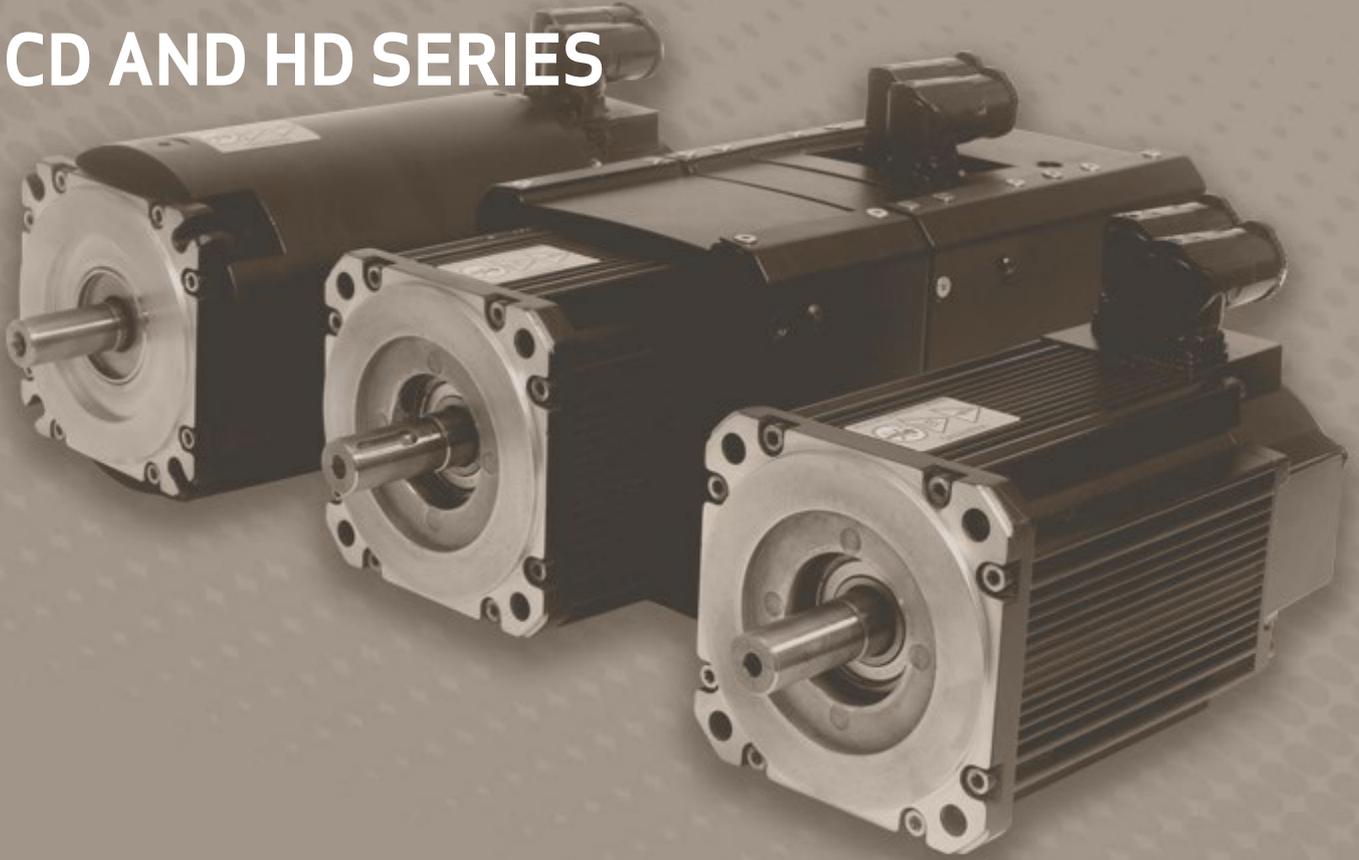


USER MANUAL

# BRUSHLESS SERVO MOTORS

CD AND HD SERIES



Rev. A, January 2023

CD AND HD SERIES SERVO MOTORS –  
WIDE RANGE OF COMPACT SERVO MOTORS  
WITH HIGH DYNAMIC PERFORMANCE

WHEN PERFORMANCE REALLY MATTERS

**MOOG**

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Images/figures shown are for representation only

## FOREWORD

This manual has been prepared in accordance with IEC 82079-1, "Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements".

The manual was written and checked at the best experience of Moog.

Moog has written this technical document to comply with the requirements of the Machinery Directive 2006/42/EC.



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## ABOUT MOOG

Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including test, simulation, plastics, metal forming, and power generation.

Moog customers include leading automotive manufacturers, aerospace manufacturers, testing labs and global automotive racing teams.

We help performance-driven companies design and develop their next-generation machines. Moog's Industrial Group is part of Moog Inc.

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## DOCUMENT VERSION

ES	DA	DE	EL	EN	FR	IT	NL	PT	FL	SV	CS	ET	LV	HU	MT	PL	SK	SL	BG	RO	GA	
				X																		

The language of documents and drawings are subject to contractual negotiations with the customer. In case of "Translation of the Original Instructions", the manufacturer of the machinery supplies also the "English Instructions".

## REVISION RECORD

Revision	Description	Prepared	Checked	Approved	Date
A	New	Naresh Gupta	U Sharath	Prashanth Bhatt	March 2022

## 1. INTRODUCTION

### 1.1. About this Document

This document gives the safe working instructions while working with the Moog Servo Motors. It describes how to install, operate, and maintain the Moog Servo Motors.

All personnel working on with the motor should have this user manual available during work and should check for the relevant information before start of the work.

### 1.2. Documents on Servo Motors

In addition to this user manual, other documents that are available on Servo Motors are:

- Installation drawing - provides information on motor mounting and wiring schematics for electrical installation (Hard copy provided along with the motor).
- Data sheet - provides information on technical data (Hard copy provided along with the motor).
- Catalogue on Compact (CD) and High Dynamic (HD) Series Servo Motor - provides product description, bearing load diagrams, Servo Motor selection and sizing.

For catalogue on CD and HD Series Servo Motor refer -

<https://www.moog.com/products/motors-servomotors/servo-motors.html>



If the information and notes provided in this documentation do not meet your requirements, please contact Moog personnel.

### 1.3. Typographical Conventions

 **DANGER**

Identifies safety instructions that are intended to warn of an immediate and impending danger to life and limb. Failure to observe these safety instructions will inevitably lead to death, serious personal injury (disablement)!

 **WARNING**

Identifies safety instructions that are intended to warn of potential danger to life and limb. Failure to observe these safety instructions might lead to death, serious personal injury (disablement)!

 **CAUTION**

Identifies safety instructions that are intended to warn of slight personal injury. Failure to observe these safety instructions might lead to slight personal injury.

**NOTICE**

Failure to observe this safety notice can result in property damage!

 **SIGNAL WORD**

Type and source of hazard  
 Possible consequences of not avoiding the potential hazard

- How to avoid the hazardous situation

-  Notes about important Operations and other useful information
- /- Identifies listings
- ➔ Identifies a reference to another chapter, page, table or figure in this manual
- Blue text Identifies a hyperlink within the PDF file or an external URL
- 1., 2., ... Identifies steps in a procedure that should be performed in consecutive order
- “.....” Used for references

## 1.4. Structure of Warning Notices

The warning notices in this user manual have the following structure:



Figure 1: Structure of a warning notice

### Legend

Warning symbol:

- 1 Signal word
- 2 Type and source of hazard
- 3 Possible consequences of a potential hazard
- 4 Hazard prevention measures

## 1.5. Acronyms and Definitions

Abbreviation	Explanation
CD	Compact Dynamic
HD	High Dynamic
DC	Direct Current
MSD	Moog Modular Multi-Axis Servo Drive System
IM B5	Motor mounting without feet with Front flange
IM V1	Motor mounting without feet with Front flange with drive shaft vertically downwards
IM V3	Motor mounting without feet with Front flange with drive shaft vertically upwards
ESD	Electrostatic Discharge

Table 1: Abbreviations

## 2. SAFETY INSTRUCTIONS

Do not attempt to install, operate, maintain or inspect the servo motor until you have read through this user manual and appended document carefully and can use the equipment correctly. The Servo Motors may only be set up and operated in conjunction with this manual.



Human safety and equipment safety must be the first considerations when performing the installation procedures for the servo motor and drive system. When it comes to electronics in your factory or workplace, you want to make sure both your facility and the employees in it are safe. The following gives safety instructions which should be followed when you are working on the servo motor.

### WARNING

#### **Danger of high voltage and electrical shock hazard!**

This creates the danger of death, severe injury, or extensive material damage.

- It is vital that you ensure the motor is safely earthed to the PE (Protective Earth). Electrical safety is impossible without a low-resistance earth connection.
- Do not unplug any connectors during operation.



Use this document if you are responsible for installing or troubleshooting motors. As with any electro-mechanical device, safety should be considered during the installation and operation. Throughout this manual you will see warning notices marked with DANGER, CAUTION and NOTICE signal words. Follow the given actions to avoid the hazardous situation.

### 2.1. Safety Oriented Systems

The use of control technology in safety-oriented systems calls for special measures. When planning to use control technology in a safety-oriented system, the user should seek detailed advice in addition to referring to all the potentially available standards or guidelines on safety-engineering installations.

### NOTICE

- Observe and adhere to the technical data and in particular the information given on the motor nameplate.
- The installation must comply with the local regulations and use of equipment and installation practices that promote electromagnetic compatibility and safety.
- Safety equipment - To protect you against personal injury by falling motor, always wear suitable safety equipment, such as work shoes, when handling the motor.

## 2.2. Qualified Personnel

Transportation, assembly, installation, operation, setup, and maintenance should be carried out by qualified personnel. Qualified personnel are those who are specialized with required technical knowledge and experience, who have been trained to perform such work and authorized to commission, systems and circuits in accordance with established safety practices and standards. The qualified personnel must know hazards involved and must be familiar with the following standards and regulations:

- IEC 60364 or DIN VDE 0100
- IEC 60664 or DIN VDE 0110
- National regulations for safety and accident prevention e.g., for Germany BGV A3

## 2.3. Electrical Hazards

Certain electrical systems must be maintained and cleaned by staff. Before they can be accessed, the systems must be disconnected from the mains supply to eliminate electrical hazards to operating staff. According to the state of technology, this is accomplished with the five safety rules of DIN VDE 0105-100.

- Disconnect the mains
- Secure against reconnection
- Verify that the system is dead
- Carry out earthing and short circuiting
- Provide protection from adjacent live parts

## 2.4. Thermal Hazards

 **CAUTION**

**Burn hazard!**



The surface temperature of the motor may reach up to +100 °C (+212 °F) and may become very hot in operation, according to their protection category.

- Do not touch hot surfaces, measure the temperature, and wait until the motor has cooled down below +40 °C (+104 °F) before touching it.



The installer should ensure to minimize the risk from electrostatic discharge. Guidelines on minimizing the risk of ignition from electrostatic discharge can be found in CLC/TR 60079-32-1:2015 standard.

### 3. PRODUCT INFORMATION

Moog Servo Motors have Brushless construction which means that they are maintenance free. The longevity of the motors is limited only by the life of the bearings, which have lifetime lubrication (a L10h life of 20,000 operation hours with the recommended maximum axial and radial loads).

The servo motors correspond to the harmonized standards of the EN 60034 (VDE 0530) series EN 60034-1, EN 60034-5, EN 60034-9 and EN 60204-1.

The CD/HD Series Servo Motors are designed and manufactured in accordance with strict CE standards, using ruggedized components with proven reliability in harsh thermal and shock load environments.

#### 3.1. Manufacturer Name and Address

The following table shows all the information regarding the manufacturer:

Info	Description
Moog Company	Moog Controls (India) PVT. LTD.
Address	No. 41 P, 99 and 100 P, KIADB Industrial Area, Electronic City Phase II, Hosur Road, Bangalore - 560100, India
Phone	+91 80 3327 6300
Fax	+91 80 2852 7309
E-Mail	<a href="mailto:info.india@moog.com">info.india@moog.com</a>
Web Site	<a href="http://www.moog.com/industrial">www.moog.com/industrial</a>

Table 2: Manufacturer Name and Address

#### 3.2. Authorized Representative for European Union

The following table shows all the information regarding the authorized representative in European Union:

Info	Description
Moog Company	Moog GmbH
Address	Hanns- Klemm- Strasse 28 71034 Boeblingen Germany
Phone	+49 7031 622 0
Fax	+49 7031 622 100
E-Mail	<a href="mailto:info.germany@moog.com">info.germany@moog.com</a>
Web Site	<a href="http://www.moog.com/industrial">www.moog.com/industrial</a>

Table 3: Authorized Representative for European Union

## 4. TRANSPORT

### 4.1. Delivery

Immediately upon delivery of the motor, please examine the package contents for intactness and check that the agreed delivery contents are complete. Particularly check the shaft and the motor for transport damage. Use the data on the nameplate to check whether the delivered motor model matches against the order placed.

The cable plugs on signal cover are secured provisionally. The connection cable should be connected by removing the cable plugs. Refer Electrical interface section for more details.

### WARNING



In case any damages or fault are found contact immediately a Moog representative providing a detailed description of the fault or damage.

### 4.2. Handling

Use suitable suspension and load devices for transportation and assembly. Use lifting eyebolts, if necessary, provided by the manufacturer. For motors without eyebolts else use lifting slings. Ensure usage of slings with suitable strength considering the mass of the motor as provided in the nameplate. Improper handling may lead to serious injury.



Figure 2: Lifting points (With and without eyebolt)

While transporting the motor to the site of installation using eye bolts, attach the motor solely using the eyebolts.

- Check the firm position of the eyebolts prior to the transportation
- Do not attach the lifting strap to the shaft as it can damage to the motor

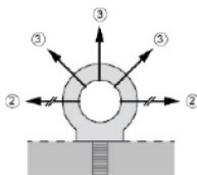


Figure 3: Shearing off (2) and non-shearing off (3) loads on eyebolts



The delivered non turn able eyebolts are not suitable for shearing off load. Refer figure 3

## ! WARNING

### Heavy Weight!



Danger during lifting and transporting procedures!

- Improper handling, unsuitable or defective devices, tools etc. can cause injuries and/or property damage. Lifting devices, ground conveyors and lifting tackle must correspond to the valid regulations.
- Lifting eye provided should not be used for lifting entire machine. Only the component attached to this support may be safely lifted by the support.
- If motor is lifted with lifting slings, then it should be ensured that load is balanced else there may be slipping of motor causing serious injuries to people and damage to the motor.

## 4.3. Storage

## ! WARNING

### Risk of electric shock

Some of the procedures to be carried out during storage include the usage of electric power supply.

- Follow necessary electrical safety requirements during these procedures.

## NOTICE

### Damage due to dirt, moisture

- Storage outside or under the wrong climatic conditions can cause corrosion and other damage to the servo motor.
- Condensation due to temperature fluctuations can result in electronic malfunctions.

## NOTICE

Danger of personal injury and damage to property!

Failure to observe the safety instructions could result in personnel injury or equipment damage.

- Do not forget to observe the safety signs indicated on the motor.
- Destruction of the paint seals on the screws will make the warranty void.
- Do not open or attempt to open the motor.

In the case of intermediate storage or shutting down the servo motors, one must observe the following storage conditions:

- It is always preferred to store the motor indoor and avoid outdoor storage.
- Protect the motors from direct sunlight and UV light
- The storage temperature must be at constant value as recommended below.
  - Recommended ambient temperature: +15 to +25 °C (+60 to +78 °F)

- permissible temperature: -20 to +70 °C (-68 to +158 °F) for fan cooled motors and -40 to +70 °C (-40 to +158 °F) for other motors, temperature fluctuation: < 10 °C (18 °F) per day.
- Relative humidity: < 65% non-condensing is recommended, 90% is permissible.
- If it cannot be excluded that the temperature may go below the dew point during the storage or shutdown, suitable measures must be taken against condensation.
- Ensure there are minimal vibration and shock where servo motors are stored.
- The motor and its attachment parts must be covered such that there should be possible air circulation and not closed airtight. Water must not be allowed to condense in the cavities on the motor surface. Suitable measure to be taken against condensation and humidity.
- Do not remove the adhesive lubricant coating (corrosion protection) on shaft ends, flange surfaces etc.
- Check the adhesive lubricant coating for every three months and apply lubricant as required. For extended period of storage (longer than three months) operate the motor as recommended below.

### **WARNING**

#### **Risk of electric shock!**

For the shaft to run, the brake must be disengaged while you apply the voltage indicated on the name plate of the brake. The motor is intended for installation and use by qualified personnel, familiar with electrical machines and safety requirements. Follow necessary electrical safety requirements during the brake opening

### **CAUTION**



The surface temperature of the motor may reach up to +50 °C (+122 °F) and may become very hot in operation, according to their protection category.

- Do not touch hot surfaces, measure the temperature, and wait until the motor has cooled down below +40 °C (+104 °F) before touching it.

- Connect the matting connector to the motor and disengage the brake. Ensure free rotation of shaft before warming up process.
- Operate the motor using suitable drive such that the motor is initially rotated at 100 rpm, then ramp up the motor to the rated speed (S1) as specified in the motor name plate.
- Continue the motor shaft rotation for 10 mins to slightly increase the motor temperature.
- Once the process is done, allow the motor to become cool and then detach the matting connector.
- Ensure that the motor is safely packed in the same conditions like that it was during the time of receipt from Moog
- For storage above 3 years, it is recommended to replace the bearing due to the ageing of the grease. Before starting of the motor after standstill or storage. Visually check for possible soiling or condensation.
- After long storage or standstill (more than one year), before restarting, check the bearings, the brake function and the brake's holding torque. If necessary, the brake must be burnished again. During this test, the motor must not be operated under load (e.g., gear or gear rim). Contact Moog personnel to suggest on appropriate brake re-burnishing cycles.
- For testing the brake holding torque use a torque wrench with corresponding shaft adaptor.
- Let the motor run at low rotational speed for the first time that you start it after the storage period.

- Do not remove the eyebolts during storage

**IMPORTANT: Already Installed Motors**

If installed motors are shut down or stored for a long time (longer than three months), the same



precautions mentioned above must be taken care.

With Installed motors, make sure that the motor's connections are in keeping with the IP Protection class

- If the motor must be dismantled from the equipment and kept in storage, the same precautions mentioned above should be taken care.
- In addition, during storage, eyebolts must be mounted to the motor by way of hand tightening. Check if
  - The eyebolt is fully inserted
  - The eyebolt is firmly screwed down and the collar sits evenly on the contact surface
  - The eyebolt is firmly seated
  - Any damage (e.g., corrosion, deformation) is visible
  - Deformed eyebolts should not be used and not screwed in again.
  - User should employ the same eyebolts as supplied by Moog or equivalent.
  - Do not red colour mark on the eyebolts that are used for motor lifting, which may wrongly interpret heavy object lifting otherwise
- If the eyebolts must be removed in an exceptional case, the threaded holes must be sealed with the plastic threaded plugs

## 5. PRODUCT DESCRIPTION

### 5.1. Principles of Operation/Description

The principal of operation of the motor is based on an electronically commuted, brushless AC electric motor with stator winding and permanent magnetic excitation in the rotor. The motor is operated via control electronics using an integrated feedback system – resolver or encoder. The components are constructed in accordance with IEC standards. The mechanical interface is represented by standardized flange dimensions with corresponding shaft end. Technical data and the applied standards can be found in the included installation drawing as well as in MOOG motor catalogues.

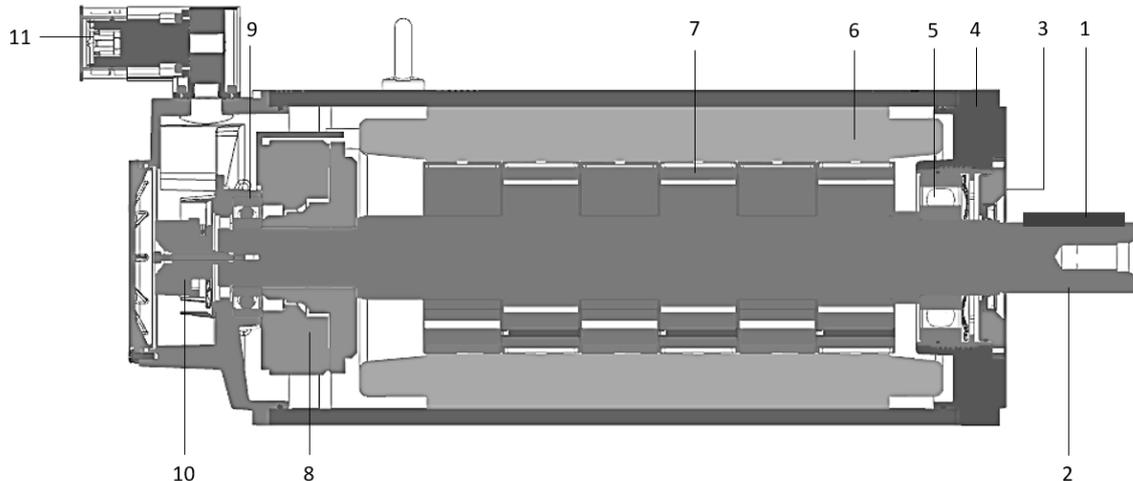


Figure 4: Product Description

(Figure is just for representation purposes only & may not reflect the actual configuration)

1. Keyway Optional
2. Shaft
3. Radial Shaft Seal
4. Flange
5. Bearing Drive End
6. Wound Stator
7. Permanent Magnets Rotor
8. Permanent Magnet Holding Brake (Optional)
9. Bearing Non-Drive End
10. Feedback Device
11. Connector/Connector Box

### 5.2. Model Strategy

#### 5.2.1. CD series model strategy

The CD series servo motor range covers six frame sizes, six magnetic designs, with natural/fan cooled and highly customizable construction

- Motor with resolver
- Motor with resolver and permanent magnet holding brake

- Motor with encoder
- Motor with encoder and permanent magnet holding brake

### 5.2.2. HD series model strategy

The HD motor is available in various sizes. Each frame size is modularly designed, Changes to the active length of the motor components allow a large power range to be covered. The following standard versions are available in natural cooled, fan cooled and liquid cooled options:

- Motor with resolver
- Motor with resolver and permanent magnet holding brake
- Motor with encoder
- Motor with encoder and permanent magnet holding brake

## 5.3. Servo Motors Product Characteristics

Motors - The motors are Brushless three phase AC synchronous servomotors which has permanent magnets which rotate and fixed stator. An electronic controller replaces the brush/commutator assembly of brushed DC motor, which continually switches the phase to the windings to keep the motor running. The key features of motors are:

- Permanent magnets - The motors use rare earth Sintered Samarium Cobalt magnets / Neodymium permanent magnets as rotor. Rare earth magnets are powerful magnets which enable precise and highly dynamic positioning of the motor.
- Motor winding - The motors have three phase winding. A servo drive will provide input to these windings which enables the motor run at high speeds.
- Winding insulation class - Class F insulation.
- Thermal sensors - the temperature of the three phase windings can be monitored by the temperature sensors placed on the windings and with suitable drives/device.
- Holding Brake - Moog servo motors uses optional permanent magnet holding brakes. The brakes operate at  $24 V_{DC}$  and used for static braking. These brakes are not intended to be used as dynamic brake. Retrofit of the brake is not possible.
- Feedback device - The motors are equipped with different type of feedback devices like resolver or encoders based on the customer requirement.
- Rotor shaft - The rotor shaft in the servo motors have different shaft extensions like cylindrical shaft extensions or spline extension (special offering). The cylindrical shaft may have key as an option which is as per DIN 6885, IEC 60072-1. Rotors are balanced dynamically as per ISO 1940. A balancing grade of 6.3 is followed as standard.
- Power transmission - The transmission of the power is through the shaft extensions. The radial forces and axial forces required during installation can be referred from the table - 10 (CD Series) and table - 11 (HD Series).
- Flange - Square flanges with spigot for customer mounting are offered. Refer chapter 13 - ordering code for frame sizes.
- Protection class - Protection class IP65 without shaft seal and IP67 with shaft seal is offered.

## 5.4. Technical Terminology

Continuous stall torque  $M_o$  (Nm) - Stall torque is the torque available from a motor whose output rotational speed is zero for continuous operation.

Continuous stall current  $I_o (A_{rms})$  - Sinusoidal current RMS value consumed at zero speed to generate stall torque.

Rated torque  $M_n (Nm)$  - Rated torque is the maximum continuous torque that a motor produces at rated speed when it is drawing rated current without overheating. This is called as S1 duty cycle as motor can operate continuously at rated conditions.

Nominal speed  $N_n (rpm)$  - Nominal speed is the RPM at which motor delivers the rated torque.

Maximum current  $I_{max} (A_{rms})$  - The maximum current that the motor can withstand for specified period.

Torque constant  $K_T (Nm/Arms)$  - Torque produced in Nm per Arms current.

Voltage constant  $K_E (V/rad/Sec)$  - Peak Induced Voltage at terminal per rad per second.

Rotor moment of inertia  $J (Kg-cm^2)$  -The constant J is a measure of the acceleration capability of the motor.

Thermal time constant  $t_{TH} (min)$  - Time to reach 63.2 % of the absolute temperature

NT Curve Example for rated speed-torque and peak speed-torque curve is shown below

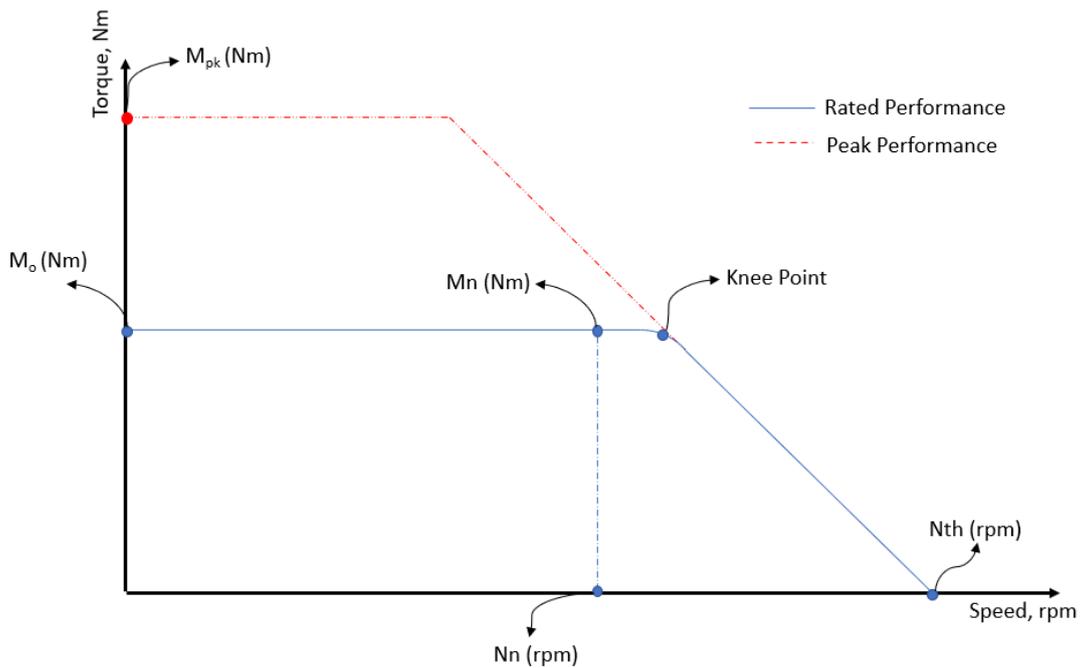


Figure 5: Torque-Speed Curve

### 5.5. Compliance of Servo Motors to Environmental Requirements

Moog Servo Motors are tested for below environmental specifications

Sl No.	Tests	Specification
1	Ingress Protection – IP <sup>1)</sup>	IP 64 - Dust and Water splashing IP 65 - Dust and Water Jet splash IP 67 - Dust and temporary water immersion

2	Vibration <sup>1)</sup>	Sine Wave No of axis: 3 ( $\pm X, \pm Y, \pm Z$ ) Frequency range: 10 Hz to 150 Hz Cross-over frequency: 60.1 Hz Displacement amplitude: 0.35 mm (peak) Acceleration: 5 g
3	Shock <sup>1)</sup>	Half Sine No. of shocks in each direction :10 No of axis: 3 ( $\pm X, \pm Y, \pm Z$ ) Peak acceleration: 30 g Shock duration: 18 ms Rest between pulses: 0.5 s
4	Bump <sup>1)</sup>	Half Sine No. Of sweeps :4000 No of axis: 3 ( $\pm X, \pm Y, \pm Z$ ) Peak acceleration: 15 g Shock duration: 6 ms Rest between pulses: 0.5 s
5	EMI/EMC	Radiated Emission 30 MHz to 230 MHz: 30 dB (mV/m) quasi peak 230 MHz to 1000 MHz: 37 dB (mV/m) quasi peak Conducted Emission 0.15 MHz to 0.5 MHz: 66 dB (mV) - 56 dB (mV) quasi peak 56 dB (mV) - 46 dB (mV) average 0.50 MHz to 5 MHz: 56 dB (mV) quasi peak, 46 dB (mV) average 5 MHz to 30 MHz: 60 dB (mV) quasi peak, 50 dB (mV) average
6	Salt Corrosion	NaCl: 5% RH: Up to 50% No of Cycles 2 (24 hours/cycle)
7	Altitude	1000 m - 4000 m
8	Operating Temperature	-20 to 40 °C for fan cooled motors and -40 to 40 °C for other motors

Table 4: Environmental characteristics

1) Specification may change for Fan cooled

### 5.6. Deration:

Derating may be necessary when ambient temperature is higher or when the motor is operating at higher altitudes. The altitude derations defined as per IEC 60034-1

The deration for stall condition with respect to higher altitude is shown in below table.

Altitude, m	Deration factor
1000	1
2000	0.90
3000	0.80
4000	0.70

Table 5: Deration for altitudes above 1000 m

The deration for stall condition with respect to higher temperature is shown in below table.

Ambient temperature °C	Deration factor
25	1
40	0.96
50	0.91
55	0.86
60	0.82

Table 6: Deration for different ambient temperatures



The Temperature deration details provided in table - 6 is with resolver as feedback device

Please contact Moog for deration details with Encoder as feedback device

## 5.7. Certifications

The Moog servo motors are certified for CE/UL/ROHS/REACH/WEEE where applicable

Markings	Description
	Motor is designed and evaluated in compliance with Low voltage Directive, Electromechanical compatibility Directive and RoHS Directive making the motor personal safety and use in machine. The CE marking can be found on the name plate.
	The motor is in compliance with UL standard requirements. The UL marking can be found on the name plate

Table 7: Certifications

## 6. FIELD OF APPLICATION

Moog Brushless Servomotors are used for various applications like plastics market, pick and place and in any general automation, energy production and generation machinery, industrial production machinery and simulation and test equipment. equipment.

The frame sizes available are G-1, G-2, G-3, G-4, G-5 and G-6 with natural cooled and fan cooled options to serve the above-mentioned field of application.

The frame sizes HD100, HD115, HD140, HD200 and HD275 with Natural cooled, Fan cooled and Liquid cooled options to serve the above-mentioned field of application.

**WARNING**

**Information on the protection type!**

- To ensure danger free operation, all installation and safety instruction must be observed.
- A skilled operator may be required for handling these series of motor.

## 7. MOTOR CODIFICATION

The data described below can be found on the motor name plate. Motor-specific details and performance data on the name plate are provided in this description only as labelling example. The correct data can be found on the name plate of the motors and motor data sheet supplied along with the Motor as per Electrical data. Using the Motor data, the user must select a suitable drive.

 Further details on your motor can be found on the name plate of the respective motor. This information is necessary for configuring the controller and for inquires to Moog. For this reason, note down the information on the name plate if the name plate is not accessible when the motor is installed.

### 7.1. Motor Codification

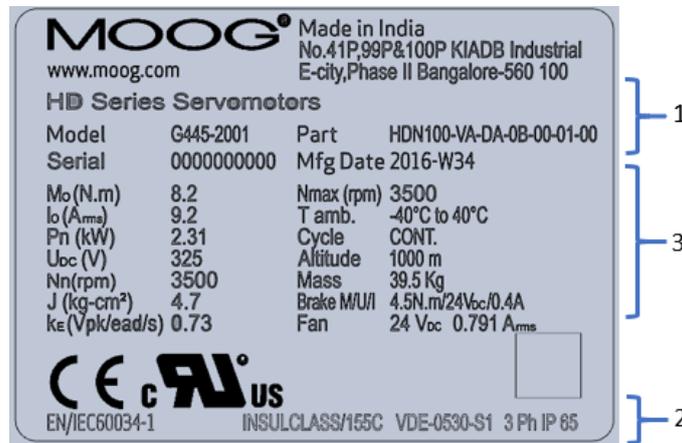


Figure 6: Representation of Nameplate on Servo Motors

Pos.	Description	
1	General data	
	Type	Motor type
	Model	Motor model number (ordering number)
	Serial	Serial number
	Part	Box Car
	Date	Week and year of production
2	Standards	
	IP65	Degree of protection. Motor protection against jets of water (at shaft with seal option)
	CLASS F	Motor listed for insulation class F (155 °C (311 °F))
	IEC 60034-1	Motor fulfills IEC 60034 -1 (standard defines rating and performance of rotating electrical machines)
	VDE-0530-S1	Performance measurements are done according to VDE-0530
	CE	Conformity certificate will be supplied on request
	3 Ph	Number of phases 3 (U, V, W)
	UL	Motor c-UL Recognized, file number
3	Technical data (data are measured at +40 °C (+104 °F) ambient temperature)	
	M <sub>0</sub> (N,m)	Continuous stall torque
	I <sub>0</sub> (Arms)	Continuous stall current (at M <sub>0</sub> )
	P <sub>n</sub> (KW)	Nominal power (max continuous output power)
	U <sub>DC</sub> (V)	Nominal operating voltage (bus voltage)
	N <sub>n</sub> (rpm)	Nominal speed at P <sub>N</sub>
	J (Kg-cm <sup>2</sup> )	Rotor moment of inertia
	K <sub>E</sub> (Vpk/rad/S)	Back emf (voltage constant)
	N <sub>max</sub> (rpm)	Maximum speed
	T amb.	Ambient temperature
	Cycle	Duty Cycle

Table 8: Motor Name plate data

## 7.2. Brake Name Plate



Description	
Brake data (brake is optional, data provided refers to holding torque)	
Type	Permanent magnet brake
Voltage	DC voltage to unlock shaft
Current	Nominal current $A_{DC}$
Caution	Caution on voltage polarity

Table 9: Motor brake data

More details on type: → [Chapter "13 Ordering Code"](#)

This information will be present only in few of the motor sizes where the main name plate does not contain the brake data mentioned.

## 8. INSTALLATION INSTRUCTIONS

### WARNING

#### Danger of personal injury!

Working with and on the motor without the required basic electrical knowledge may cause injuries or parts may be damaged.

- The motor is intended for installation and use by qualified personnel, familiar with electrical machines and safety requirements.
- The safety equipment necessary to prevent accidents and electrical shocks must be provided by the installer.
- Ensure that the installation drawing and data sheet are available.

Following care must be taken while installing the motor:

- Read the name plate, warning and caution plates on the motor carefully.
- Permissible radial and axial loads should be known to the personnel handling.
- Screwed-in lifting eye bolts can be removed after installation.
- Refer installation drawing before installing.

### CAUTION

#### Electrical hazard!



Moog motors may consist of ESD sensitive parts. For motors with such parts additional care is required.

- Touching signal connections with electrostatically charged hands or tools can result in malfunctions.
- If the user carries out a HI pot test, then pins must be short circuited before the test is carried out. The polarity must be carefully observed. Avoid currents > 4 mA in

### NOTICE

#### Risk of damage

- Release the brake before starting the motor by supplying proper voltage as defined by the manufacturer.
- Do not use holding brake to stop the motor. It is not permitted to be used as working brake.



- The installation dimensions for the respective motor model can be found in the provided installation drawing.
- When installing and mounting the motor, ensure that the shaft extension is protected against impact and pressure.
- Observe the technical data on the label plates on the motor enclosure

## 8.1. Recommended Drives

The Moog motors are designed to be used together with a sinusoidal servo drive. The best performance will be achieved by using a fully digital controller with extremely high bandwidth capability like the Moog DS2020, DM2020, DR2020 and MSD Servo Drive Systems.

Some remarkable points about the Moog Servo Drives are listed below:

- Wide range of powers
- Single axis (DS2020, DR2020, MSD), Multi-axes (DM2020, MSD) and decentralized (DR2020) solutions available
- High frequency control loops with result in high current, velocity, and position loop bandwidths
- High encoder interpolation factor to ensure adequate speed and position resolution with error compensation
- Advanced control algorithms and additional features: Like feed-forward, observers, notch filters compensation of cogging torque, stick slip, and others
- Extreme compactness (DS2020, DM2020)
- CE and UL certification



Avoid Uneven current phase load at Zero Speed – The RMS phase current values differ across the phases which may lead to single-phase overheating. For additional information, please contact Moog.

## 8.2. Mounting

- The motor shaft should be degreased carefully before mounting a coupling. When using a degreaser (grease dissolving substance), prevent it from flowing into the bearing as this will destroy the lifetime lubrication. A clamp coupling or a shrink connection is recommended to provide a reliable torque transmission. For direct drive, use flexible couplings. Alignment to be coaxial, poor alignment will lead to mechanical vibration during operation. The resulting damage to the bearings can reduce the motor's life.

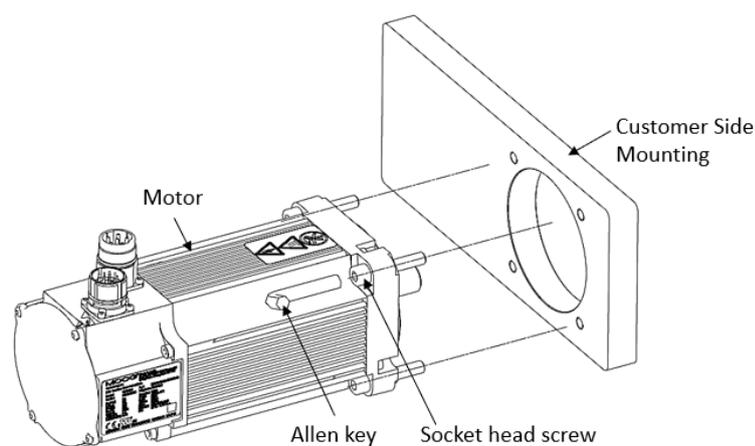


Figure 7: Natural cooled motor

- Excessive axial force on the rotor shaft can result in bearing failure and impair the functionality of brake in case of brake motors. This leads to either reduced braking force or brake failure. Therefore, excessive pressure and shocks on the front end of the shaft and the back housing must be avoided

under all circumstances. The impulse of any hammer blow always exceeds the maximum permissible axial and radial forces

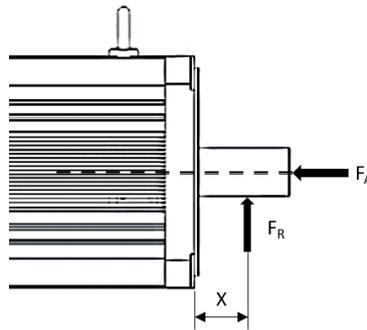


Figure 8:  $X$  = Radial load at midpoint of the shaft extension

Type	G-1	G-2	G-3	G-4	G-5	G-6
Axial Load*	60	150	150	300	400	500
Radial load*	300	500	500	1000	1600	2000

Table 10: Maximum permissible axial and radial loads (N) during installation for CD series Motors

Type	HD100	HD115	HD140	HD200	HD275
Axial Load*	150	200	700	1200	2000
Radial load*	800	1000	4000	4500	6000

Table 11: Maximum permissible axial and radial loads (N) during installation for HD series Motors

\*During installation Less load is allowed when the motor is rotating (Refer Catalogue, section BEARING LOAD DIAGRAM).

### 8.3. Servo Motor Mounting Orientations

HD motors can be mounted horizontal, vertical up and vertical down as per standard IEC 60034-7

Type of Mounting	IM B5 Standard Mounting	IM V1	IM V3
Representation			

Table 12: Servo Motors Motor Mounting Orientation



- When configuring the IM V3 type of construction, attention must be paid to the permissible axial forces (weight force of the drive elements) and especially to the necessary degree of protection
- Brake actuation time may vary based on the type of mounting orientation.

### 8.4. Flange Mounting

Below table show the required bolt size information for all the CD and HD motor sizes for mounting the motor on the machine or system.

Frame	Mounting Hole/slot size (mm)	Bolt Size and length	Tightening Torque (Nm)	Recommended CL for Bolts
G-1	∅3.3	M3x12L	1	8.8
G-2	∅5.5	M5X16L	6	8.8
G-3	∅5.5	M5x16L	6	8.8
G-4	∅9	M8X24L	25	8.8
G-5	∅11.3	M10X30L	49	8.8
G-6	∅13.7	M12X30L	84	8.8

Table 13: Flange mounting bolts suggestion at customer end

Frame	Mounting Hole/slot size (mm)	Bolt Size and length	Tightening Torque (Nm)	Recommended CL for Bolts
HD100	∅9.6	M8X 35L	25	8.8
HD115	∅8.6	M8X30L	25	8.8
HD140	∅11	M10x35L	49	8.8
HD200	∅14	M12X45L	144	12.9
HD275	∅18	M16X55L	359	12.9

Table 14: Flange mounting bolts suggestion at customer end

**i** Table 13 and 14 shows the suggestion of bolt size and length to be used with suitable washers.

### 8.5. Output Elements

**⚠ WARNING**

**Danger of personal injury!**

- Do not touch hot output elements like coupling or pulley without personnel safety instructions.
- Wear thermal protective gloves.
- Remove the shaft protection cap on the motor shaft before assembling the coupling or pulley.

#### Output element installation

- Oven heat the output elements like pulley/coupling as per manufacturer’s instructions
- Degrease and clean the shaft
- Insert the output element keeping it center and inserting straight into the shaft

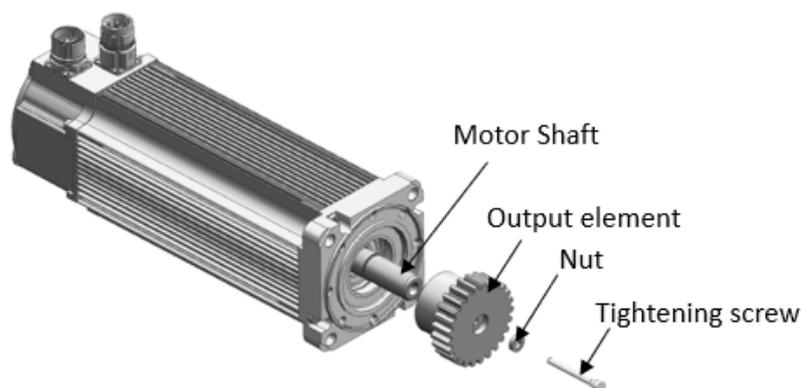


Figure 9: Installation of output element

Dismantling of the output element

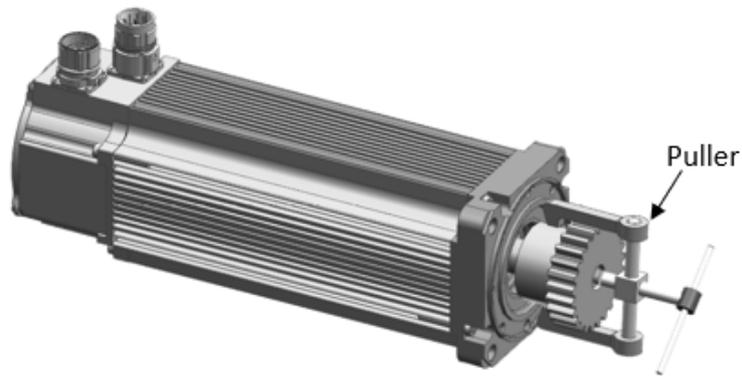


Figure 10: Dismantling of output element

## 8.6. Fan Cooled Motors

Fan cooled option is available with specific motor sizes. Additional precautions that have to be considered for fan cooled motors are:

- Fan termination should be checked for correct polarity before starting the motor. Connection details: → [Chapter "9 Electrical Interfaces"](#)
- Motor should not be rested on the cowl which otherwise may get damaged.
- The air passage inside the cowl should be free from blockage to enable free flow of air and proper functioning of fan.
- Back of the cowl area should be free for air to circulate.
- Fan cooled motors should not be lifted using cowl.

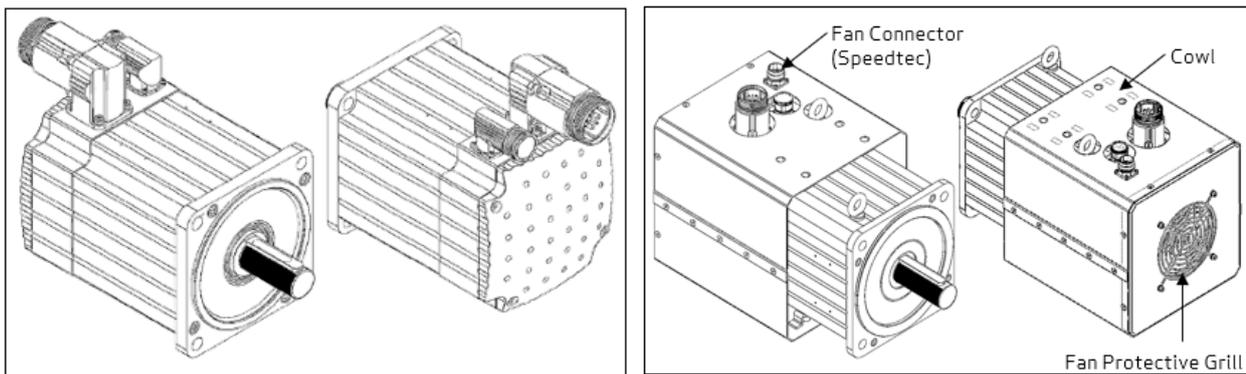


Figure 11: Natural cooled and Fan cooled Motor: CD Series Motors

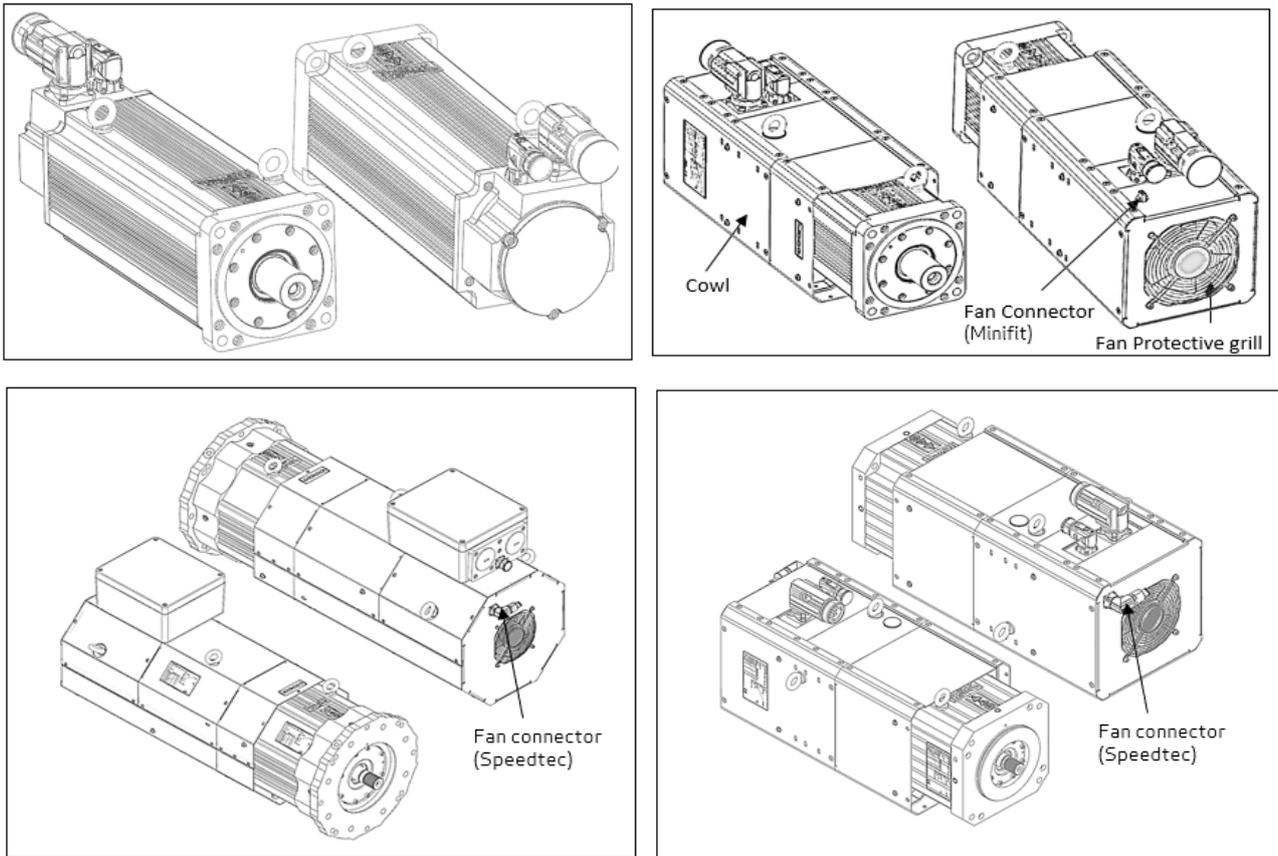


Figure 12: Natural cooled and Fan cooled Motor: HD Series Motors

**i** As a standard fan connector minifit connectors are offered, other connectors like Speedtec connectors are optional.

Fan specifications

Power in W	Supply	Air Flow in CFM	Speed	Approvals	Operating temp
45	24 VDC	229.5	7500 rpm	VDE, CSA, UL	-20° C - 65° C
19.5	24 VDC	182.4	6000 rpm	VDE, CSA, UL	-20° C - 65° C
50	24 VDC	164.8	13000 rpm	VDE, CSA, UL	-20° C - 70° C

**NOTICE**

If proper precaution is not taken while installing, the motor fan protective grill may get damaged which in turn might result in fan noise and vibration sometimes even failure.

8.7. Water Cooled Motors in HD Series Motors

The water-cooled motors in HD series can only be operated in a closed cooling-water circuit with a cooling unit. The motor is connected to the cooling circuit by means of two male/female threads at the rear of the motor.

Suggested cooling water flow rate [l/min(US gpm)]	HDW100	HDW115	HDW140	HDW200	HDW275
	6 (1.58)	6 (1.58)	8 (2.11)	8 (2.11)	8 (2.11)
Maximum pressure at inlet [bar (psi)]	10 (145)				
Pressure drop between inlet and outlet [bar (psi)]	<1 (14.5)	<1 (14.5)	<1 (14.5)	<1 (14.5)	<2 (29)
Inlet cooling water temperature [°C (°F)]	+25 to +40 °C (+77 to +104 °F)				

Table 15: Technical data of water cooling

The cooling medium has to be composed from desalted and demineralised water chemically neutral and with the addition of anti-corrosion agent. Such that products have to be computable with the materials of the housings (aluminium and its alloys), with the materials of the gaskets (Viton) and with all components of the circuit. For additional requirement refer to the table chemical requirement of the cooling medium.

Contents and chemical composition	Value
pH value	6 to 8
Total hardness	<150 ppm
Chloride	<50 ppm
Sulphate	<50 ppm
Particle size	<0.05 mm
Suspension solid parts	<2 ppm
Total salinity (NaCl)	<1,500 ppm
Nitrate	<50 ppm
Manganese (Mn)	<0.15 ppm
Organic parts	<2 ppm
Large solid parts	None
Free carbon dioxide	<3 ppm
Iron (Fe)	<0.2 ppm
Oils	0
Total alkalinity	<600 ppm

Table 16: Chemical requirements of the cooling medium

The pipe fitting length “D” for the cooling connections to the motor must not exceed a maximum length indicated in the table below to allow the correct coolant flow.

Motor Type	Thread	Thread depth C [mm(in)]	Thread length D [mm(in)]
HDW100/HDW115/HDW140/HDW200 (Fig - 10)	G1/4"	12 (0.472)	12 (0.472)
HDW275 (Fig - 11)	M18x1.5	7 (0.2755)	12 (0.4724)

Table 17: Pipe fitting details

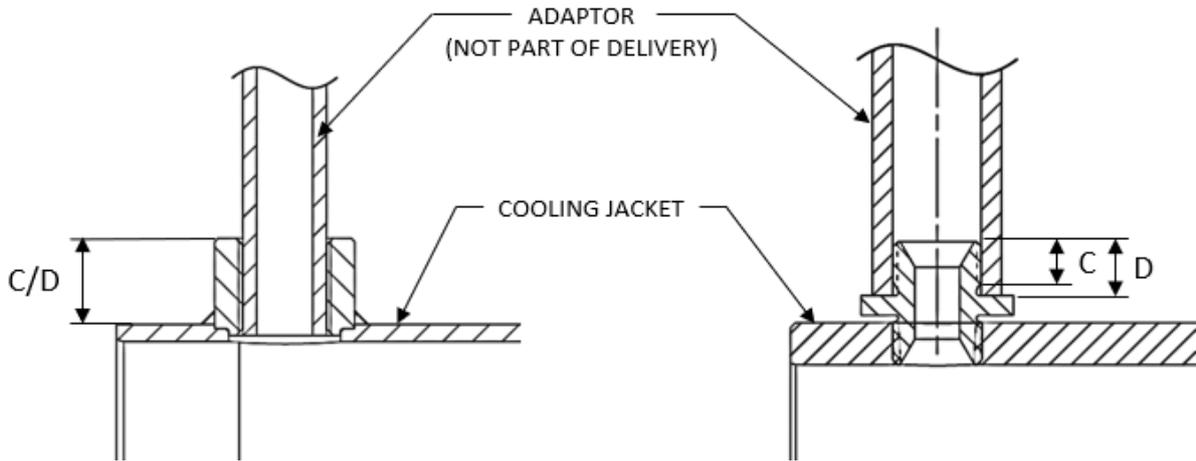


Figure 13: Female thread

Figure 14: Male thread

**NOTICE**

Before starting the motor, the motor with coolant temperature must be higher than the motor frame temperature by at least 2 °C (36 °F).

Before activating the motor, make sure the cooling circuit is completely filled and leak free.

**NOTICE**

Storing or Transportation of motor

The cooling circuit must be emptied when storing the motor, when the motor is out of service for a long period, and when the motor is being transported.

## 9. ELECTRICAL INTERFACES

For connection of CD and HD Series Moog motors, it is best to use the mating connectors and cable characteristics indicated in the table. When using non-Moog components, the cable specifications must be fulfilled in every way.

### WARNING

#### Hazardous voltage!

The rotating motor can generate dangerously high voltage at motor terminals.

- Making contact with exposed cable or motor terminals can lead to electric shock.
- Ensure shaft is standstill while working on electrical interfaces.
- Always make sure that there are no exposed cables.

Connection and disconnection of the motors must be made with the controller switched off. Simply disabling the controller is not sufficient. During installation, special attention should be paid to the diameter of the protective earth (PE) conductor, which must be sized according to legal safety rules.

We recommend shielding of power and signal cables. The shielding should be connected to earth at both ends.

### NOTICE

Small wire diameters lead to an unacceptable heating in the cable. This results in power loss to the motor, especially when the cables are long.

### 9.1. Wiring Schematics

For wiring schematics refer to the installation drawing provided along with the motor.

Below tables give information on cable schemes and mating connectors for power and signal connectors.

This information is only for standard motor configuration.

Note: For a special configuration please contact Moog personnel.

#### Power Connector Size 1

Cable scheme	4 x 1.5 mm <sup>2</sup> Power	G-1 to G-4
		HDN100, HDF100, HDW100 HDN140, HDF140, HDW140
	4 x 2.5 mm <sup>2</sup> Power	G-5-x2 up to G-5-x6
		HDN115, HDF115, HDW115
4 x 4.0 mm <sup>2</sup> Power	G-5-x8 up to G-5-x	
2 x 1.0 mm <sup>2</sup> Power	Brake	
Mating connector loose (recommended)	Moog part number:	
	Up to 2.5 mm <sup>2</sup>	C08365-001
	Up to 4 mm <sup>2</sup>	C08365-001

Table 18: Power connector size 1

## Power Connector Size 1.5

Cable scheme	4 x 6.0 mm <sup>2</sup> Power	G-5-x9 up to G-6
		HDN140, HDF140, HDW140
		HDN200, HDF200, HDW200
	4 x 10.0 mm <sup>2</sup> Power	G-5-x9 up to G-6
		HDN275, HDF275, HDW275
	2 x 1.0 mm <sup>2</sup> Power	Brake
Mating connector loose (recommended)	Moog part number:	
	6-16 mm <sup>2</sup>	B47711-001

Table 19: Power connector size 1.5

## Connector Box Small

Connector box - small		
Cable scheme	4 x 10.0 mm <sup>2</sup> Power	HDW140
		HDW200
	2 x 1.0 mm <sup>2</sup> Power	Brake

Table 20: Connector box small

## Connector Box Big

Cable scheme	4 x 25.0 mm <sup>2</sup> Power	HDN275, HDF275, HDW275
	2 x 1.0 mm <sup>2</sup> Power	Brake

Table 21: Connector box big

## Resolver Signal Connector

Cable scheme	8 x 0.25 mm <sup>2</sup> , stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	Moog part number: C08485-001/CA46373-001/CA46373-003

Table 22: Resolver signal connector

## Encoder Signal Connector

Cable scheme	17 x 0.25 mm <sup>2</sup> , stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	Moog part number: C08666-001

Table 23: Encoder signal connector

## Fan Connector Mini Fit 2-Pin Type

Cable scheme	4 x 0.25 mm <sup>2</sup> , stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	Moog part number: Receptacle housing connector: CC15043-001 (4-pin type) Female crimp terminal: CC15364-001

Table 24: Fan connector minifit

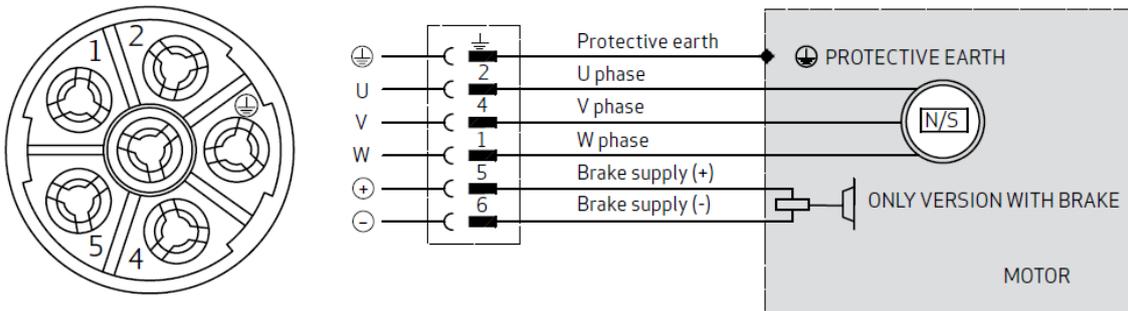
Fan Connector 6-Pin Type

Cable scheme	2 x 0.25 mm <sup>2</sup> , stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	Moog part number: Receptacle housing connector: CC16750-001 (2-pin type) Female crimp terminal: CC15364-001

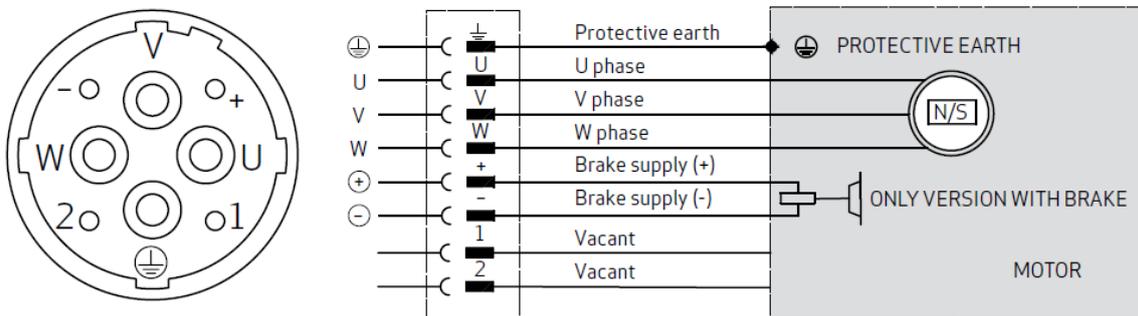
Table 25: Fan connector 6-Pin type

## 9.2. Wiring Diagrams – Power

### Power connector Size - 1



### Power connector Size 1.5



### Power connection in terminal box (big)<sup>2)</sup>

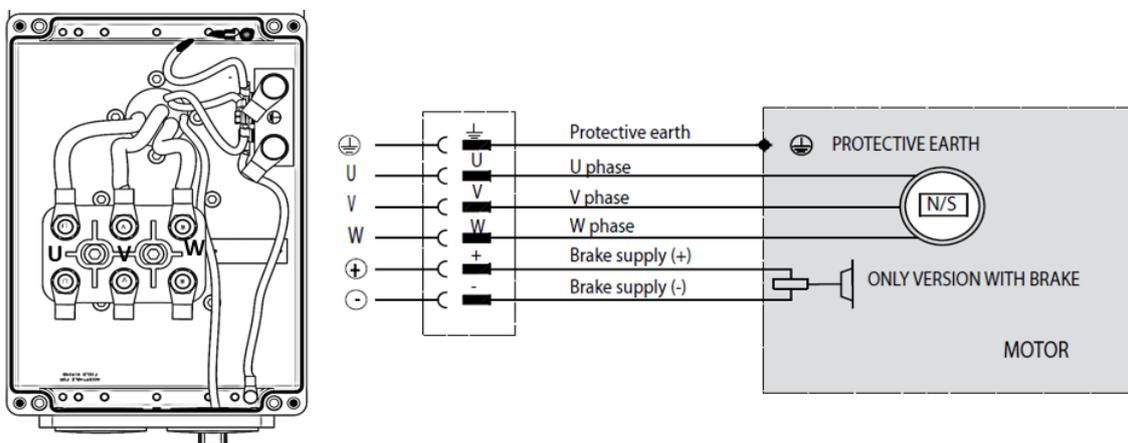


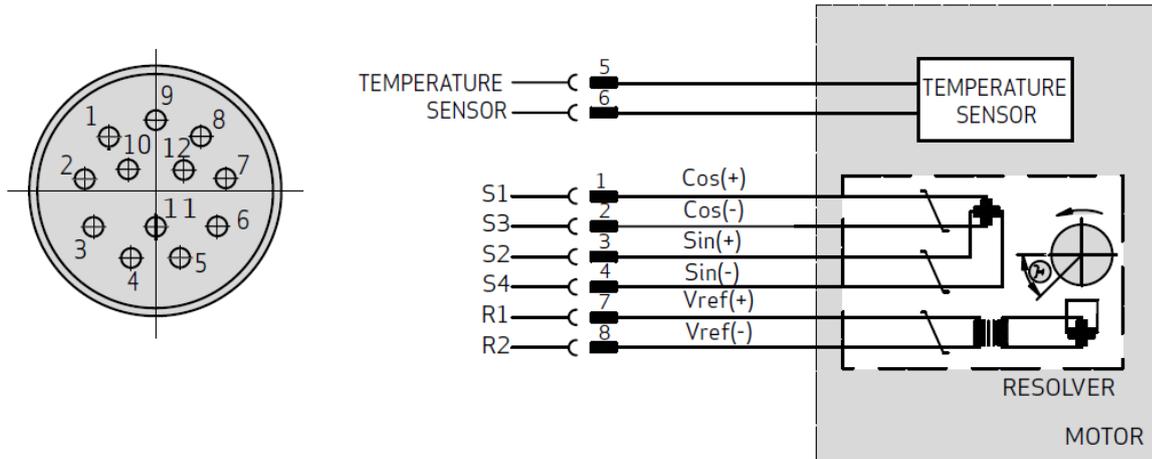
Figure 15: Wiring sequence

2) Refer installation drawing for lug size

### 9.3. Wiring Diagrams – Feedback Device

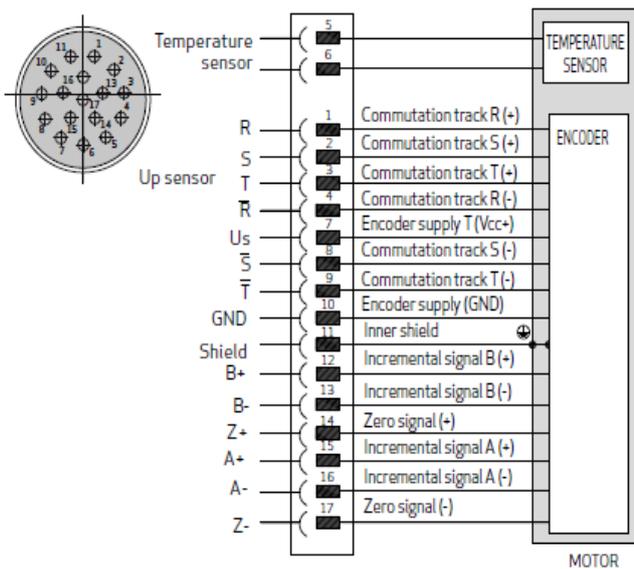
#### Resolver – Signal connector

##### Signal Resolver Connector

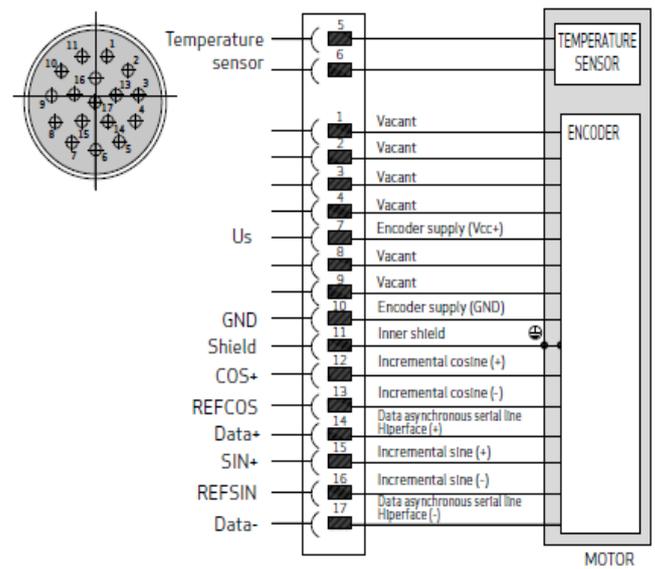


#### Encoder – Signal connector<sup>3)</sup>

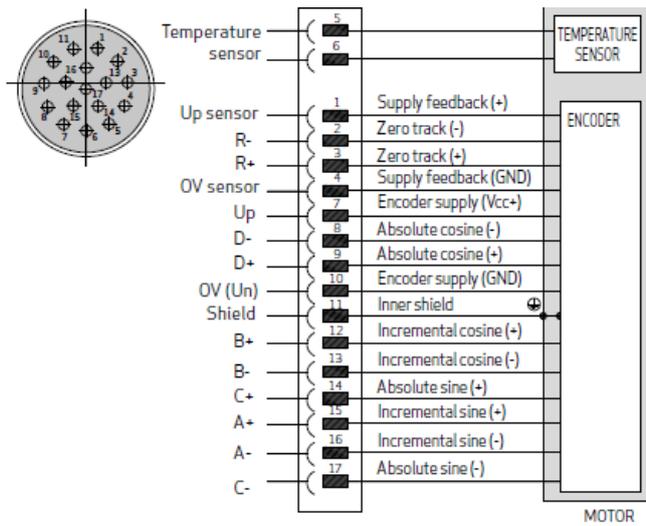
##### Stegmann Incremental



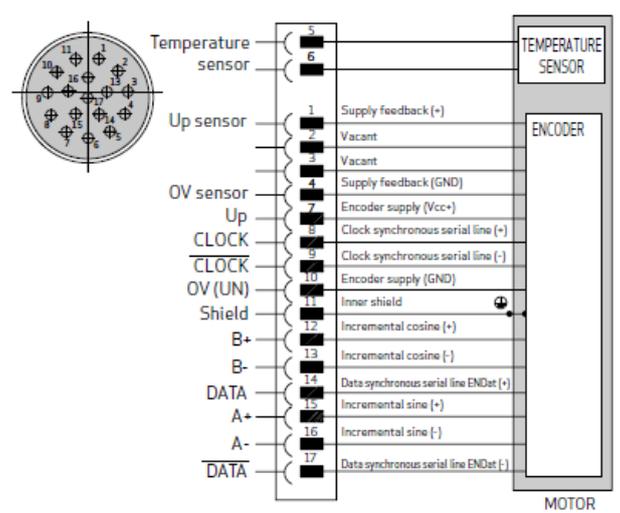
##### Stegmann Absolute



Heidenhain Incremental



Heidenhain Absolute



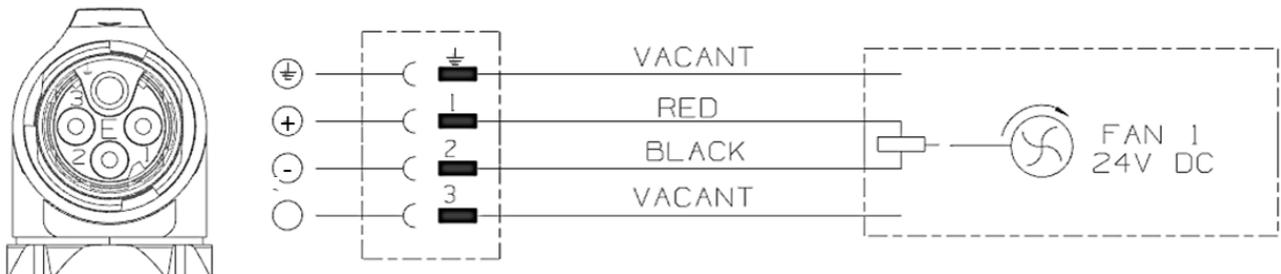
3) Feedback option: [Chapter "13 Ordering Code"](#)

9.4. Wiring Diagram – Fan Connector

Minifit connector



Speedtec Connector



9.5. Connectors

Moog motors have Threaded, Speedtec and Speedtec-ready connectors mounted on it. The Threaded and Speedtec-ready connectors will have O-ring installed in them.

The mating connectors are of two types Threaded and Speedtec plug type.

The threaded Speedtec connector have the following thread sizes

- Size 1 connector – M23x1P
- Size 1.5 connector – M40x1.5P

If a Speedtec-ready connector is used with a Threaded plug mating connector, the O-ring need not be removed from the motor connector, i.e., the connector can be used as is.

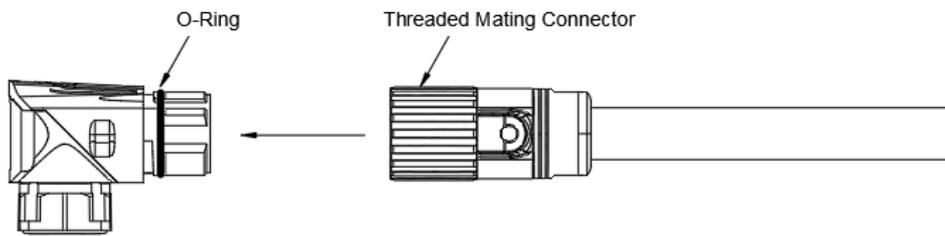


Figure 16: Speedtec-ready motor connector with O-ring

If a Speedtec-ready connector is used with a Speedtec plug mating connector, the O-ring should be removed from the motor connector.

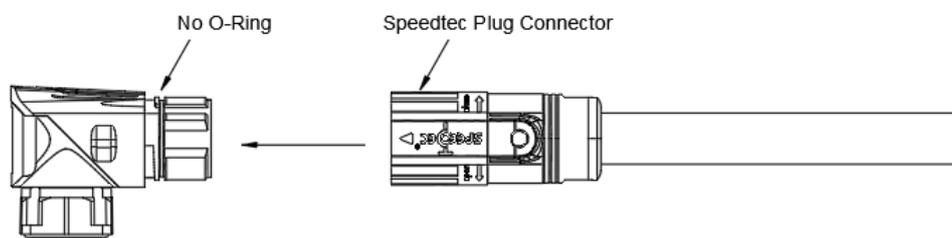


Figure 17: Speedtec-ready motor connector with O-ring uninstalled

Size 1 connector - M17x1P

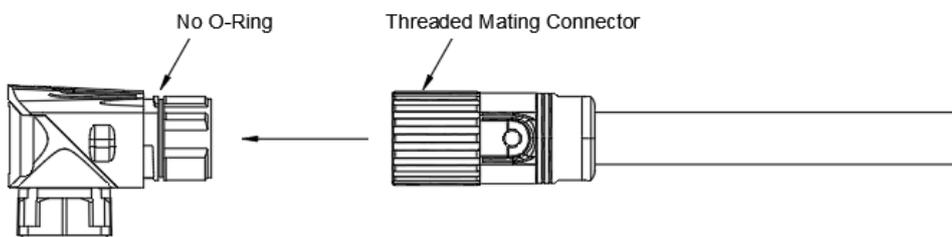


Figure 18: Speedtec connector with O-ring uninstalled

Fan Connector with mating connector

Minifit connector



Figure 19: Fan connector with mating connector

**Note:** For more details on connectors please contact Moog personnel (for the pin arrangement please refer installation drg)

## 10. MAINTENANCE

### WARNING

#### **Risk of Electric shock!**

- In case of motor disassembly make sure that all electrical power motor windings and any accessory device from the motor is disassembled which otherwise may lead to fatal injury.

### NOTICE

Because of product liability issues any motor damage should be repaired by Moog. Non-Moog staff may be unable to comply with safety rules (e.g. VDE guide lines) and Moog quality standards.

Any unexpected mechanical rotation of parts can cause severe damage during maintenance operation.

### NOTICE

Each time the motor is disassembled care should be taken that encoder system phasing is done properly by Moog personnel.

Observe the following:

- Before performing any maintenance procedure make sure that shaft rotation is locked. Make sure that the equipment connected to the shaft does not cause any shaft rotation. Disconnect the load, if necessary, before performing maintenance.
- Check for bearing noise and vibrations for normal operation of motor at regular intervals.
- Bearing service life is approx. -20,000 hours.
- Brakes should be checked on fixed regular intervals to ensure safe and trouble-free running of motor.
- Check for full engagement and disengagement functioning of brake.
- Check brake torque for holding the motor. If torque is below as specified in the name plate, brake may have to be re-burnished. For more details on this please contact Moog personnel.
- Keep the motor clean in order to ensure free ventilation and cooling.
- Check that motor is not noisy during operation and vibration does not exceed standard levels.
- For Fan cooled motors: Checking and cleaning of fan protective grill and air passage in cowl is recommended.
- For Water cooled motors: Periodically cleaning and checking of the cooling circuit is recommended.
- The use of cleaning products and/or deposit removers has to be subjected to preventive verification of compatibility with the materials of the housing (aluminium and its alloys), with the material of gaskets (Viton) and with all the components of the circuit.
- To detect and correct any irregularities at early stage it is recommended to carry out inspection at first 50 to 75 operation hours.

## 11. TROUBLE SHOOTING

Problem	Cause	Action
Motor dose not start	Wrong connections	Check the connections of the motor power and signal cables.
	Mechanical Brake	Check that the brake is supplied with the voltage ( $V_{DC}$ ) as defined by the manufacturer
	Mechanical failure	Check that the mechanics coupled to the servo motor allow free rotation.
	Parameters	Check the parameter settings of the drive system.
	Overload	Reduce the load or contact application engineer for more details.
Motor does not reach the rated speed	Parameters	Check the parameter settings of the drive system.
	Overload	Reduce the load or contact application engineer for more details.
Motor runs in wrong direction	Connections	Check both the power and signal connections on the motor and drive side.
Motor overheats	Overload	Reduce the load or contact application engineer for more details.
	Wrong connections	Check that no phase is incidentally open or grounded.
	Harmonic distortion	High harmonic distortion in the frequency converter output is not allowed.
	Cooling water not connected/switched off	In case of water-cooled motor: Check cooling water connection, switch on cooling water
	Cooling water flow rate too low	In case of water-cooled motor: Increase cooling water flow rate
	Water connection/pipe defective	Locate leaks and seal as required
	Cooling air Inlet and/or outlet is blocked by foreign bodies	In case of fan cooled motor: Remove the blockage and ensure that cooling air can flow in and out.
Vibrations or loud noise	Bearing failure	Contact Moog for repairs.
	Misalignment	Check the correct alignment of the motor and load. Ignoring misalignment can cause serious damage of bearings, shaft and mechanics.
Fan does not start (in case of fan cooled motors)	Wrong connections	Check the polarity and proper connection sequence.
	Obstruction in the fan enclosure	Clean dust particle entrapped between fan blades.
Vibration or loud noise in fan (in case of fan cooled motors)	Bearing failure in the fan kit	Contact Moog for repairs
Water is leaking	Water connection/pipe defective	Locate leaks and seal as required

Table 26: Trouble shooting

If the fault still cannot be resolved after applying the measures specified above, please contact the Moog Service centre.

## 12. MOTOR DISPOSITION

Motors may contain environmentally regulated materials, such as lead solder and circuit boards. When disposing of a motor, please recycle motors per regulations applicable at your region (National/International standards or regulations). You may choose to return a motor for disposal by contacting Moog personnel. Please contact Moog site for supplied motor warranty, non-warranty, or disposal work.

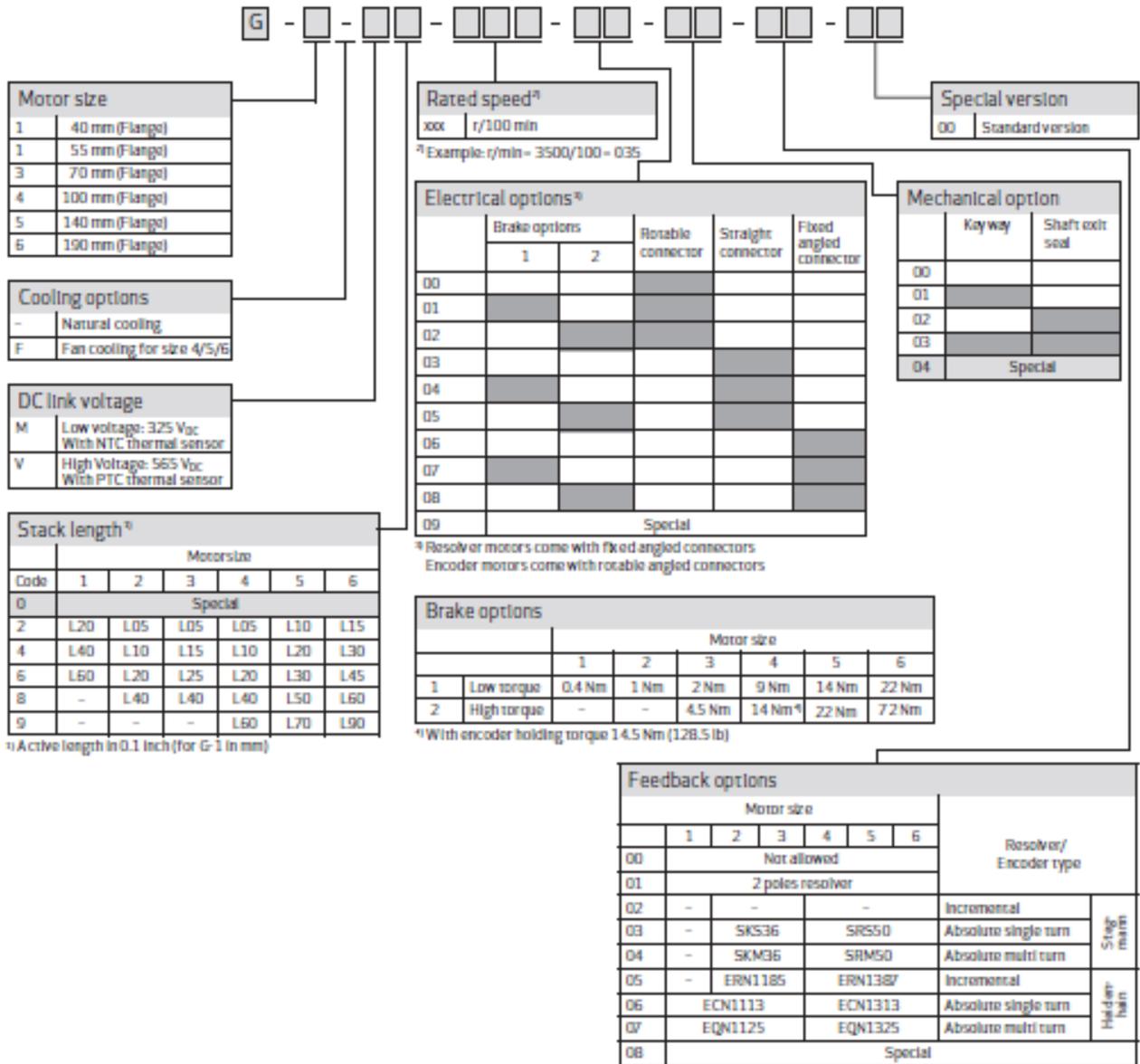
### 12.1. What to do if repairs are required?

If a repair of a Moog motor should prove necessary, all parts such as gear, toothed wheels, pinions etc. not fitted by Moog should be removed because Moog cannot guarantee correct disassembly. Grease and dirt on the front flange should be removed. Moog would appreciate a detailed failure or breakdown report attached to the delivery paperwork. "For Repair" should be clearly stated on the delivery note.

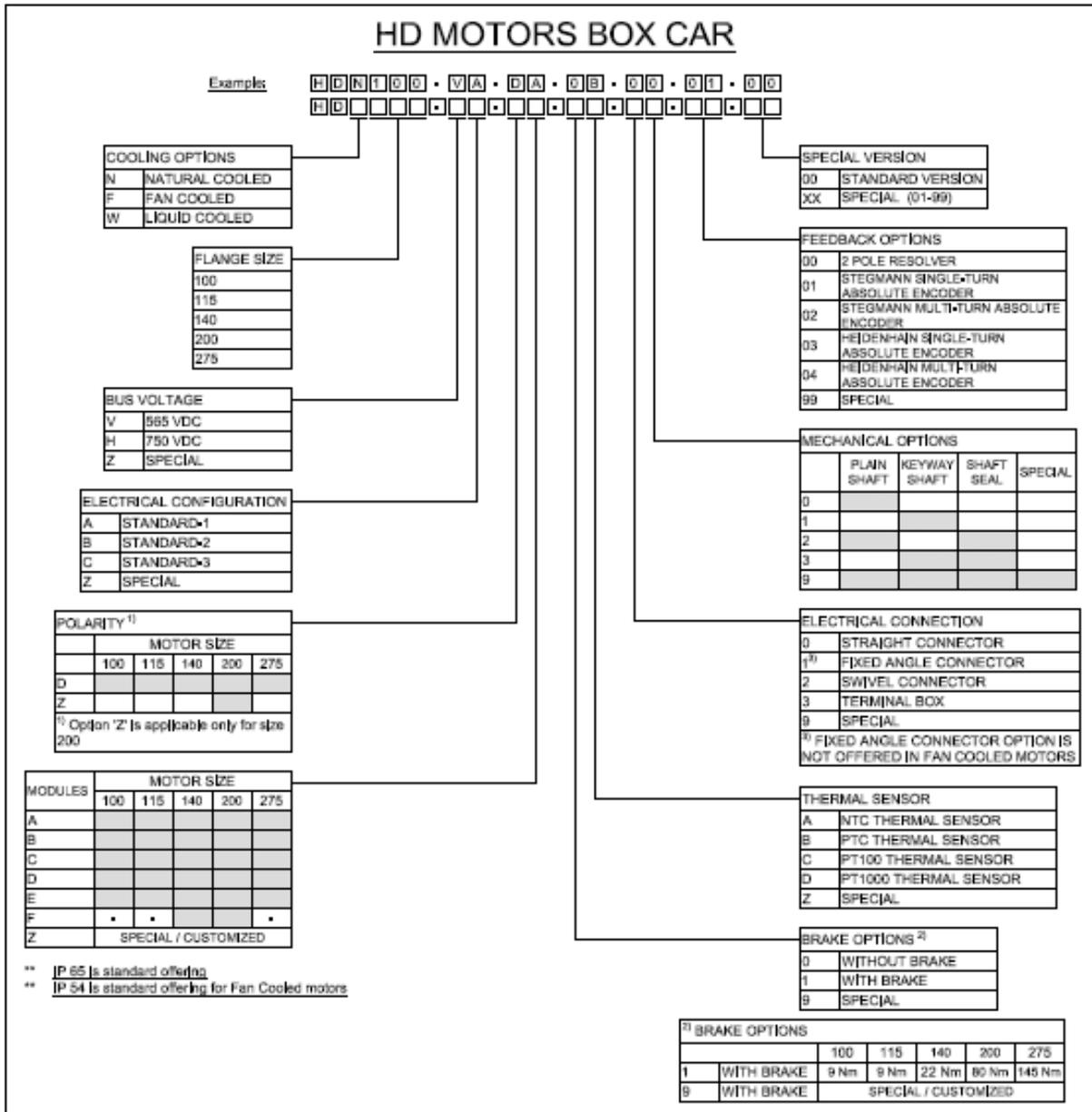
**Notes**

# 13. ORDERING CODE

## 13.1. CD Series Ordering Code



### 13.2.HD Series Ordering Code



# MORE SOLUTIONS. MORE SUPPORT.

Moog range of electromechanical and motion control products goes far beyond what is featured in this document. Moog also provides service and support for all of our products. Moog has offices around the world. For more information or the office nearest you, visit [www.moog.com/contact-us/moog-facilities](http://www.moog.com/contact-us/moog-facilities)



For more information, visit [www.moog.com/industrial](http://www.moog.com/industrial)  
or email us [info-india@moog.com](mailto:info-india@moog.com)

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