP induction servomotors manufactured by ABB Sace S.p.A.

Safety

WARNING! **Electrical installation must be carried out only by skilled persons.** Carefully observe the *Safety Instructions* given at the beginning of this Manual.

Note. Electrical installation must be carried out observing the local standards as well. Electrical installation includes preparation and layout of the power and signal cables, insulation distances and requirements, earthing of the machine, compliance to EMC standards.

WARNING! Switch off both power and auxiliary supply of the drive before any operation of electrical installation or maintenance.

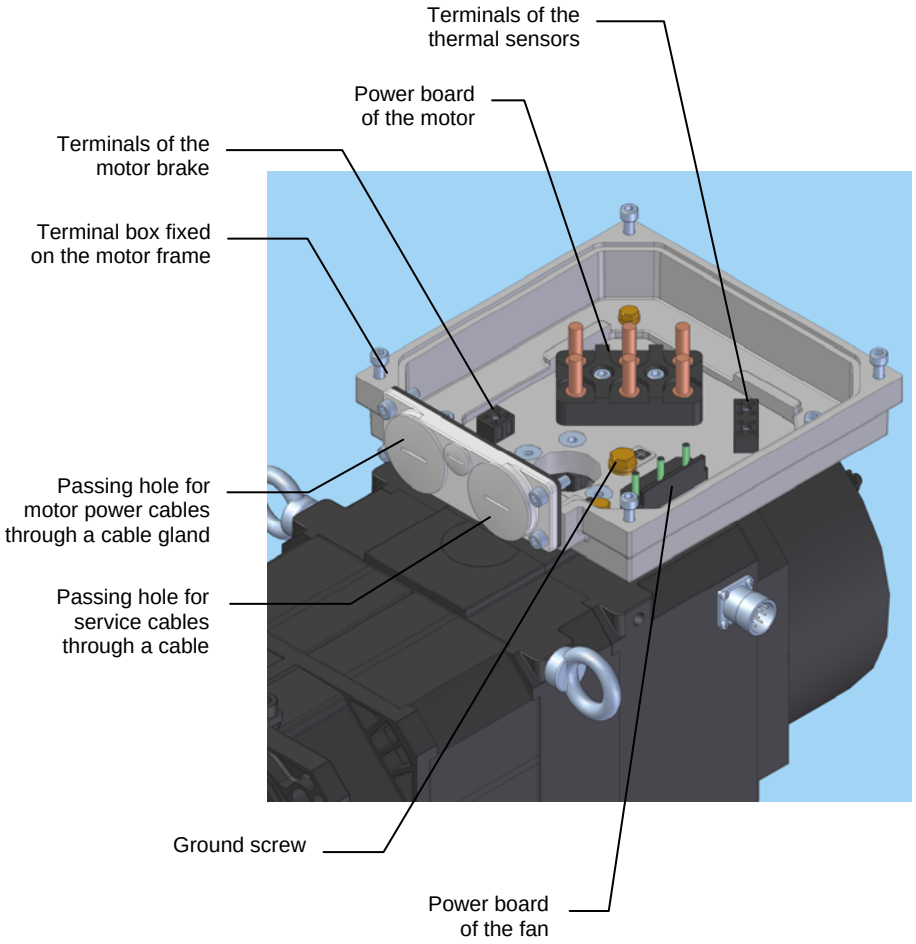
Electrical Connections

Electrical connections are made after the mechanical installation. Use the cables provided by ABB Sace or prepare the cables following the instructions given in this Chapter.

HDP Servomotors are provided with

- a die cast aluminium terminal box with two holes for connecting the motor and fan power supply cables, the thermistors and the optional brake;
- a signal connector fixed on the motor frame, typically on the back-flange, for connecting the position transducer.

Overview of the Terminal Box



Note. Connections must be made passing the cables through the passing holes and using cable glands.

Cable glands are not provided with the motor. The passing holes are closed with screw caps.

When connecting the servomotor, remove the caps and arrange the wiring so that the motor power cables pass through the same hole, and all the service cables pass through the second large hole.

Power Connections

ABB Sace can provide preassembled power cables. For information please contact our Customer Support.

When preparing the power cables by hand, note that:

- the size of the power input cables must be adequate for the current load,
- the termination of each conductor must have adequate size and the proper shape. Terminals inside the terminal box require conductors terminated with an eyelet.

Servomotor

For the motor power cable use a shielded four-pole cable (three-phases + yellow-green), with appropriate cross section.

The cable shall pass through a cable gland. Each conductor shall be tightened to the screwed terminals of the motor power terminals board. For this operation use the nuts and washers provided together with the motor.

When connecting, observe the correspondence of the U, V, W phase symbols attached inside the terminal box. The yellow-green earth cable must be connected to the ground screw inside the motor terminal box. The motor ground is marked with the earth symbol according to international standards.

It is also recommended to perform the installation of the motor according to the grounding and cabling instructions described in the converter manual. A general advice is given in Appendix B, *Application Guidelines to Electromagnetic Compatibility*.

Fan

The fan is a three-phase asynchronous motor. It can be built into the motor frame (IP54) or fixed externally on the motor frame (IP23).

Prepare the fan supply cable using a shielded four-pole cable (three-phases + yellow-green), with appropriate cross section.

The cable shall pass through the smaller cable gland. Each phase conductor shall be tightened to the screwed terminals of the fan terminal board and the earth cable connected to the ground screw inside the motor terminal box.

The ratings of the fan motor are given on the motor plate.

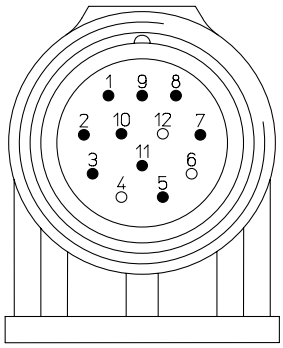
Note that the fan motor can be supplied by one of the following supply systems:

- Three-phase 220 Vac, 50/60 Hz
- Three-phase 400 Vac, 50/60 Hz

Encoder Feedback Standard HDP Servomotors embody an encoder sensor.

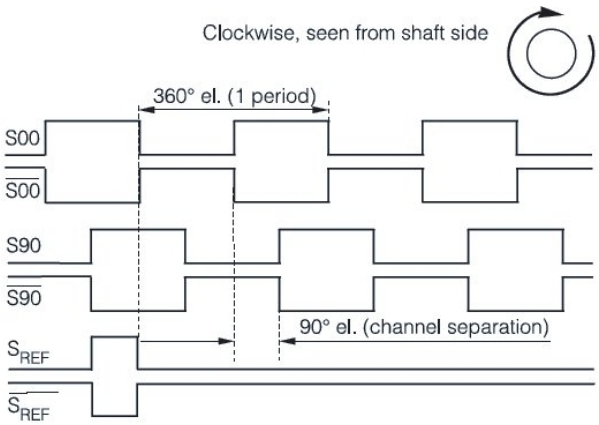
The encoder terminal is a standard 12-pin male connector for industrial application. The connector is fixed on the motor back-flange.

Output Signals When the motor embodies a HTL incremental encoder type Leine & Linde RHI 503, the pin-out of the signal connector is as follows.



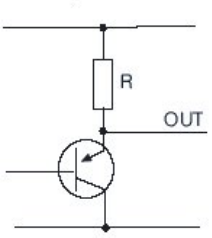
PIN	Signal
1	S90 inverted
2	-
3	Sref
4	Sref inverted
5	S00
6	S00 inverted
7	STATUS output
8	S90
9	-
10	0 Volt
11	-
12	+E Volt

The following describes the electrical specs of the encoder circuit. HTL encoders provide square wave pulse signals trains.

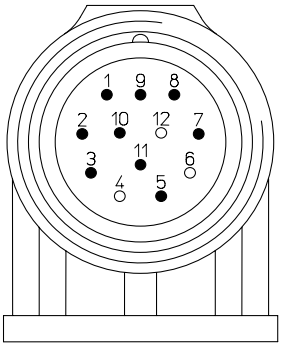


Technical Data	
Number of lines	1024
Power supply	9-30 V
Polarity protected	Yes
Short-circuit protected	Yes
Current consumption	50 mA @ 24Vdc
Max consumption	75 mA
Max output load	± 40 mA
Max output frequency	300 kHz
U-high @ 10 mA load	> +EV - 2.0 V
U-low @ 10 mA load	< 1.15 V
Status output high	Encoder OK
Status output low	Encoder failure

Status output circuit

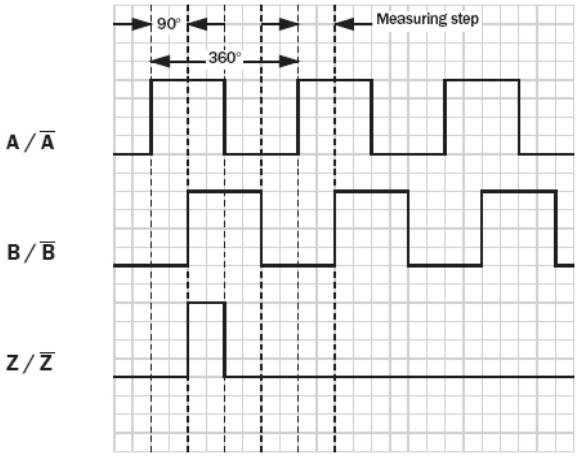


When the motor embodies a HTL incremental encoder type Stegmann DGS66-HAZ0-S02, the pin-out of the signal connector is as follows.



PIN	Signal
1	Channel A+
2	-
3	Channel A-
4	Channel Z+
5	Channel Z-
6	Channel B-
7	-
8	Channel B+
9	-
10	Ground
11	Shield
12	Supply

The following describes the electrical specs of the encoder circuit. HTL encoders provide square wave pulse signals trains.



Technical Data	
Number of lines	1024
Power supply	12-30 V
Polarity protected	Yes
Short-circuit protected	Yes
Current consumption	100 mA @ 24Vdc @ no load
Max consumption	70 mA
Max output frequency	300 kHz
Status output high	Encoder OK
Status output low	Encoder failure

Note. Grounding and cabling of the drive system is very important to comply with EMC standards and to avoid noisy motion due to conducted noises.

In order to suppress electromagnetic disturbances the encoder cable must be shielded over 360° and connected to the ground terminal both on the motor and on the converter side.

Connection of the Thermal Sensor

Inside the motor two thermal switches are provided by default. As stated above, the thermal switches may be replaced with PTC thermal sensors, according to a special ordering code.

The thermal sensitive devices inform the converter control circuit about the temperature of the motor windings. These thermal sensors must be wired to the converter used for the application and the converter must be set with proper alarm tripping thresholds, in order to trigger a possible overtemperature of the motor windings.

Output wires of the thermal devices are available inside the motor terminal box on a separate board. These sensors can be connected in parallel or in series at user's choice and the wires shall pass through the cable gland before being connected to the converter.

Note. The motor windings are manufactured according to temperature rise class F. The maximum operating temperature of the windings is 140°C. Higher temperatures will damage the windings insulation, therefore adequate alarm levels and protection functions must be set on the converter.

Chapter 5 – Servomotors Ratings

Introduction

This Chapter provides an overview of the servomotors ratings by type, size and speed code.

HDP Servomotors Data @ 400VAC Rated Voltage

The tables following in this Chapter specify the performance data of HDP Servomotors series, by type, size and rated speed. All the data refer to 400 VAC rated voltage motors, characterized by letter A in 14th position of the motor code.

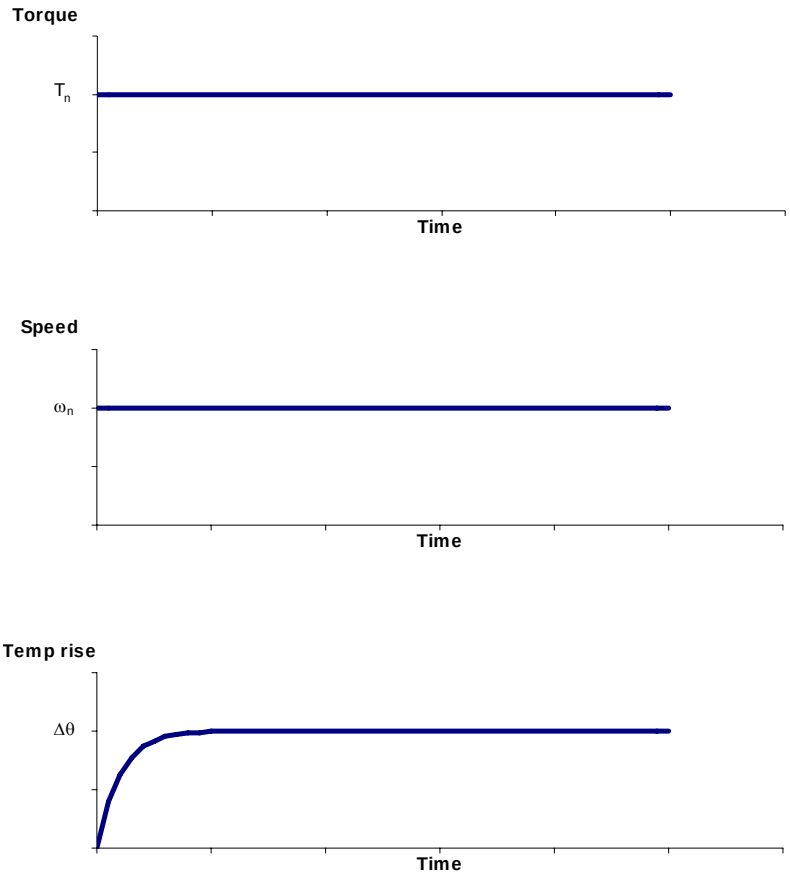
Performance data of the servomotors are provided for both continuous (“S1 - Continuous”) and periodic duty (“S6 40% - Periodic”). Graphs show the operating curves of peak torque, rated torque and continuous torque in “S6 40%”. See also next section *Duty Types* for details.

Note that not all types and sizes are shown below. Please contact ABB Sace - Line S, Sales Office, for all available options.

Duty Type The duty type of an electrical machine defines the specifications of the machine operation in terms of load, speed and time of operation. A machine duty can be of “continuous”, “short-time” or “periodic” type.

Continuous Duty “S1” Continuous duty type “S1” means by definition a continuous operation at constant load and speed in which the motor reaches the thermal equilibrium (IEC 60034-1).

The figure below illustrates duty type “S1” at rated torque.



Periodic Duty "S6 - 40%"

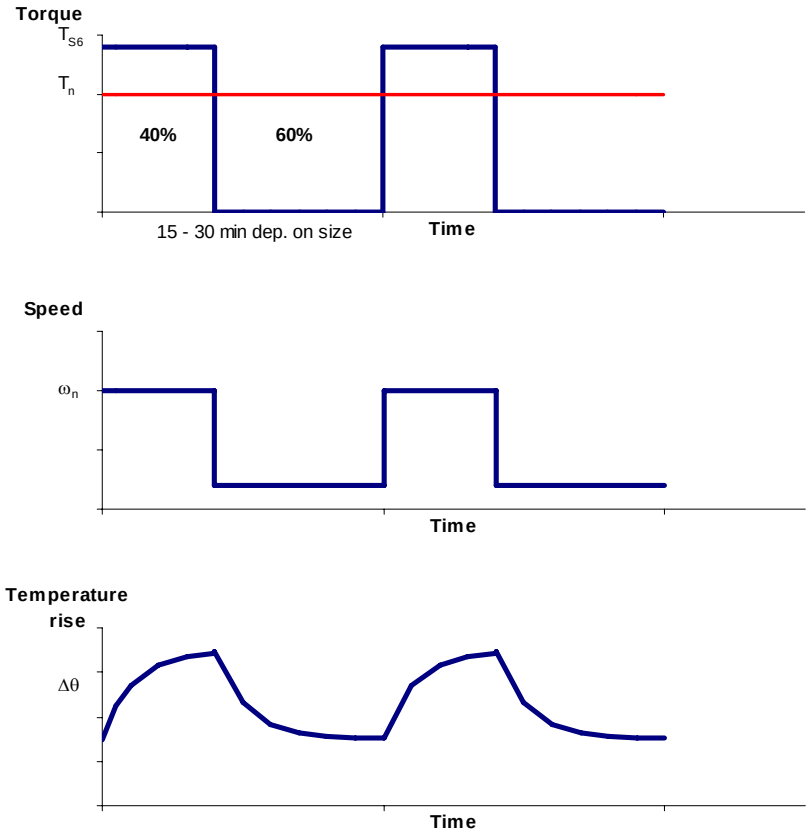
Periodic duty means by definition a continuous duty cycle in which the motor does not reach the operative temperature (IEC 60034-1). Periodic duty type "S6" allows a duty cycle that consists of

- a time of operation at constant load, higher than rated torque,
- and a time of operation running at no-load, in which the motor temperature returns approximately to ambient temperature.

Periodic duty type "S6" is followed by an indication of the so called "cyclic duration factor", that is

$$\frac{Load\ time\ [s]}{Duty\ cycle\ time\ [s]}\ \%$$

The figures below show an example of continuous torque, speed and temperature curves in periodic duty "S6 40%".



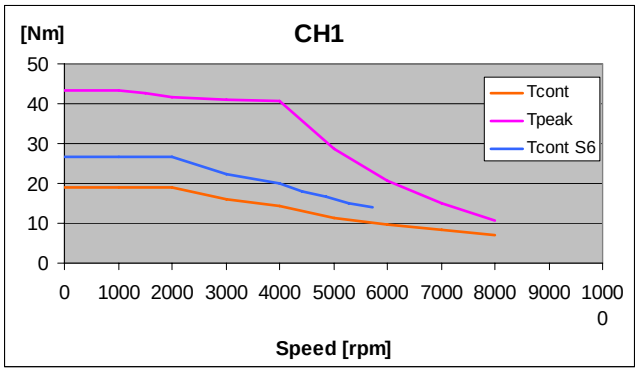
H100 – IP54 Rated Data

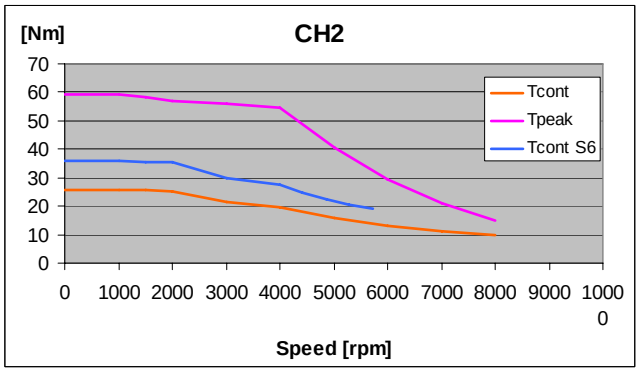
IP54 Servomotors Rated Data (Vn = 400 V)															
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H100	CH1	.1	1000	52,5	2,0	19,1	5,4	2000	2,8	26,7	7,6	1430	2,3	0.0062
		.2	1500	77,4	3,0	19,1	7,9	3000	4,2	26,7	11,1	2150		
		.3	2000	102,4	4,0	19,1	10,2	4000	5,6	26,7	14,3	2860		
		.5	3000	152,2	5,0	15,9	12,7	6000	7,0	22,3	17,8	4290		
		.7	4000	202,3	6,0	14,3	15,4	8000	8,4	20,1	21,6	5720		
	CH2	.1	1000	52,4	2,7	25,8	7,1	2000	3,8	36,1	9,9	1430	2,3	0.0075
		.2	1500	77,3	4,0	25,5	10,3	3000	5,6	35,7	14,4	2150		
		.3	2000	102,3	5,3	25,3	13,4	4000	7,4	35,4	18,8	2860		
		.5	3000	152,1	6,7	21,3	17,1	6000	9,4	29,8	23,9	4290		
		.7	4000	202,1	8,2	19,6	21,2	8000	11,5	27,4	29,7	5720		
	CH3	.1	1000	52,3	3,7	35,4	9,5	2000	5,2	49,5	13,3	1430	2,3	0.0102
		.2	1500	77,2	5,4	34,4	13,7	3000	7,6	48,1	19,2	2150		
		.3	2000	102,3	7,2	34,4	17,8	4000	10,1	48,1	24,9	2860		
		.5	3000	152,0	9,4	29,9	23,4	6000	13,2	41,9	32,8	4290		
		.7	4000	202,2	11,3	27,0	27,8	8000	15,8	37,8	38,9	5720		
	CH4	.1	1000	52,3	5,0	47,7	12,5	2000	7,0	66,8	17,5	1430	2,3	0.0142
		.2	1500	77,2	7,4	47,1	18,4	3000	10,4	65,9	25,8	2150		
		.3	2000	102,2	9,7	46,3	23,5	4000	13,6	64,8	32,9	2860		
		.5	3000	151,9	12,6	40,1	31,2	6000	17,6	56,2	43,7	4290		
		.7	4000	202,0	15,3	36,5	38,9	8000	21,4	51,1	54,5	5720		
	CH5	.1	1000	52,2	6,0	57,3	15,0	2000	8,4	80,2	21,0	1430	2,3	0.0168
		.2	1500	77,1	8,9	56,7	22,0	3000	12,5	79,3	30,8	2150		
		.3	2000	102,1	11,7	55,9	28,5	4000	16,4	78,2	39,9	2860		
		.5	3000	151,9	14,9	47,4	36,4	6000	20,9	66,4	51,0	4290		
		.7	4000	202,0	17,9	42,7	44,3	8000	25,1	59,8	62,0	5720		
	CH6	.1	1000	52,3	7,4	70,6	18,1	2000	10,4	98,9	25,3	1430	2,2	0.0198
		.2	1500	77,1	10,9	69,4	26,7	3000	15,3	97,2	37,4	2150		
		.3	2000	102,2	14,2	67,8	33,7	4000	19,9	94,9	47,2	2860		
		.5	3000	151,9	18,0	57,3	43,8	6000	25,2	80,2	61,3	4290		
		.7	4000	202,0	20,5	48,9	49,8	8000	28,7	68,5	69,7	5720		

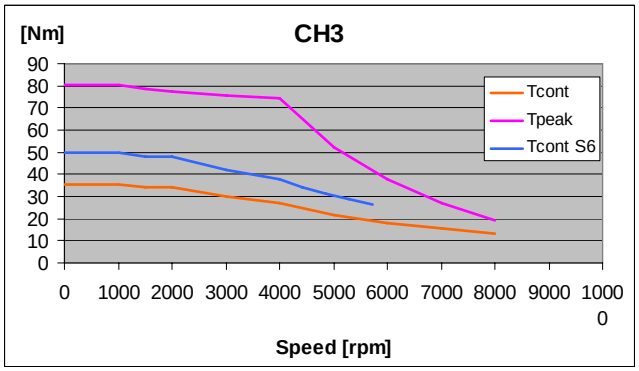
Note. Accuracy of the motor torque, current and power data is 10%.

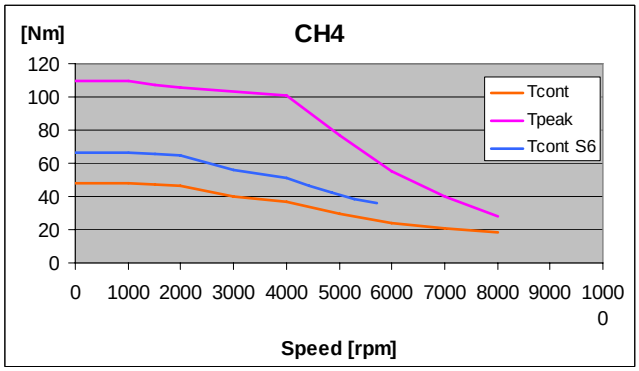
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

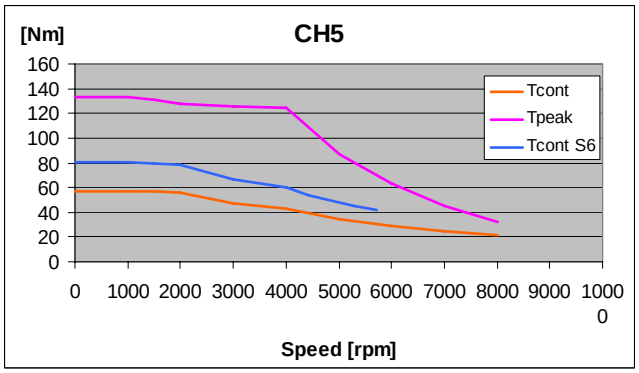
H100 – IP54 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H100 – IP54.

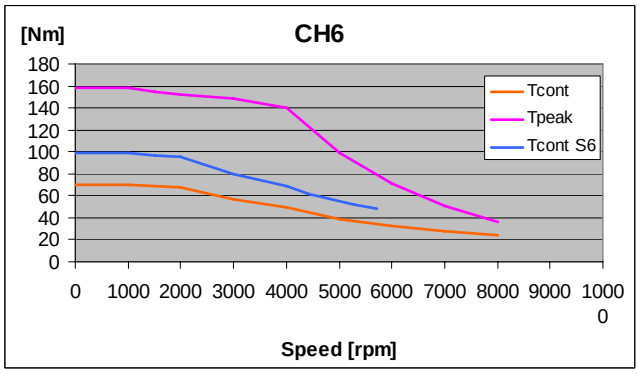












The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “CH1” refers to motor type CH1.7. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

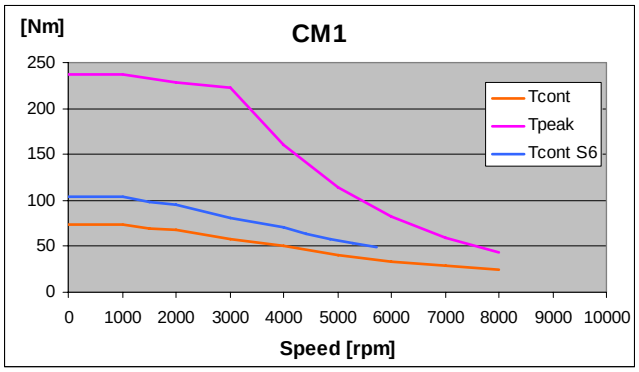
H132 – IP54 Rated Data

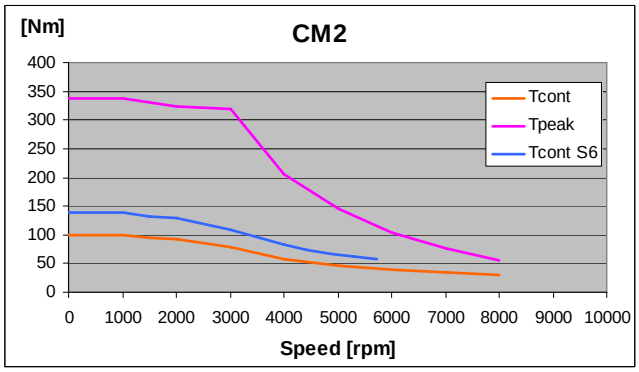
IP54 Servomotors Rated Data (Vn = 400 V)														
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H132	CM1	.1	1000	35,2	7,8	74,3	17,4	2500	10,9	104,0	24,4	1790	3,2	0,061
		.2	1500	51,6	11,0	70,0	25,7	3750	15,4	98,0	36,0	2680		
		.3	2000	68,2	14,2	68,0	29,0	5000	19,9	95,2	40,6	3580		
		.5	3000	101,7	18,3	58,2	36,1	7500	25,6	81,5	50,5	5360		
		.7	4000	135,6	21,0	50,1	37,2	8000	29,4	70,2	52,1	5720		
	CM2	.1	1000	35,0	10,4	99,4	22,0	2500	14,6	139,1	30,8	1790	3,4	0,080
		.2	1500	51,5	14,8	94,3	32,1	3750	20,7	132,0	44,9	2680		
		.3	2000	68,3	19,3	92,2	37,4	5000	27,0	129,1	52,4	3580		
		.5	3000	101,5	24,6	78,3	48,2	7500	34,4	109,7	67,5	5360		
		.7	4000	135,4	29,8	71,1	51,5	8000	41,7	99,6	72,1	5720		
	CM3	.1	1000	34,9	12,5	119,4	26,3	2500	17,5	167,2	36,8	1790	3,5	0,094
		.2	1500	51,5	17,9	114,0	37,0	3750	25,1	159,6	51,8	2680		
		.3	2000	68,2	23,5	112,3	46,1	5000	32,9	157,2	64,5	3580		
		.5	3000	101,6	29,6	94,2	55,7	7500	41,4	131,9	78,0	5360		
		.7	4000	135,5	34,5	82,4	59,6	8000	48,3	115,3	83,4	5720		
	CM4	.1	1000	34,8	16,2	154,7	33,2	2500	22,7	216,6	46,5	1790	3,5	0,122
		.2	1500	51,5	23,5	149,6	46,3	3750	32,9	209,4	64,8	2680		
		.3	2000	68,2	30,6	146,1	57,4	5000	42,8	204,6	80,4	3580		
		.5	3000	101,5	38,2	121,6	70,3	7500	53,5	170,2	98,4	5360		
		.7	4000	135,3	43,2	103,1	74,5	8000	60,5	144,4	104,3	5720		
	CM5	.1	1000	34,8	20,8	198,4	42,3	2500	29,1	277,8	59,2	1790	3,5	0,150
		.2	1500	51,4	30,2	192,3	60,8	3750	42,3	269,2	85,1	2680		
		.3	2000	68,2	40,0	190,9	75,6	5000	56,0	267,2	105,8	3580		
		.5	3000	101,4	49,3	157,0	91,4	7500	69,0	219,8	128,0	5360		
		.7	4000	135,5	54,4	129,8	92,5	8000	76,2	181,8	129,5	5720		

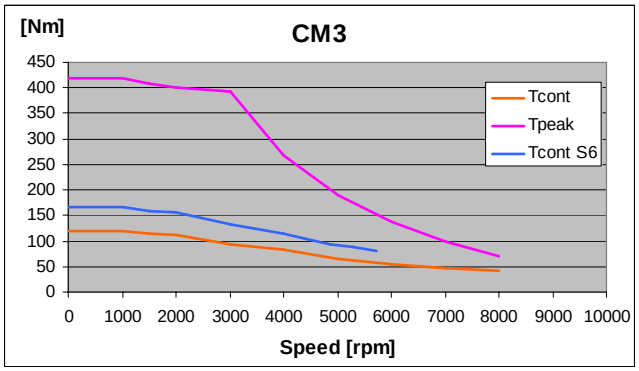
Note. Accuracy of the motor torque, current and power data is 10%.

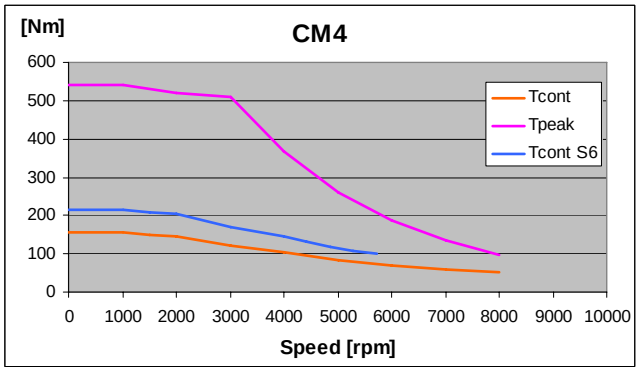
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

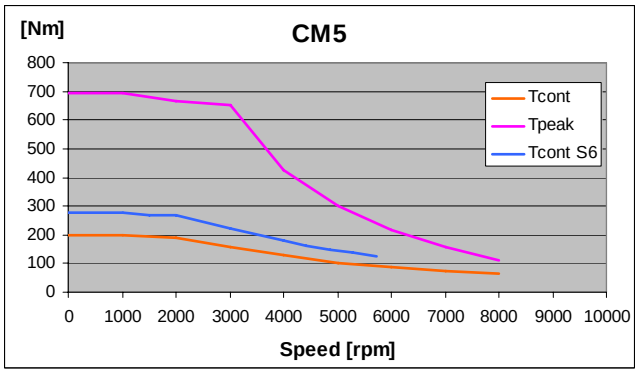
H132 – IP54 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H132 – IP54.











The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “CM1” refers to motor type CM1.7. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

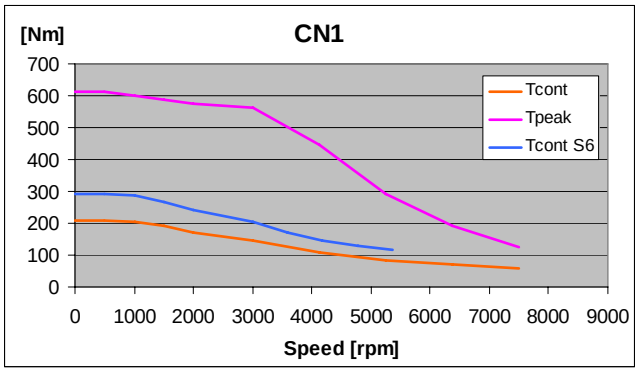
H160 – IP54 Rated Data

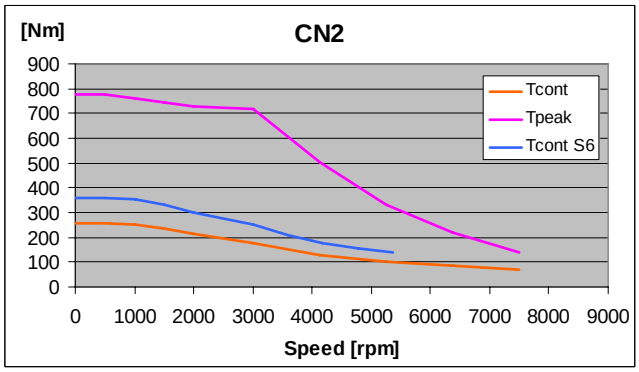
IP54 Servomotors Rated Data (Vn = 400 V)														
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H160	CN1	.0	500	17,6	11,0	209,5	25,3	1250	15,4	293,3	35,4	900	2,9	0,24
		.1	1000	34,2	21,4	204,5	43,5	2500	30,0	286,2	60,9	1790		
		.2	1500	50,9	30,0	190,9	57,8	3750	42,0	267,2	80,9	2680		
		.3	2000	67,5	36,0	171,9	68,2	5000	50,4	240,6	95,5	3580		
		.5	3000	100,8	46,0	146,5	83,2	7500	64,4	205,0	116,5	5360		
	CN2	.0	500	17,5	13,5	258,2	29,7	1250	18,9	361,5	41,6	900	3,0	0,28
		.1	1000	34,2	26,4	252,0	52,6	2500	37,0	352,7	73,6	1790		
		.2	1500	50,8	37,0	235,7	70,7	3750	51,8	329,9	99,0	2680		
		.3	2000	67,5	45,1	215,2	84,7	5000	63,1	301,3	118,6	3580		
		.5	3000	100,9	56,0	178,2	97,2	7500	78,4	249,5	136,1	5360		
	CN3	.0	500	17,5	16,3	311,3	34,4	1250	22,8	435,8	48,2	900	3,1	0,34
		.1	1000	34,2	31,7	302,5	60,6	2500	44,4	423,5	84,8	1790		
		.2	1500	50,8	45,0	286,4	85,1	3750	63,0	401,0	119,1	2680		
		.3	2000	67,4	54,4	259,9	100,5	5000	76,2	363,9	140,7	3580		
		.5	3000	100,8	68,8	219,1	118,1	7500	96,3	306,7	165,3	5360		
	CN4	.0	500	17,5	19,2	366,5	39,2	1250	26,9	513,2	54,9	900	3,1	0,40
		.1	1000	34,2	37,3	355,7	70,2	2500	52,2	498,0	98,3	1790		
		.2	1500	50,8	52,7	335,2	99,2	3750	73,8	469,3	138,9	2680		
		.3	2000	67,4	64,6	308,5	119,3	5000	90,4	431,9	167,0	3580		
		.5	3000	100,8	80,0	254,7	137,3	7500	112,0	356,5	192,2	5360		
	CN5	.0	500	17,4	22,0	420,4	47,3	1250	30,8	588,6	66,2	900	3,4	0,46
		.1	1000	34,1	41,9	400,3	78,6	2500	58,7	560,4	110,0	1790		
		.2	1500	50,8	59,0	375,2	107,8	3750	82,6	525,3	150,9	2680		
		.3	2000	67,4	71,7	342,1	134,3	5000	100,4	479,0	188,0	3580		
		.5	3000	100,8	91,7	291,9	156,2	7500	128,4	408,7	218,7	5360		

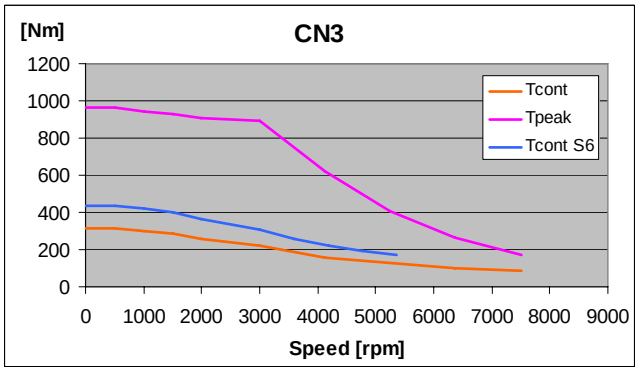
Note. Accuracy of the motor torque, current and power data is 10%.

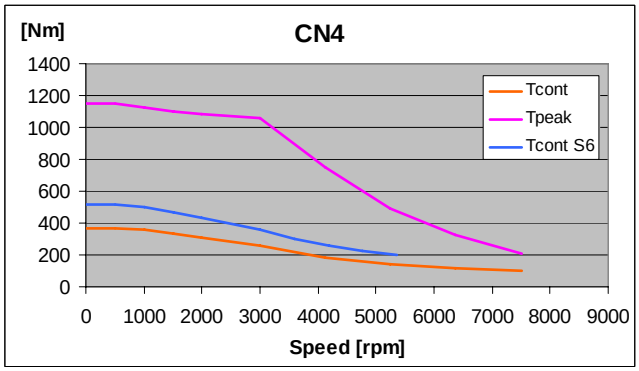
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

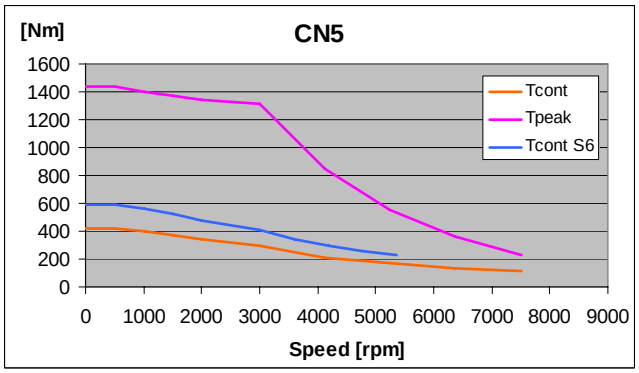
H160 – IP54 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H160 – IP54.











The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “CN1” refers to motor type CN1.5. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

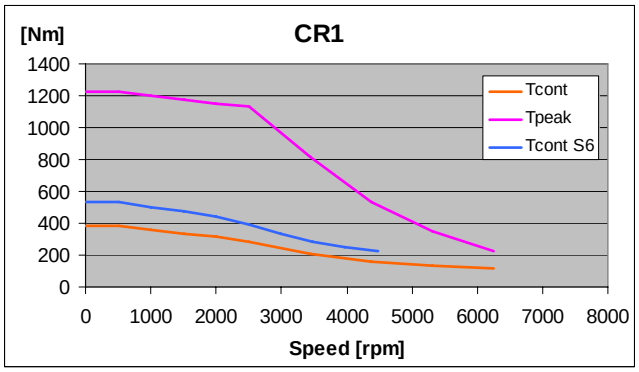
H200 – IP54 Rated Data

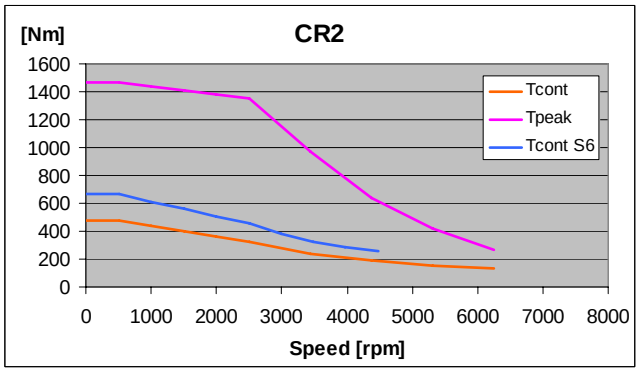
IP54 Servomotors Rated Data (Vn = 400 V)														
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H200	CR1	.0	500	17,3	20,0	381,2	43,6	1250	28,0	533,7	61,0	900	3,2	0,68
		.1	1000	33,9	37,5	357,9	79,0	2500	52,5	501,1	110,6	1790		
		.2	1500	50,6	53,0	337,1	103,6	3750	74,2	471,9	145,0	2680		
		.3	2000	67,2	65,5	312,9	122,8	5000	91,7	438,0	171,9	3580		
		.4	2500	83,9	74,0	282,7	133,8	6250	103,6	395,7	187,3	4470		
	CR2	.0	500	17,3	25,0	477,3	52,1	1250	35,0	668,2	72,9	900	3,1	0,78
		.1	1000	33,9	45,5	434,1	94,8	2500	63,7	607,7	132,7	1790		
		.2	1500	50,5	62,5	398,0	123,4	3750	87,5	557,3	172,8	2680		
		.3	2000	67,2	75,0	358,0	142,8	5000	105,0	501,2	199,9	3580		
		.4	2500	83,9	85,5	326,5	152,9	6250	119,7	457,1	214,1	4470		
	CR3	.0	500	17,2	27,9	534,3	56,7	1250	39,1	748,1	79,4	900	3,3	0,91
		.1	1000	33,9	52,0	495,9	103,5	2500	72,8	694,2	144,9	1790		
		.2	1500	50,5	72,5	461,5	140,3	3750	101,5	646,1	196,4	2680		
		.3	2000	67,2	88,5	422,4	163,0	5000	123,9	591,3	228,2	3580		
		.4	2500	83,9	103,0	393,2	183,1	6250	144,2	550,5	256,3	4470		
	CR4	.0	500	17,2	33,0	631,4	64,1	1250	46,2	883,9	89,7	900	3,3	1,09
		.1	1000	33,9	60,0	572,2	110,5	2500	84,0	801,1	154,7	1790		
		.2	1500	50,5	85,0	541,2	152,6	3750	119,0	757,7	213,6	2680		
		.3	2000	67,2	103,0	491,4	184,9	5000	144,2	688,0	258,9	3580		
		.4	2500	83,9	117,5	448,6	200,8	6250	164,5	628,1	281,1	4470		
	CR5	.0	500	17,2	40,5	774,6	75,8	1250	56,7	1084,4	106,1	900	3,4	1,34
		.1	1000	33,8	70,0	668,5	128,6	2500	98,0	935,9	180,0	1790		
		.2	1500	50,4	94,5	602,1	169,5	3750	132,3	843,0	237,3	2680		
		.3	2000	67,1	111,5	532,7	189,9	5000	156,1	745,8	265,9	3580		
		.4	2500	83,9	134,0	511,7	223,4	6250	187,6	716,3	312,8	4470		

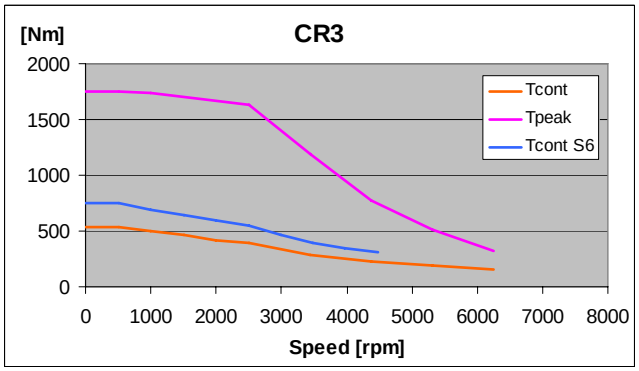
Note. Accuracy of the motor torque, current and power data is 10%.

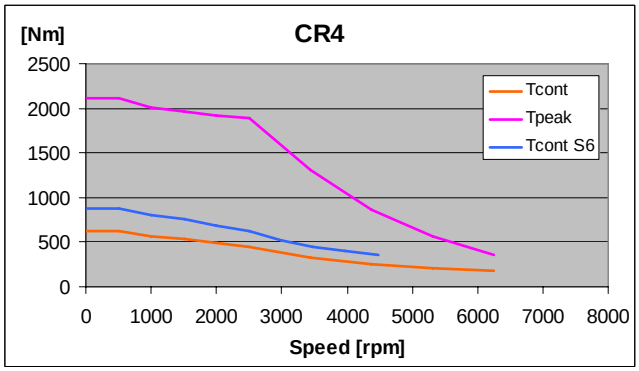
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

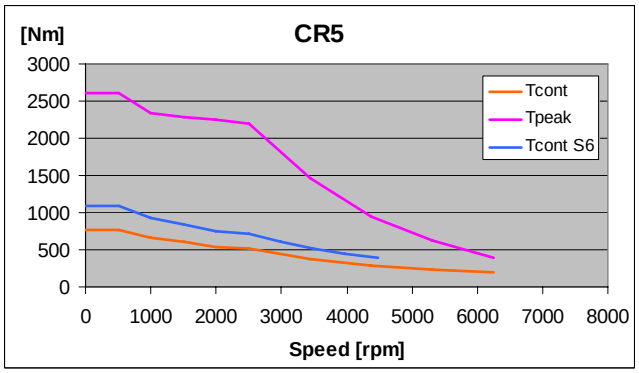
H200 – IP54 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H200 – IP54.











The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “CR1” refers to motor type CR1.4. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

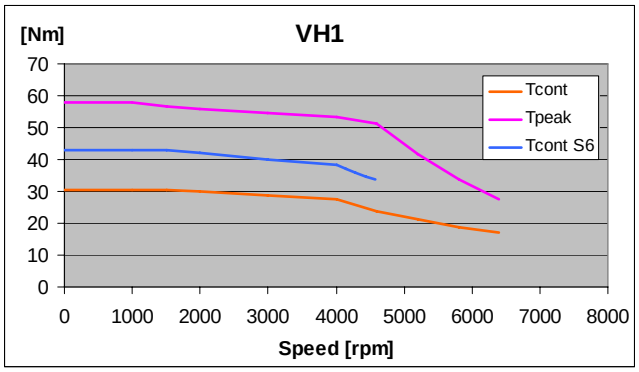
H100 – IP23 Rated Data

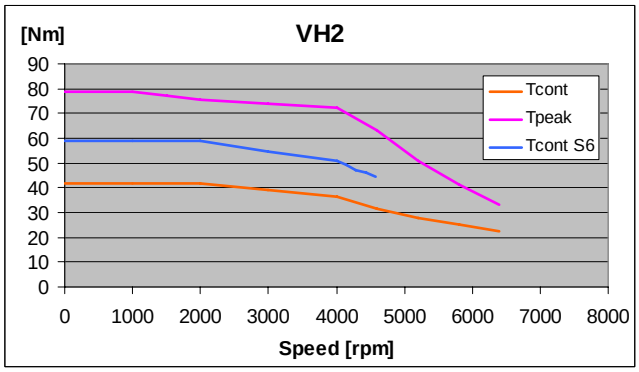
IP23 Servomotors Rated Data (Vn = 400 V)															
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H100	VH1	.1	1000	53,3	3,2	30,6	10,1	1600	4,5	42,8	14,1	1150	1,9	0.0062
		.2	1500	78,5	4,8	30,5	13,5	2400	6,7	42,8	18,9	1720		
		.3	2000	103,3	6,3	30,1	17,6	3200	8,8	42,1	24,6	2290		
		.5	3000	153,2	9,0	28,6	24,3	4800	12,6	40,1	34,0	3430		
		.7	4000	202,9	11,5	27,5	33,3	6400	16,1	38,4	46,6	4580		
	VH2	.1	1000	53,3	4,4	42,0	13,3	1600	6,2	58,8	18,6	1150	1,9	0.0075
		.2	1500	78,2	6,6	42,0	19,1	2400	9,2	58,8	26,7	1720		
		.3	2000	103,3	8,8	42,0	24,1	3200	12,3	58,8	33,7	2290		
		.5	3000	153,0	12,3	39,2	33,9	4800	17,2	54,8	47,5	3430		
		.7	4000	203,0	15,2	36,3	39,1	6400	21,3	50,8	54,7	4580		
	VH3	.1	1000	53,2	6,0	57,3	17,6	1600	8,4	80,2	24,6	1150	1,9	0.0102
		.2	1500	78,1	9,0	57,3	25,3	2400	12,6	80,2	35,4	1720		
		.3	2000	103,2	11,9	56,8	31,2	3200	16,7	79,6	43,7	2290		
		.5	3000	152,9	16,7	53,2	44,5	4800	23,4	74,4	62,3	3430		
		.7	4000	202,9	20,3	48,5	51,1	6400	28,4	67,9	71,5	4580		
	VH4	.1	1000	53,0	8,0	76,3	23,2	1600	11,2	106,9	32,5	1150	1,9	0.0142
		.2	1500	78,1	12,0	76,3	32,0	2400	16,8	106,9	44,8	1720		
		.3	2000	103,0	15,8	75,4	41,6	3200	22,1	105,6	58,2	2290		
		.5	3000	152,7	21,6	68,8	56,7	4800	30,2	96,3	79,4	3430		
		.7	4000	202,7	27,7	66,1	71,8	6400	38,8	92,6	100,5	4580		
	VH5	.1	1000	52,8	9,2	87,9	26,3	1600	12,9	123,1	36,8	1150	2,0	0.0168
		.2	1500	77,8	13,8	87,8	37,4	2400	19,3	123,0	52,4	1720		
		.3	2000	102,8	17,8	85,0	46,3	3200	24,9	119,0	64,8	2290		
		.5	3000	152,5	25,2	80,2	69,5	4800	35,3	112,3	97,3	3430		
		.7	4000	202,6	31,2	74,5	78,4	6400	43,7	104,3	109,8	4580		
	VH6	.1	1000	52,7	10,7	102,1	30,6	1600	15,0	143,0	42,8	1150	2,1	0.0198
		.2	1500	77,8	16,1	102,4	42,3	2400	22,5	143,4	59,2	1720		
		.3	2000	102,7	21,3	101,7	56,6	3200	29,8	142,3	79,2	2290		
		.5	3000	152,6	30,0	95,5	77,6	4800	42,0	133,7	108,6	3430		
		.7	4000	202,3	32,3	77,1	79,4	6400	45,2	108,0	111,2	4580		

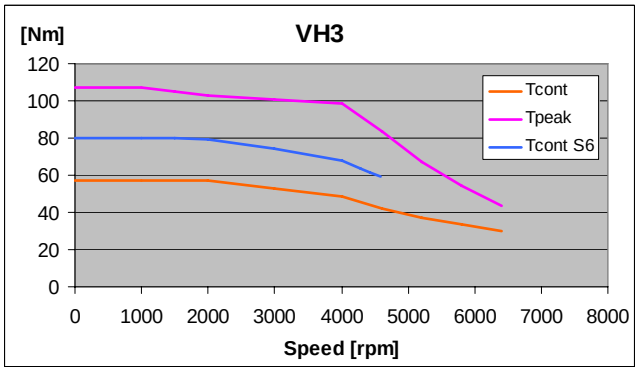
Note. Accuracy of the motor torque, current and power data is 10%.

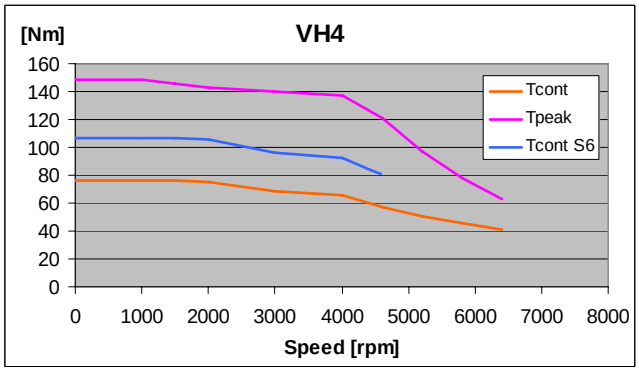
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

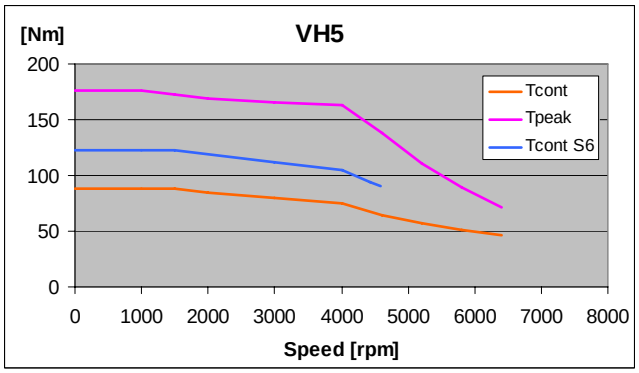
H100 – IP23 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H100 – IP23.

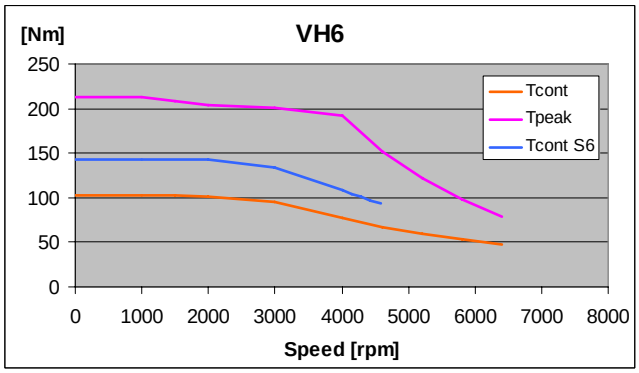












The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “VH1” refers to motor type VH1.7. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

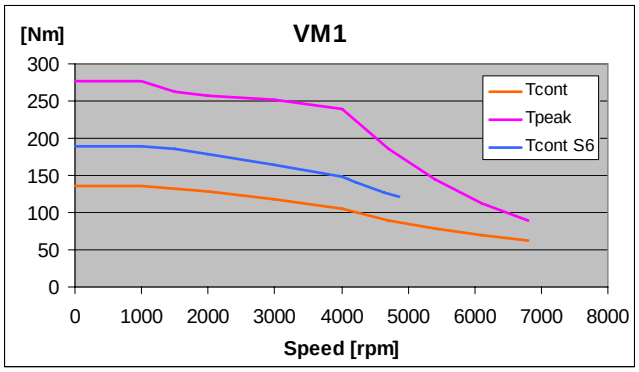
H132 – IP23 Rated Data

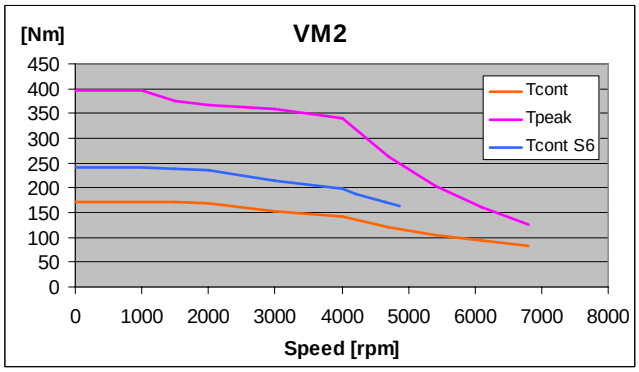
IP23 Servomotors Rated Data (Vn = 400 V)															
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H132	VM1	.1	1000	36,6	14,2	135,5	32,1	1500	19,9	189,7	44,9	1080	2,0	0,061
		.2	1500	53,3	20,9	133,0	43,2	2500	29,3	186,2	60,5	1790		
		.3	2000	69,8	26,8	127,9	53,2	3400	37,5	179,1	74,5	2430		
		.5	3000	103,1	37,0	117,7	70,0	5100	51,8	164,8	98,0	3650		
		.7	4000	136,7	44,3	105,7	79,2	6800	62,0	148,0	110,9	4860		
	VM2	.1	1000	36,1	18,0	172,0	38,7	1500	25,2	240,7	54,2	1080	2,3	0,080
		.2	1500	52,9	26,8	170,5	53,5	2500	37,5	238,7	74,9	1790		
		.3	2000	69,5	35,2	168,1	67,5	3400	49,3	235,4	94,5	2430		
		.5	3000	102,7	48,2	153,5	89,6	5100	67,5	214,8	125,4	3650		
		.7	4000	136,4	59,1	141,1	103,8	6800	82,7	197,5	145,3	4860		
	VM3	.1	1000	36,2	22,0	209,8	45,7	1500	30,8	293,7	64,0	1080	2,3	0,094
		.2	1500	52,7	32,8	209,0	65,0	2500	45,9	292,6	91,0	1790		
		.3	2000	69,5	42,8	204,4	80,4	3400	59,9	286,2	112,6	2430		
		.5	3000	102,6	58,4	185,9	107,4	5100	81,8	260,3	150,4	3650		
		.7	4000	136,5	68,9	164,4	119,3	6800	96,5	230,2	167,0	4860		
	VM4	.1	1000	35,9	28,4	271,1	57,4	1500	39,8	379,5	80,4	1080	2,5	0,122
		.2	1500	52,5	43,0	273,7	84,1	2500	60,2	383,2	117,7	1790		
		.3	2000	69,2	57,0	272,0	107,7	3400	79,8	380,9	150,8	2430		
		.5	3000	102,3	74,2	236,1	137,0	5100	103,9	330,6	191,8	3650		
		.7	4000	135,9	92,6	221,1	161,1	6800	129,6	309,5	225,5	4860		
	VM5	.1	1000	35,9	35,8	341,2	71,1	1500	50,1	477,7	99,5	1080	2,5	0,150
		.2	1500	52,4	53,0	337,5	101,7	2500	74,2	472,6	142,4	1790		
		.3	2000	69,1	69,8	333,4	129,0	3400	97,7	466,7	180,6	2430		
		.5	3000	102,3	91,0	289,7	163,3	5100	127,4	405,6	228,6	3650		
		.7	4000	135,7	111,5	266,2	193,9	6800	156,1	372,6	271,5	4860		

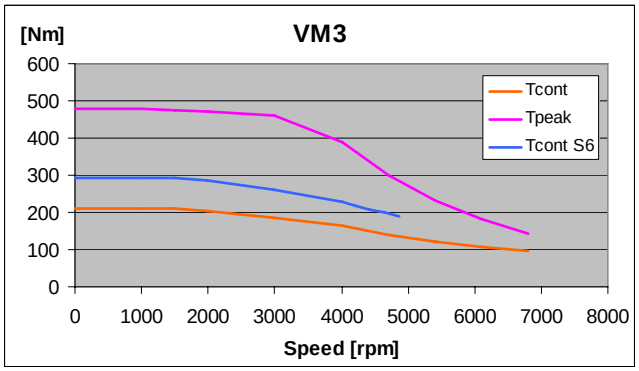
Note. Accuracy of the motor torque, current and power data is 10%.

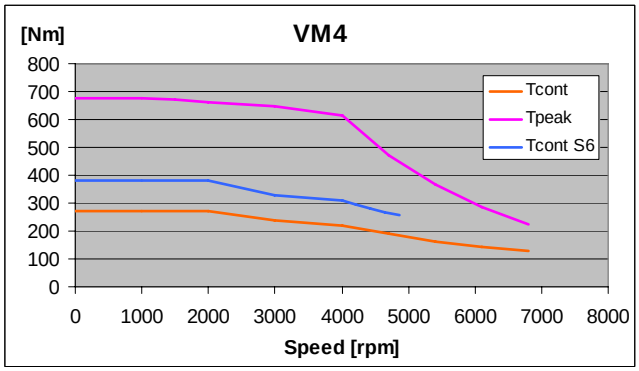
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

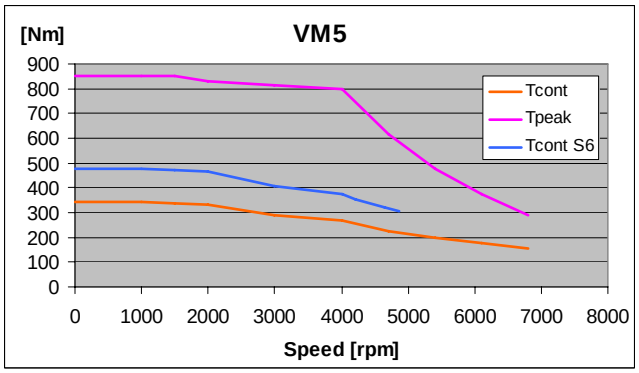
H132 – IP23 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H132 – IP23.











The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “VM1” refers to motor type VM1.7. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

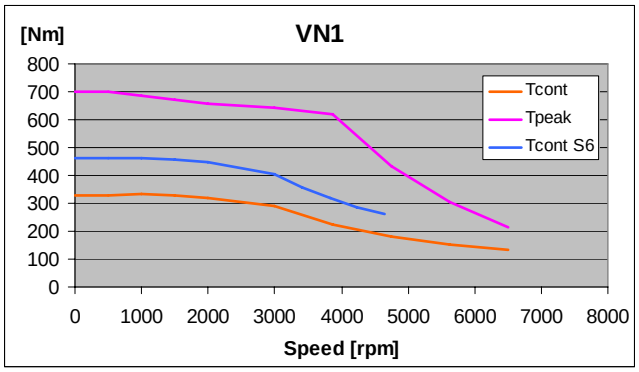
H160 – IP23 Rated Data

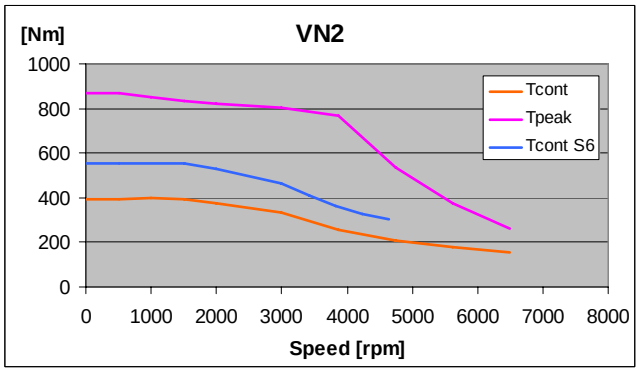
IP23 Servomotors Rated Data (Vn = 400 V)														
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H160	VN1	.0	500	18,0	17,2	328,6	39,4	1000	24,1	460,0	55,2	720	2,1	0,24
		.1	1000	34,7	34,7	331,1	70,2	2200	48,6	463,6	98,3	1580		
		.2	1500	51,4	51,5	327,7	97,3	3300	72,1	458,8	136,2	2360		
		.3	2000	68,0	67,1	320,3	127,3	4400	93,9	448,5	178,2	3150		
		.5	3000	101,3	91,0	289,6	165,1	6500	127,4	405,5	231,1	4650		
	VN2	.0	500	17,9	20,6	394,0	45,8	1000	28,8	551,6	64,1	720	2,2	0,28
		.1	1000	34,6	41,6	397,3	81,7	2200	58,2	556,2	114,4	1580		
		.2	1500	51,3	61,9	393,8	116,0	3300	86,7	551,4	162,4	2360		
		.3	2000	67,9	78,9	376,5	149,1	4400	110,5	527,1	208,7	3150		
		.5	3000	101,2	104,6	332,8	187,5	6500	146,4	466,0	262,5	4650		
	VN3	.0	500	17,8	24,2	463,1	52,1	1000	33,9	648,4	72,9	720	2,4	0,34
		.1	1000	34,5	48,0	457,6	95,0	2200	67,2	640,7	133,0	1580		
		.2	1500	51,2	71,2	453,0	131,4	3300	99,7	634,2	184,0	2360		
		.3	2000	67,8	91,7	438,1	166,7	4400	128,4	613,3	233,4	3150		
		.5	3000	101,1	123,2	392,3	214,8	6500	172,5	549,2	300,7	4650		
	VN4	.0	500	17,8	27,5	525,2	57,2	1000	38,5	735,3	80,1	720	2,4	0,40
		.1	1000	34,4	55,7	532,1	108,0	2200	78,0	745,0	151,2	1580		
		.2	1500	51,1	82,0	522,5	148,1	3300	114,8	731,5	207,3	2360		
		.3	2000	67,8	104,7	500,0	185,7	4400	146,6	700,0	260,0	3150		
		.5	3000	101,1	136,5	434,5	233,3	6500	191,1	608,3	326,6	4650		
	VN5	.0	500	17,7	30,5	583,7	62,7	1000	42,7	817,1	87,8	720	2,5	0,46
		.1	1000	34,4	62,1	591,9	120,7	2200	86,9	828,7	169,0	1580		
		.2	1500	51,0	92,2	587,4	169,6	3300	129,1	822,4	237,4	2360		
		.3	2000	67,7	117,4	560,7	211,1	4400	164,4	785,0	295,5	3150		
		.5	3000	101,1	155,6	495,1	266,0	6500	217,8	693,1	372,4	4650		

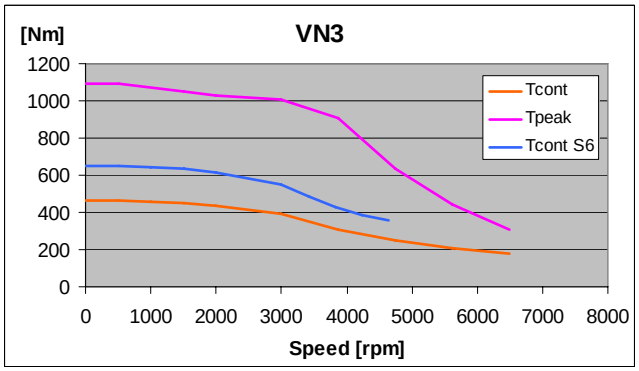
Note. Accuracy of the motor torque, current and power data is 10%.

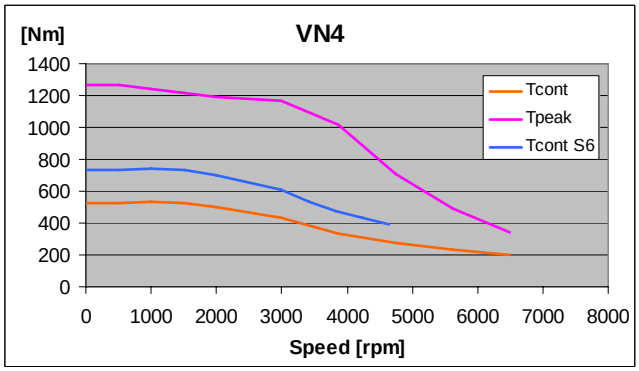
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

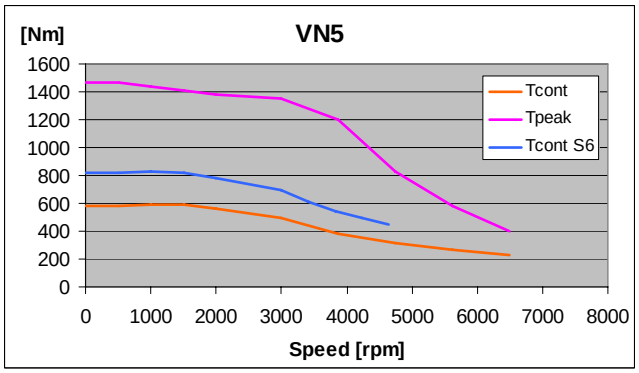
H160 – IP23 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H160 – IP23.











The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “VN1” refers to motor type VN1.5. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

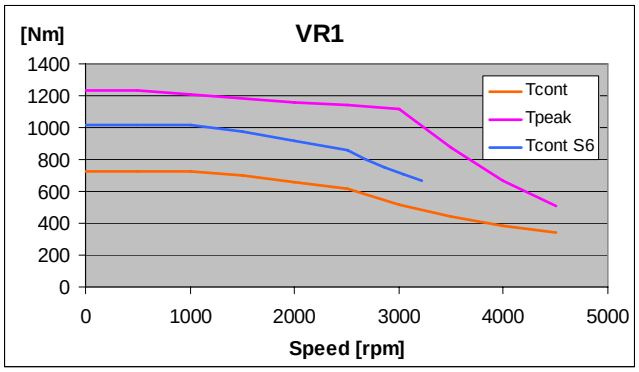
H200 – IP23 Rated Data

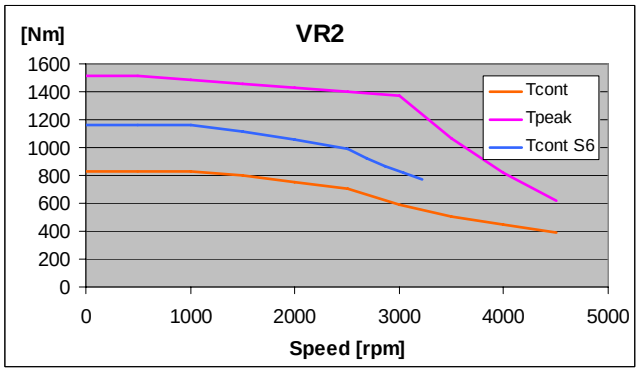
IP23 Servomotors Rated Data (Vn = 400 V)														
Frame	Main Data				Duty Type								Mmax / MN Ratio	Rotor Inertia
					S1 - Continuous				S6 40% - Periodic					
	Motor Code		Speed	Frequency	Power	Torque	Current	Max speed at constant P	Power	Torque	Current	Max speed at constant P		
	Size	Speed	nN[rpm]	fN[Hz]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]	PN[kW]	MN[Nm]	IN[A]	nmax[rpm]		J [kgm^2]
H200	VR1	.0	500	18,0	38,0	725,2	78,4	750	53,2	1015,2	109,8	540	1,7	0,68
		.1	1000	34,5	75,8	724,1	144,9	1800	106,1	1013,7	202,9	1290		
		.2	1500	51,1	109,4	696,6	203,2	2700	153,2	975,2	284,5	1930		
		.3	2000	67,8	137,8	657,6	246,6	3600	192,9	920,6	345,2	2580		
		.4	2500	84,4	161,0	615,2	281,8	4500	225,4	861,3	394,5	3220		
	VR2	.0	500	17,9	43,6	830,9	88,1	750	61,0	1163,2	123,3	540	1,8	0,78
		.1	1000	34,4	86,7	828,9	162,9	1800	121,4	1160,5	228,1	1290		
		.2	1500	51,1	125,2	796,3	228,1	2700	175,3	1114,8	319,3	1930		
		.3	2000	67,7	158,0	754,7	277,7	3600	221,2	1056,6	388,8	2580		
		.4	2500	84,4	185,8	709,3	324,4	4500	260,1	993,0	454,2	3220		
	VR3	.0	500	17,8	50,0	953,6	98,9	750	70,0	1335,0	138,5	540	1,9	0,91
		.1	1000	34,4	100,6	959,5	187,2	1800	140,8	1343,3	262,1	1290		
		.2	1500	51,0	146,2	930,7	263,3	2700	204,7	1302,9	368,6	1930		
		.3	2000	67,7	183,7	876,9	318,9	3600	257,2	1227,6	446,5	2580		
		.4	2500	84,4	214,0	817,1	363,6	4500	299,6	1143,9	509,0	3220		
	VR4	.0	500	17,6	58,8	1124,8	116,1	750	82,3	1574,7	162,5	540	2,1	1,09
		.1	1000	34,3	119,7	1142,4	221,7	1800	167,6	1599,3	310,4	1290		
		.2	1500	51,0	175,0	1112,7	312,1	2700	245,0	1557,8	436,9	1930		
		.3	2000	67,6	211,7	1010,9	363,6	3600	296,4	1415,3	509,0	2580		
		.4	2500	84,2	242,4	925,9	415,9	4500	339,4	1296,3	582,3	3220		
	VR5	.0	500	17,5	70,0	1339,0	136,0	750	98,0	1874,7	190,4	540	2,3	1,34
		.1	1000	34,2	137,0	1307,7	247,6	1800	191,8	1830,8	346,6	1290		
		.2	1500	50,8	201,8	1284,8	362,4	2700	282,5	1798,7	507,4	1930		
		.3	2000	67,6	262,3	1251,8	445,6	3600	367,2	1752,6	623,8	2580		
		.4	2500	84,2	270,0	1030,6	451,6	4500	378,0	1442,8	632,2	3220		

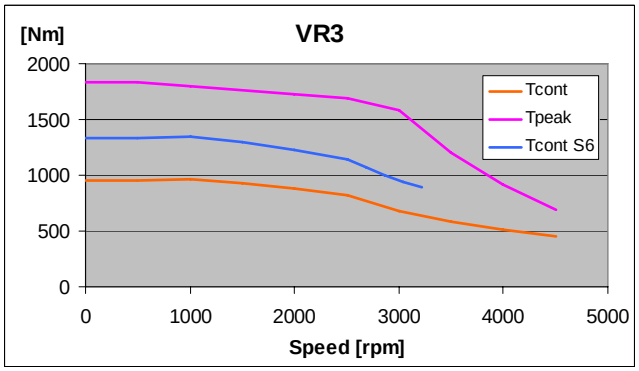
Note. Accuracy of the motor torque, current and power data is 10%.

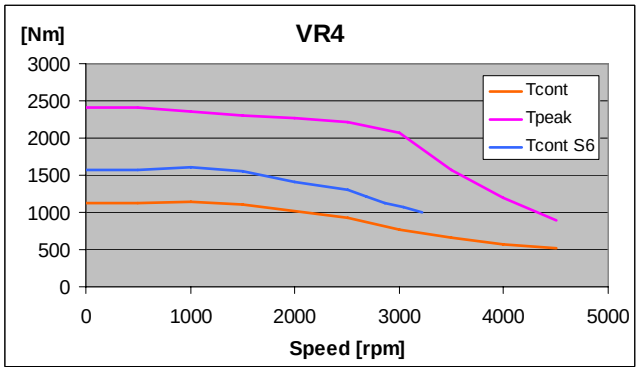
Note. The ratio “Mmax / Mn” is valid at rated speed only and it is not guaranteed in the field weakening operation range.

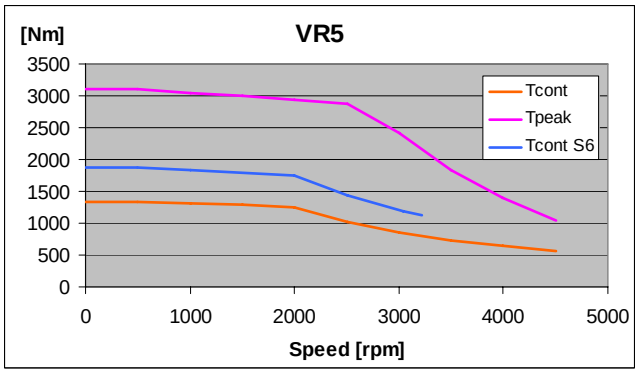
H200 – IP23 Curves The following diagrams illustrate the operating curves for each size of the servomotor frame H200 – IP23.











The diagrams above provide the curves of peak torque “Tpeak”, continuous torque “Tcont” and continuous torque in S6 “Tcont S6” respectively, at the maximum rated speed of each motor frame-size. The curves trend beyond rated speed represents the motor performances in the weakening operation range (constant power).

For example, diagram “VR1” refers to motor type VR1.4. For lower values of rated speed, the curves must be adapted, so that operation at constant power starts at the respective rated speed.

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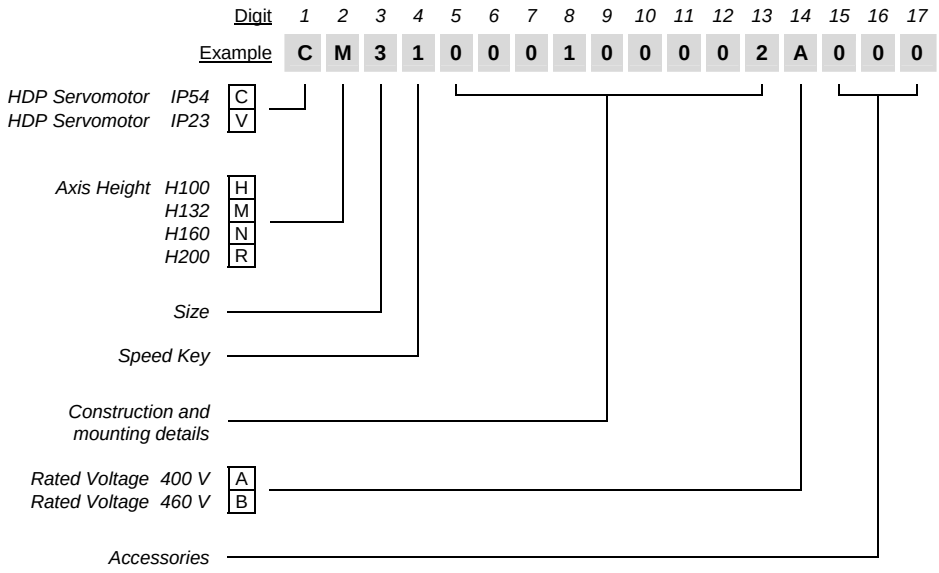
Appendix A – Motor Code

The motor identification code is a 17-digit code that is to be used for ordering and support information. The motor identification code is always stated on the motor plate (see *Motor Plate*, Chapter 2).

The following figure shows the coding method used for HDP series servomotors manufactured by ABB Sace. For a complete list of orderable options please contact our Customer Service.



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Appendix B – Standards and Safety

Introduction

HDP series servomotors have been designed in compliance with IEC 60034 norm. Moreover, for completeness, other norms have been followed. The main norms are here reported.

Standards

[1] IEC 60034-1: "Rotating electrical Machines – Part 1: Rating and performance".

[2] IEC 60034-5: " Rotating electrical Machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification".

[3] IEC 60034-6: "Rotating electrical Machines – Part 6: Methods of cooling (IC code)".

[4] IEC 60034-7: " Rotating electrical Machines – Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM code)".

[5] IEC 60034-8: "Rotating electrical Machines – Part 8: Terminal markings and direction of rotation".

[6] IEC 60034-9: "Rotating electrical Machines – Part 9: Noise limits".

[7] IEC 60034-11: "Rotating electrical Machines – Part 11: Built-in thermal protection. Chapter 1: Rules for protection of electrical machines".

[8] IEC 60034-14-1: "Rotating electrical Machines – Part 14-1: Mechanical vibration of certain machines with shaft heights 56 mm and higher – Measurements, evaluation and limits of vibration".

[9] IEC 60034-18-1: "Rotating electrical Machines – Part 18: Functional evaluation of insulation systems for rotating electrical machines. Part 1: General guidelines".

[10] IEC 60034-25: "Rotating electrical Machines – Part 25: Guide for the design and performance of cage induction motors specifically designed for converter supply".

[11] IEC 60072-1: "Dimensions and output series for rotating electrical machines – Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080".

[12] IEC 60085 "Thermal evaluation and classification of electrical insulation" IEC 60204-1, "Safety of machinery – electrical equipment of machines. Part 1: General requirements".

Electromagnetic Compatibility (EMC) Directive

[13] Directive 89/336/EEC, “On the approximation of the laws of the Member States relating to electromagnetic compatibility” and the subsequent amendments 92/31/EEC and 93/68/EEC.

[14] Italian Legislative Decree, 4 December 1992, No. 476 “Attuazione della direttiva 89/336/CEE del Consiglio del 3 maggio 1989, in materia di ravvicinamento delle legislazioni degli Stati membri relative alla compatibilità elettromagnetica, modificata dalla direttiva 92/31/CEE del Consiglio del 28 aprile 1992” (Directive 89/336/EEC, “On the approximation of the laws of the Member States relating to electromagnetic compatibility” and the subsequent amendments 92/31/EEC and 93/68/EEC).

[15] Italian Legislative Decree, 12 November 1996, No. 615 “ Attuazione della direttiva 89/336/CEE del Consiglio del 3 maggio 1989, in materia di ravvicinamento delle legislazioni degli Stati membri relative alla compatibilità elettromagnetica, modificata ed integrata dalla direttiva 92/31/CEE del Consiglio del 22 luglio 1993 e dalla direttiva 93/97/CEE del Consiglio del 29 ottobre 1993” (Implementation of the directive 89/336/EEC, 3 May 1989, “On the approximation of the laws of the Member States relating to electromagnetic compatibility” changed and integrated by the Directive of the Council 92/31/EEC, 22 July 1993 and by the Directive of the Council 93/97/EEC, 29 October 1993).

IMPORTANT NOTE: This Legislative Decree repeals the Legislative Decree [2], excepting article 14, sub-section 2.

Low Voltage Directive

[16] Directive 73/23/EEC, 19 February 1973, “Harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits”, integrated by the Directive 93/68/EEC, 29 June 1993.

[17] Italian Law 18 October 1977, No. 791 “Attuazione della direttiva del Consiglio delle Comunità europee (n. 73/23/CEE) relativa alle garanzie di sicurezza che deve possedere il materiale elettrico destinato ad essere utilizzato entro taluni limiti di tensione” (Directive 73/23/EEC, 19 February 1973, “Harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits”, integrated by the Directive 93/68/EEC, 29 June 1993).

[18] Italian Legislative Decree, 25 November 1996, No. 626 “Attuazione della direttiva 93/68/CEE in materia di marcatura CE del materiale elettrico destinato ad essere utilizzato entro taluni limiti di tensione” (Implementation of the Directive 93/68/EEC concerning the CE marking of electric material designed for use within certain voltage limits).

Compliance with EEC Directives and CE Marking

Conditions for compliance with EMC Directives of the ABB drive systems composed by **HDP SERIES Servomotors**.

The compliance of the drive systems made with HDP servomotors, defined in the title of this section, with the directives and/or legislative provisions, related to the Electromagnetic Compatibility, are only valid under the following conditions.

Restricted Distribution

HDP Servomotors are only delivered as component of the **"Restricted distribution"** Class, and only sold to professional assemblers to be included as part of a system or of an installation. The actual EMC behaviour is under the responsibility of the equipment manufacturer of the system or of the installation, to which the specific standards apply.

Therefore the CE marking, placed on the HDP SERIES servomotor, only certifies the compliance of the said components with the directives and the laws specified in section *Low Voltage Directive*.

Mounting and Installing Instructions

HDP Servomotors presented in this Manual must be installed according to the instructions prescribed in this Manual; provisions indicated in this Chapter at section *Application Guidelines to Electromagnetic Compatibility* must also be strictly followed.

Compliance of the Drive Systems with the Directives

Declaration of Conformity

ABB Sace declares that, under the conditions specified in this document, in particular in section *Compliance with EEC Directives and CE Marking*, the drive systems composed of the **SERIES HDP Servomotors** comply with EMC European Directives [12], including the most recent changes, with the related endorsement Italian legislation [13] and [14], and with the Low Voltage European Directives [15], [16] and [17]; the applicable regulatory references are indicated in section Normative Documents.

Note for the Application of Other EEC Directives

Servomotors are not subject to other EEC directives, apart from those specified in section *Standards*. As far as the **89/392 EEC Machine Directive and subsequent changes 91/368/EEC, 93/44 EEC, 93/68 EEC, Italian legislation for implementation of the Presidential Decree No. 459, 24 July 1996**, the Certificate of Incorporation (also known as "Manufacturer's declaration") is sometimes required.

Certificate of Incorporation

ABB Sace, according to what required in the Machine Directive (MD) 89/392 EEC and subsequent changes, declares that **SERIES HDP Servomotors**, must be installed in accordance with our installation instructions and must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the Machinery Directive.

Safety Instructions

Meaning of the Symbols

WARNING! Dangerous Voltage

WARNING! General Warning

Installation and Operation

This Manual is intended for qualified personnel who have a relevant experience with installation, troubleshooting and maintenance of drive systems.

WARNING! Only properly qualified personnel who are familiar with operation on servomotors are allowed to perform the commissioning and operation activities on the drive.

WARNING! The cabinet, the power supply and the auxiliary supply must be disconnected during mechanical and electrical installation of the servomotor.

For no reason should an unskilled operator work on the servomotor terminal box.

Dangerous Temperature

WARNING! During operation the servomotor can reach temperatures up to 140 °C (with ambient temperature of 40°C) **with consequent risk of scalding.**

Application Guidelines to Electromagnetic Compatibility

This section applies to prescriptions specified in *Note for the Application of Other EEC Directives* concerning the standard about electromagnetic compatibility for drive systems [8].

The need to follow precise rules as far as EMC is concerned, is due to the increasing use of electronic power units, which, for the used techniques, represent a noise source in a wide frequency range (**emission**). These devices are at the same time sensitive to noise produced by other devices; for this reason they must be provided with an adequate **immunity** level.

Noise is conventionally classified as **low frequency** (0 = < f < 9 kHz) and **high frequency** (f > 9 kHz) noise.

In the range of the low frequency noise, the **harmonic frequency** phenomena of the power supply line frequency are particularly important.

There are also **large spectrum** events, such as electrostatic discharges in the air or by contact.

Noise can be transmitted both through conductors (**<conducted noise>**; conducted emission: 0,15 MHz ÷ 30 MHz) and through irradiation (**<irradiated noise>**; irradiated emission: 30 MHz ÷ 1000 MHz). **Industrial experience showed that the main causes of compatibility lack are caused by conducted noise.**

The servomotor installation must be carried out by closely following the instructions in this Manual and, in particular, in Chapter 3 and 4.

For electromagnetic compatibility, the installation must be carried out following some appropriate instructions.

The motor assembly, including the **HDP SERIES** servomotor and the angle position transducer, as well as the motor thermal switch and - where necessary - the brake, is usually mounted on the machine at a certain distance from the electrical control cabinet.

There are actually two different types of installations: the one referring to the electrical control cabinet manufacture and the actual on-site installation, which is carried out by the installer at the premises of the final user. In this guide we will deal with instructions related to the connections of the motor only.

Electric System

As stated above, we refer to the on-site installation, in the final installation of the machine. For some types of machines (such as small machine tools), the electrical control cabinet is physically connected to the machine and therefore the on-site electrical equipment is reduced to the connection of the machine to the power mains. Nevertheless, the electrical control cabinet is usually placed at a certain distance from the machine, on which the motor assembly is mounted; sometimes there is also a remote control desk, to which conductors could be connected.

In this case, since the emission problem is strictly linked to installation factors, the following recommendations come from good technique standards and from experience in field and must be basically considered as guidelines and not as sure solutions.

- **Keep in mind that the servomotor is intended for the use in a "Second Environment", i.e. industrial environments where the low voltage network does not feed residential buildings.**
- **Carefully study the installation cable routes, minimizing their length.**
- **All the metal channels and sheaths and, in general, all the shields, if not otherwise specified, must be earthed both on the electrical control cabinet side and on the motor side; the earthing connections must have a largely dimensioned section and their route must be as short as possible.**

  This is an EMC specific need, which can seem in contrast with what is often prescribed, that is to say the need to earth shields at only one side; this prescription requires very efficient earths.

Customer Service

For any additional question and support, please contact our Customer Service.

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