TECHNICAL CATALOGUE

VAR SERIES

MOTOVARIATORS

STANDARD **IEC**

MOTOVARIO®
HEART OF MOTION
a TECO Group company

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1.1 COMPANY PROFILE

Motovario® corporate philosophy aims to promote the company's brand and products at an international level with determination and transparency, while constantly striving to offer innovative solutions for satisfying and anticipating the demand of the market. Motovario® provides technologically advanced solutions in the transmission components field for industrial and civil applications worldwide.

The company

At Formigine, the heart of Modena's industrial district, Motovario® boasts a production plant spanning 50,000 m^2 that employs 500 people.
1965 Foundation of Motovario
1998 Acquisition of Spaggiari Trasmissioni, an important brand in the mechanical technology sector.
2006 Motovario acquisition by a private investment fund managed by Synergo SGR, in order to guarantee its development and support its expansion throughout the world.
2014 Acquisition of Pujol.
2015 Acquisition by TECO.

At the core of Motovario® lies an evolved production process based on technological solutions that convert power into movement. Motovario® is at the heart of the production processes that drive industries worldwide. Quality and reliability are the company's fundamental assets. Motovario® is present throughout the world with branches in France, Spain, Germany, England, China, the United States and India. The sales network and customer service guarantee immediate and high-quality support to all customers. In addition, the company boasts a worldwide network of MAC (Motovario Assembly Centre). Qualified assembly centres are present, in Italy, Australia, Benelux, Bulgaria, China, Finland, France, India, Ireland, Israel, Malaysia, Poland, Portugal, South Korea, Spain, Sweden, Turkey, United Kingdom, Ukraine and USA. The company is able to offer a wide range of products: speed variators, right-angle, helical-bevel, shaft-mounted, worm gear reducers and gearmotors, electric motors, inverter and inverter drives. Maximum quality and precision are ensured by the cutting-edge technologies implemented in the production process. 170 numerical control machines, served by LGV lines for storage in automatic warehouses, ensure a high standard of efficiency for the Motovario® production department.
The highly automated assembly lines are supported by a specific computerised system. The process statistical control system manages the production process to avoid rejects, by enabling the operator to monitor all the processing phases. The annealing, tempering, hardening and carburizing treatments are carried out inside the plant. The plant operates on a 24-hour basis, including holidays. Reliability, resilience and versatility are the distinctive features of Motovario® products, the most qualified solution to any power transmission requirement.

Main fields OF APPLICATIONS

- Mechanical-electromechanical industry (car washing, pumps, barriers & automatic doors, circuit breakers)
- Ceramic industry (ovens, press feeding systems)
- Food, farming, oenology industry
- Wood, marble, glass industry
- Packaging & bottling industry
- Textile, shoes, leather industry
- Transport, logistic industry
- Construction industry
- Milling, animal husbandry, flower industry
- Machine tools & steel industry
- Mining, quarry, cement industry
- Energy industry (solar, nuclear, biomass, wind)
- Amusement industry (theatres, leisure parks, kiddy rides)
- Chemical & pharmaceuticals industry
- Paper & printing industry
- Plastic & rubber industry
- Telecommunications industry (satellite orientation systems, military radar)
- Engineering and consultant companies

1.1 COMPANY PROFILE

Certifications

Our products can be manufactured to conform with the ATEX Directive 2014/34/UE. In addition, the safety and quality of our motors, geared motors and motovariators is guaranteed by the EAC (EurAsian Conformity) certification, an essential requirement for products exported to the Russian Federation. Our motors are UL certified, which guarantees their safety and quality requirements for the North American market.

Quality CONCEPT

Motovario® has obtained the quality certification renewal of its production system in conformity to the UNI EN ISO 9001:2008 standard. This internationally recognised certification acknowledges the company's commitment and drive geared towards constantly improving products, projects and services offered. Moreover, the company has obtained the OHSAS 18001:1999 (Occupational Health and Safety Assessment Series) certification, which defines the requirements of the workplace safety and health management system.

Research & DEVELOPMENT

Technological innovation: a crucial factor for competing in the market. In the company's 50-year history, research and change have been the pivotal factors in guaranteeing competitiveness at a global level, thanks to increasingly advanced products in terms of performance and reliability. Each year the company invests an increasing amount of its turnover in research and development, geared towards promoting the constant study and analysis of products, control processes and performance certification.In order to ensure that customers receive products that comply with the requested performance levels, the company carries out simulations on all new products, including NVH (Noise, Vibration, Harshness) tests effected in the advanced semi-anechoic chamber.

Customer CARE

Innovative instruments and software applications supporting the technical and logistic requirements of our partners worldwide guarantee a timely and customised service. The experienced acquired by Motovario® has led to the creation of the new online portal MyMotovario 4.0, which allows for selecting products and exporting their 3D file. As a result, designers and engineering departments can download the three-dimensional model of the requested product and implement it directly in their own layout. In order to maximise customer service and quality, Motovario® offers all its customers the following online services: Order Tracking, which allows for monitoring the progress of an order in real time, and the Stock Availability service, through which users may check the availability (stock) of our products, both in the Italian plant and in the various branches.

Motovario chooses technological evolution.

Motovario® has chosen technological evolution and actively collaborates with the Faculty of Engineering of the University of Modena and Reggio Emilia and of the University of Bologna.

1.2 PRODUCTS AND SOFTWARE MOTOVARIO

Reliability, sturdiness, versatility
These are the distinctive traits of Motovario products. A broad range of transmission products that provide a competent, innovative solution to each and every power application need. Cutting-edge tools, unrelenting research efforts and ongoing commitment to upgrading manufacturing equipment to the latest state-of-the-art enable us to offer high quality and performance standards to cater to industry requirements and the broadest variety of applications. Motovario ranks among the leading, well-reputed companies in Italy engaged in the design, manufacture and sales of transmission products for industrial and civil applications. The entire manufacturing process takes place in Formigine and Ubersetto plants, in Modena area, with an overall surface area of over 50.000 sq m. and a workforce of about 500 people. 170 numerically controlled machines and cutting-edge handling, storage and assembly automated systems ensure that all products meet high quality standards. The network includes more than 40 Motovario-certified assembly centres, with the capability to supply products in a broad range of versions, including customised versions, high service capacity and fast response. As a result, our product offering can cater to the needs of all plant engineering sectors, in all industries and for different applications, and includes: speed variators, helical, bevel-helical, parallel helical, worm gear reducers and gearmotors, electric motors and motor-inverters. All of the products we manufacture share such common features as reliability, sturdiness and versatility, topped with a high innovation content. At the heart of a company's technological innovation is the ability to develop integrated tools for computer-aided calculation simulation and management of different processes as part of product development. When simulating operating, setup and process conditions, it is also necessary to analyse and optimize the overall functional design of a product using a synergistic approach. This is achieved by implementing an exhaustive experimental plan, without using interpolation or approximation, as they frequently allow criticalities or any oversizing which is not conducive to maximising quality/cost ratio to go unnoticed.

High-efficiency method for calculation according to standards
A set of specific functions have been developed to this end. A few significant examples include functions to:

- Optimise individual reduction ratios and the combinations of the different reduction stages based on parametrisable target normal series;
- Calculate torque values and maximum permissible external forces for gear reducer units, using iterative numeric algorithms to confirm target life/safety values of components;
- Create databases for loading a FEM structural analysis model by automatically writing all reaction components of bearings under all load conditions to a specific file, with automatic selection of critical cases that need to be verified.

Another goal of the method is to create synergy between calculation according to standards and FEM structural calculation and the implementation of FEM model loading procedures, so as to simplify input data, meshing and constraint criteria

Competitiveness and operational benefits of the new method
This method offers many practical advantages over traditional calculation procedures within the company, namely:

- Iterative optimisation of project since setup stage;
- Accurate assessment of the various service factors and reliability levels for the entire gear reducer unit and for all operating conditions as per catalogue rating or customer specific requirements;
- Faster support to customers in analysing tailored product configurations;
- Integrated corporate databases that can be updated in real-time;

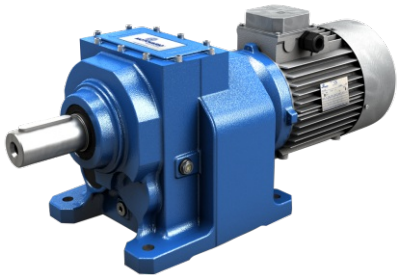
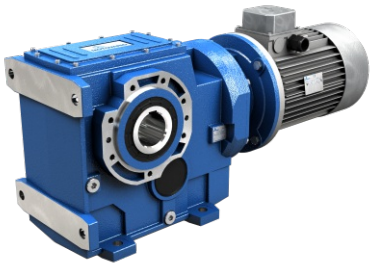
Range extension and ongoing evolution
The steady, significant growth of Motovario Group is achieved thanks to an ongoing search for new calculation and design tools, as well as to customer service. The new tools identified have led to innovation, improved product reliability as well as positive developments in market management. The following software products are used for design, calculation and management:

- Solidworks;
- Kissoft;
- Kissys;
- Ansys;
- FEM modelling analysis software;
- Circuit design and simulation software;
- Specific spreadsheets;
- SAP.

In MyMotovario 4.0 portal, PRODUCT SELECTION includes a section named APPLICATIONS where customers can enter application data and find out which gear reducer suits them best in a matter of minutes.

1.2 PRODUCTS AND SOFTWARE MOTOVARIO

MOTOVARIO Products

HELICAL GEAR REDUCERS Cast iron or aluminum casing Output shaft up to 90 mm Mn_2 up to 8.600 Nm Reduction stages 1, 2, 3 Ratios up to 354 Atex units	
HELICAL BEVEL GEAR REDUCERS Cast iron or aluminum casing Output shaft up to 110 mm Mn_2 up to 14.000 Nm Reduction stages 2, 3 Ratios up to 443 Atex units	
SHAFT MOUNTED GEAR REDUCERS Cast iron Output shaft up to 90 mm Mn_2 up to 10.250 Nm Reduction stages 2, 3 Ratios up to 395 Atex units	
WORM GEAR REDUCERS Cast iron or aluminum casing Output shaft up to 50 mm Mn_2 up to 2.700 Nm Ratios up to 1083 Atex units	

PARALLEL HELICAL AND BEVEL HELICAL GEAR REDUCERS FOR HEAVY INDUSTRY Cast iron casing Output shaft up to 180 mm Mn_2 up to 90.000 Nm Reduction stages 1, 2, 3, 4 Ratios up to 636 Atex units	 
MOTOVARIATORS AND MOTOVARIATOR-GEAR REDUCERS Cast iron or aluminum casing Ratios infinite Mn_2 up to 5.000 Nm Atex units	

1.2 PRODUCTS AND SOFTWARE MOTOVARIO

ELECTRIC MOTORS

Power ratings up to 90 kW
Poles 2, 4, 6
Three-phase and single-phase, built-in brake, dual polarity
Protection class up to IP66

DRIVES

DRIVON – motoinverter

Three phase and single phase power supply
High dynamics sensorless vectorial control
Power ratings up to 5,5 kW
Standard integrated STO
Integrated field bus
Optional field bus

LM16 - EM16 - AM16 – inverter

Compact, standard and premium/servo drive
Protection class IP20 - IP66
Torque and speed regulation
PLC integrated functions

1.3 SYMBOLS AND FORMULAS

1.3.1 Symbols

Physical dimension	Symbol	Symbol units of measure	Input	Output
Power	P	[kW]	P_1	P_2
Requested power	Pr	[kW]	Pr_1	Pr_2
Nominal power	Pn	[kW]	Pn_1	Pn_2
Torque	M	[Nm]	M_1	M_2
Nominal torque	Mn	[Nm]		Mn_2
Requested torque	Mr	[Nm]	Mr_1	Mr_2
Speed	n	[rpm]	n_1	n_2
Load	F	[N]		
Radial load	Fr	[N]	Fr_1	Fr_2
Radial axial	Fa	[N]	Fa_1	Fa_2
Reduction ratio	i			
Dynamic efficiency	η_d			
Service factor	f.s.			
Static	s			
Dynamic	d			
Calculated	c			
Maximum	max			
Minimum	min			
Moment of inertia	J	[kgm^2]	J_1	
Ambient temperature	T_{amb}	[°C]		
Dimension		[mm]		
Number of screw threads	Z1			
Lead angle	ϒ	[° ′ ″]		
Axial module	Mx			
Dynamic efficiency of n1= 1400 rpm	ηδ(1400)			
Static efficiency	ηs			

1.3 SYMBOLS AND FORMULAS

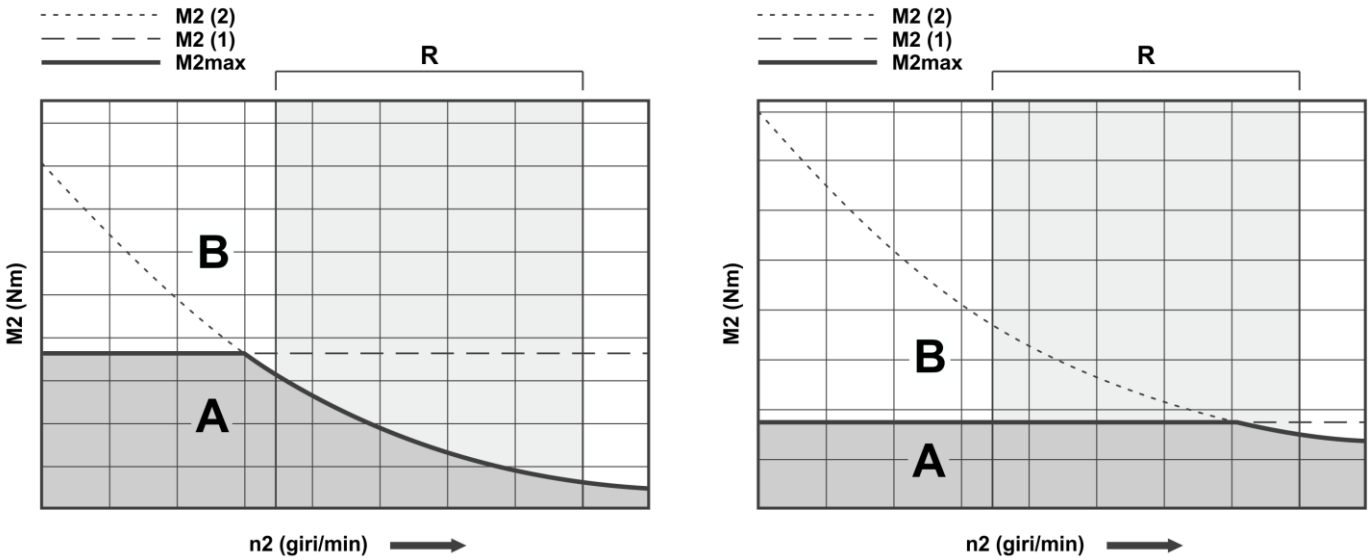
1.3.2 Formulas

REDUCER		
Starting or stopping time	$t = v / a$	[s]
Velocity in rotary motion	$v = \pi * d * n / 60$ $v = \omega * r$	[m/s]
Speed velocity Angular velocity	$n = 60 * v / (\pi * d)$ $\omega = v / r$	[rpm] [rad/s]
Acceleration or deceleration according to a starting / stopping time	$a = v / t$	[m/s^2]
Angular acceleration	$\alpha = n / (9{,}55 * t)$ $\alpha = \omega / t$	[rad/s^2]
Starting or stopping distance (according to acceleration / deceleration or angular velocity)	$s = a * t^2 / 2$ $s = v * t / 2$	[m]
Horizontal translation force	$F = \mu * m * g$	[N]
Vertical translation force (lifting)	$F = m * g$	
Inclined plane translation force	$F = m * g (\mu * \cos\beta + \text{sen}\beta)$	
m= mass [kg]; g= gravity acceleration [m/s^2]; μ= friction coefficent; β= angle of inclination		
Moment of inertia	$J = m * v^2 / \omega^2$	[kgm^2]
Torque	$M = F * d / 2$ $M = J * \omega / t$	[Nm]

MOTOR and GEARMOTOR		
Starting time	$ta = (Jext+Jm)*n_n/9{,}55+(M_{peak}-Mr)$	[s]
Braking time	$ts = (Jext+Jm)*n_n/9{,}55+(M_{peak}+Mr)$	[s]
Motor rotation angle during starting	$\varphi = n_n * ta / 19{,}1$	[rad]
Motor rotation angle during braking	$\varphi = n_n * ts / 19{,}1$	[rad]
Power available at the shaft of single phase motor	$P = V * I * \eta * \cos\omega$	[W]
Power available at the shaft of three phase motor	$P = 1{,}73 * V * I * \eta * \cos\omega$	[W]

RUNNING at 60Hz		
Speed velocity at 60Hz	$n_{60Hz} = 1{,}2 * n_{50Hz}$	[rpm]
Power at 60Hz	$P1_{60Hz} = P1_{50Hz} * V_{60Hz}/V_{50Hz}$	[kW]
If input voltage at 60 Hz (V_{60Hz}) corresponds to winding voltage at 50 Hz (V_{50Hz}), power doesn't change $P1_{60Hz} = P1_{50Hz}$ If input voltage at 60 Hz (V_{60Hz}) is 20% higher than winding voltage at 50 Hz (V_{50Hz}), power increases by 20% $P1_{60Hz} = 1{,}2\ P1_{50Hz}$		
Torque at 60Hz	$M_{60hz} = M_{50Hz} * P1_{60Hz} / (1{,}2 * P1_{50Hz})$	[Nm]
Service factor at 60Hz	$f.s._{60Hz} = f.s._{50Hz} * 1{,}175 * P1_{50Hz} / P1_{60Hz}$	-

1.4 PRODUCT SELECTION

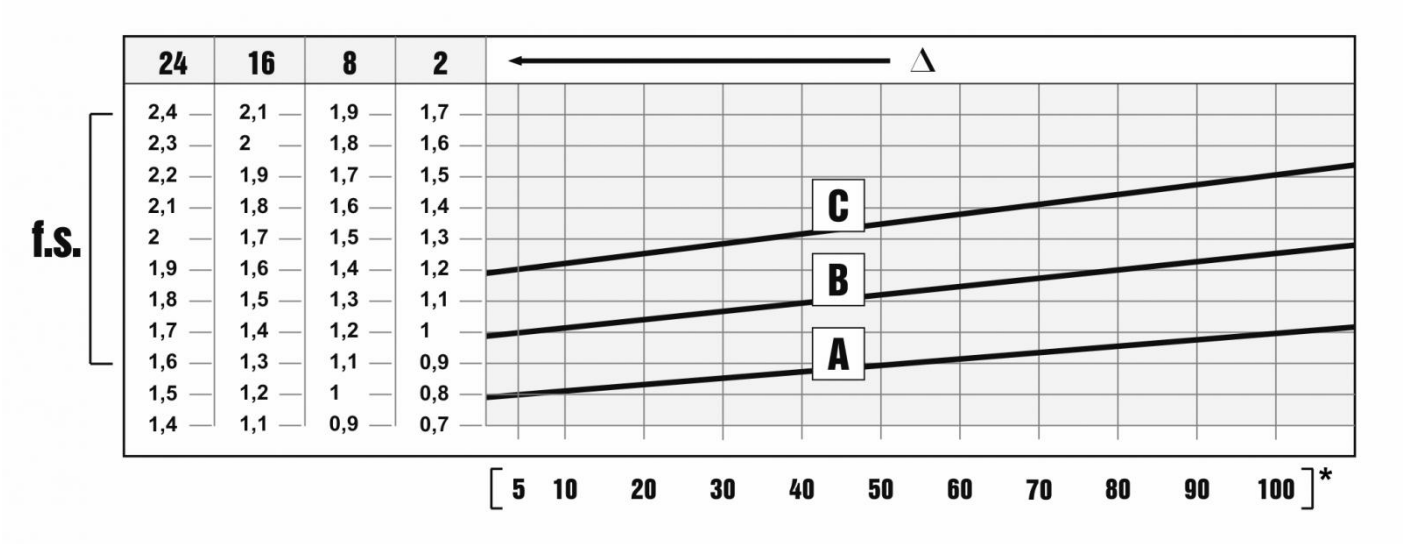


The maximum loading curve of a motovariator (M2 max) is usually split into two separate parts: one with constant torque and another one with a decreasing torque. This curve is given by the minimal value between:

- The speed variator maximum capacity (M2 (1)) is represented by the horizontal line of the graph.
- The maximum output torque (M2 (2)) which refers to motor power is represented by a decreasing curve inversely proportioned to the speed.

To avoid damage, the motor performance cannot exceed the M2 max constant output torque of the variator. The speed variator can use the full motor nominal power at higher r.p.m. In case the performance required by the application is within the decreasing torque section (as per the picture on the left side) it is not necessary to check the motor output torque, because motor nominal power is always lower than variator capacity (A correct section). For the correct motovariator running, motor output torque must be lower than variator mechanical capacity. When choosing a motovariator it is not necessary to check the service factor, but it is sufficient that the different running speeds are within the correct section, see area A. When choosing a motorvariator coupled with a gear reducer it is important to check the service factor, as indicated on the gear reducers catalogue. The maximum number of starts depends on the type of application, it is recommended not to exceed 5-10 per minute. For any different requests, please contact MOTOVARIO TECHNICAL SERVICE.

1.5 SERVICE FACTOR



The service factor (f.s.) depends on the operating conditions the gear reducer is subjected to.
The parameters that need to be taken into consideration to select the most adequate service factor correctly comprise:

- type of load of the operated machine : A - B - C
- length of daily operating time: hours/day (Δ)
- start-up frequency: starts/hour (*)

LOAD:

- **A** - uniform = fa ≤ 0,3
- **B** - moderate shocks = fa ≤ 3
- **C** - heavy shocks = fa ≤ 10

fa = Je/Jm

- Je [kgm^2] moment of reduced external inertia at the drive-shaft
- Jm [kgm^2] moment of inertia of motor

If fa > 10 call MOTOVARIO TECHNICAL SERVICE.
In the case of a variable speed reducer, once determined the service factor of the application it is necessary to compare this value with the safety factor of the S reducer reported in the selection tables, verifying S ≥ f.s. condition. The maximum number of admissible starts depends on the type of application. Approximately, the figure must not exceed 5-10 for minute. Contact MOTOVARIO TECHNICAL SERVICE if you have any special requirements.

A. Screw feeders for light materials, fans, assembly lines, conveyor belts for light materials, small mixers, lifts, cleaning machines, fillers, control machines.
B. Winding devices, woodworking machine feeders, goods lifts, balancers, threading machines, medium mixers, conveyor belts for heavy materials, winches, sliding doors, fertilizer scrapers, packing machines, concrete mixers, crane mechanisms, milling cutters, folding machines, gear pumps.
C. Mixers for heavy materials, shears, presses, centrifuges, rotating supports, winches and lifts for heavy materials, grinding lathes, stone mills, bucket elevators, drilling machines, hammer mills, cam presses, folding machines, turntables, tumbling barrels, vibrators, shredders.

1.6 INSTALLATION

To install the variator with reducer it is necessary to note the following recommendations:

- Check the correct direction of rotation of the gear reducer output shaft before fitting the unit to the machine.
- In the case of particularly lengthy periods of storage (4/6 months), if the oil seal is not immersed in the lubricant inside the unit, it is recommended to change it since the rubber could stick to the shaft or may even have lost the elasticity it needs to function properly.
- Whenever possible, protect the variator with reducer against solar radiation and bad weather.
- Ensure the motor cools correctly by ensuring good passage of air from the fan side.
- In the case of ambient temperatures < -5°C or > +40°C call MOTOVARIO TECHNICAL SERVICE.
- The various parts (pulleys, gear wheels, couplings, shafts, etc.) must be mounted on the solid or hollow shafts using special threaded holes or other systems that anyhow ensure correct operation without risking damage to the bearings or external parts of the units. Lubricate the surfaces in contact to avoid seizure or oxidation.
- Painting must definitely not go over rubber parts and the holes on the breather plugs, if any.
- For units equipped with oil plugs, replace the closed plug used for shipping with the special breather plug.
- Check the correct level of the lubricant through the indicator, if there is one.
- Starting must take place gradually, without immediately applying the maximum load.
- When there are parts, objects or materials under the motor drive that can be damaged by even
- limited spillage of oil, special protection should be fitted.

Please note: in the event of a cover with adhesive label having to be replaced, you will have to stick a new label onto the new cover. Please contact Motovario and we can supply you with one.

2.1 DESIGN FEATURES

2.1.1 Design features

Motovario products are supplied with the following surface treatment features:

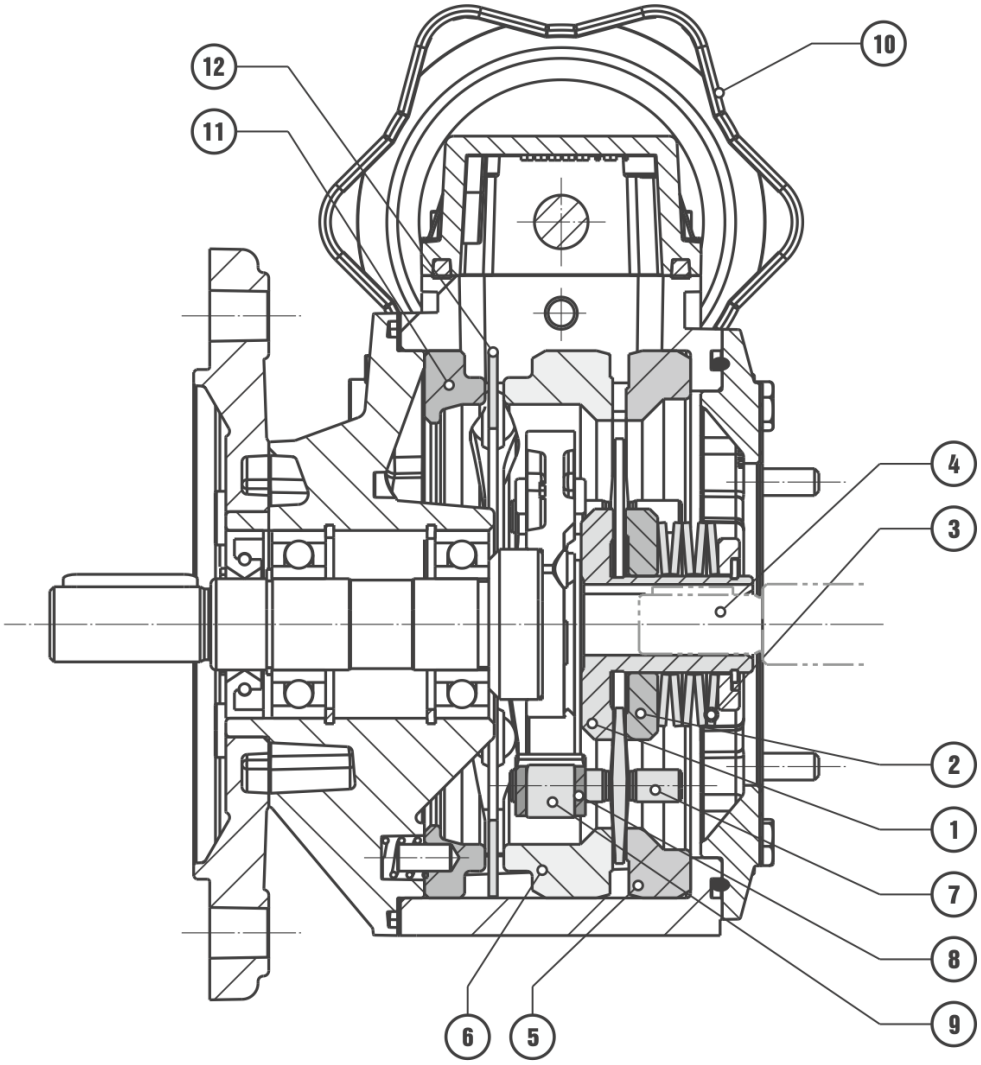
Die-cast aluminium alloy cases for gears
Die-cast materials undergo the following surface cleaning operations:
- De-burring by means of a mechanically operated shearing system.
- Accurate shot-peening.
- Painting.
- Washing and passivation.

Grey-coloured cast-iron cases for gears
- Die-cast materials are always painted.
  Grey-coloured cast-iron inspection cover: The gear reducer H... series with 2, 3 stages sizes 125 are supplied with grey-coloured cast-iron closing cover and a metal nameplate printed.

Painting specifications:
- Orange-peel blue epoxy-polyester RAL 5010. Polyester resin based heat-hardening powders, altered with epoxy resins.
  Mechanical properties: Tests carried out onto degreased Unichim white lattens (film thickness: 60 microns) comply with the following specifications: adherence (ISO2409).
  Heat resistance: 24 HOURS AT 150°C.
  Corrosion strength: ASTM B 117/97 salt fog from 100 to 500 hours depending on the support's preliminary treatment.

Performance:
- Loading capacity in accordance with DIN 3990, ISO 6336, AGMA 2101, ISO 10300, DIN 3991, ISO 281, DIN 743, ISO 14521, DIN 3996, BS 721, AGMA 6034.

2.1.2 Running



N°	Description
1	Fixed sun race
2	Adjustable sun race
3	Belleville spring
4	Shaft

N°	Description
5	Fixed annulus race
6	Adjustable annulus race
7	Planet disk
8	Planet disk friction bearing

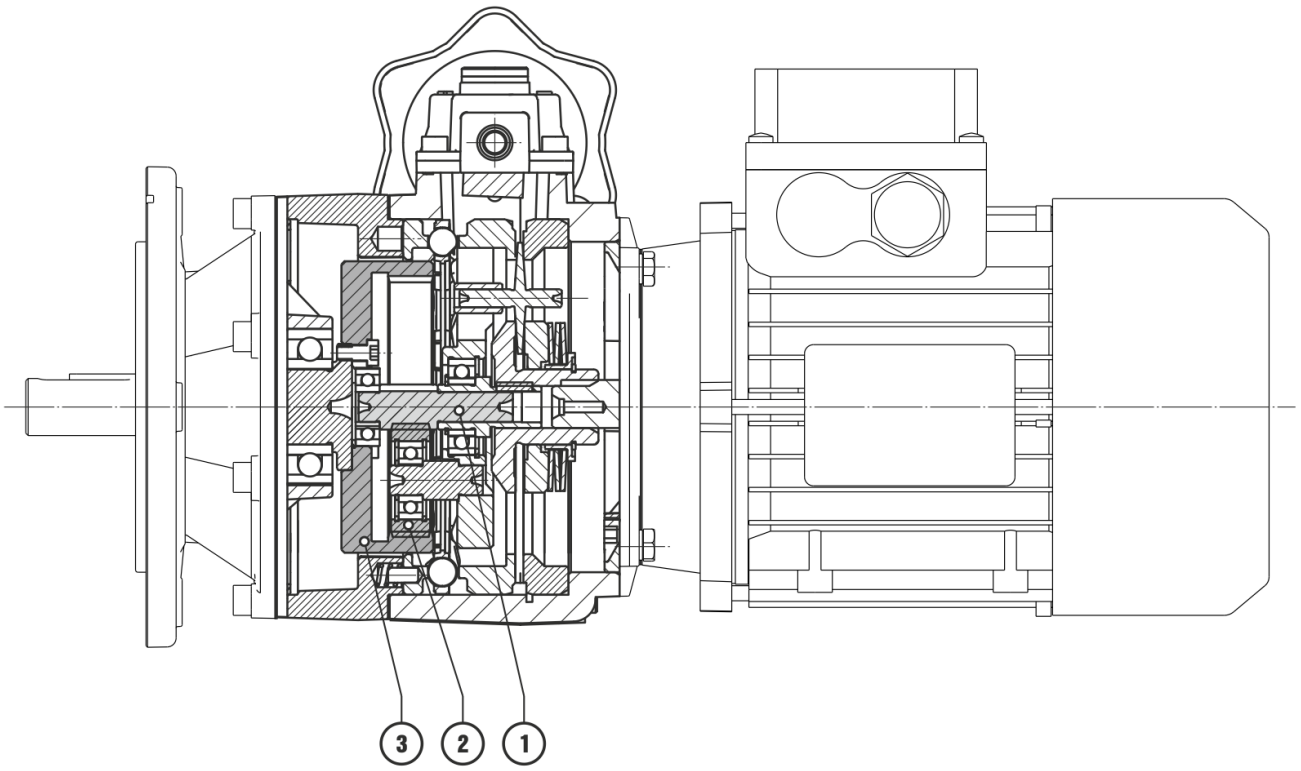
N°	Description
9	Planet carrier
10	Control Handwheel
11	Cam ring
12	Ball ring

Variators basically consist of the following compo- nents: two sun races (1, 2) are pushed together by a set of Belleville springs (3) and are keyed to the input shaft (4), two annulus races (5, 6) are fixed to the variator casing and therefore remain stationary. Planet discs (7) rotate in friction bearings (8) and are capable of sliding radially in planet carrier (9) which is keyed to the output shaft. Planet discs (7) are held between the driving sun races (1, 2) on the inside and the stationary annulus races (5, 6) on the outside. This imparts a double rotation to the planet discs which rotate individually about their own axis and collectively around the annulus races. Since the friction bearings which hold the planet discs are fixed to the planet carrier, the collective motion of the planet discs rotates the planet carrier and the output shaft to which it is keyed. Continuous speed variation is achieved by turning handwheel (10). This move annulus race (6) against pressure from ball ring (12) and came race ring (11). As annulus ring (6) moves, the gap between it and annulus ring (5) widens or narrows, causing the planet discs to slid outwards or inwards. This radial sliding move- ment of the planet discs varies the ratio of the drive transmitted to the planet carrier and output shaft.

N.B. **The said variation must be absolutely made with running motor.**

2.1 DESIGN FEATURES

2.1.3 Differential



MOTOVARIO motovariators can be equipped with epicyclic differential units to vary output speed over the range between 0 RPM and maximum RPM. Zero RPM output speed is achieved by transmitting the constant speed of the input shaft not only to the variator's sun races but also to the sun gear (1) which drives the additional epicyclic gear train. Input speed as varied by the variator is relayed to the pla- net gears (2) of the epicyclic differential. This causes planet gears (2) to rotate at the same speed as the driving sun gear (1). Under these conditions the annulus gear (3) of the epicyclic differential remains stationary, and there is no rotation of the output shaft.

2.2 CRITICAL APPLICATIONS

2.2.1 Critical applications

TXF - SF	002-003	005	010	020	030	050	100
2000 < n1 < 3000	✔	✔	✔	B	A	A	A
n1 > 3000	B	B	B	A	A	A	A
V3 - V6	B	B	B	B	B	B	B

H	A30	A40	A50	A60
V5 - V1: 1500 < n1 < 3000	✔	✔	✔	✔
n1 > 3000	B	B	B	B
V3 - V6	B	B	B	B

H	030	040	050	060	080	100	125
V5 - V1: 1500 < n1 < 3000	✔	✔	✔	✔	✔	✔	B
n1 > 3000	B	B	B	B	B	B	A
V3 - V6	B	B	B	B	B	B	B

	NMRV			NMRV-P				NMRV	
NMRV - NMRV-P	030	040	050	063	075	090	110	130	150
V5: 1500 < n1 < 3000	✔	✔	✔	B	B	B	B	B	B
n1 > 3000	B	B	B	B	B	A	A	A	A
V6	B	B	B	B	B	B	B	B	B

✔ Verified application
A Application not recommended
B Check the application and/or call MOTOVARIO TECHNICAL SERVICE.

2.2.2 Information

The performance given in the catalogue correspond to mounting position B3 or similar, when the first stage is not entirely immersed in oil. For other mounting positions and/or particular input speeds, refer to the tables that highlight different critical situations for each size of gear reducer. It is also necessary to take due consideration of and carefully assess the following applications by calling MOTOVARIO TECHNICAL SERVICE:

- To avoid the use as multiplier.
- Use in services that could be hazardous for people if the gear reducer fails.
- Applications with especially high inertia.
- Use as a lifting winch.
- Applications with high dynamic strain on the case of the gear reducer.
- In places with T_{amb} under -5°C or over 40°C.
- Use in chemically aggressive environments.
- Use in a salty environment.
- Mounting positions not envisaged in the catalogue.
- Use in radioactive environments.
- Use in environments pressures other than atmospheric pressure.
- Use of brake motors coupled with variators/geared variators.

Avoid applications where even partial immersion of the reducer is required.
In the presence of overloading due to full load, braking, shocks or other static and dynamic causes, please verify that the peak torque is less than $2*Mn_2$.

2.3 OVERHUNG LOAD

2.3.1 Information

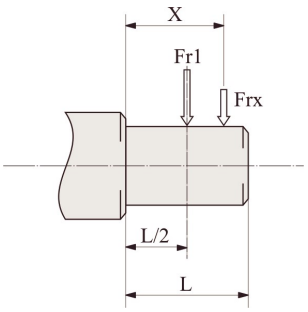
The value of the admissible radial load [N] is given in the tables relating to the performance of the gear reducer at issue. It is related to the load applied on the centre line of the shaft and in the most unfavourable conditions of angle of application and direction of rotation. The maximum admissible axial loads are 1/5 of the value of the given radial load when they are applied in combination with the radial load. The tables relating to the output shafts give the maximum admissible value. This value must never be exceeded since it relates to the strength of the case. Particular conditions of radial load higher than the limits of the catalogue may occur. In this case, call our Technical Sevice and provide details on the application: direction of the load, direction of rotation of the shaft, type of service. In case of double extension shafts with radial load applied on both ends, the max. admissible radial loads must be defined according to the specific running conditions, in this case call our Technical Service. The radial load on the shaft is calculated with the following formula: **Fre=(2000*M*fz)/D≤Fr1 or Fr2**

- **Fre** [N] Resulting radial load
- **M** [Nm] Torque on the shaft
- **D** [mm] Diameter of the transmission member mounted on the shaft
- **Fr1**-**Fr2** [N] Value of the maximum admitted radial load (see relative tables)
- **fz** = 1,1 gear pinion - 1,4 chain wheel - 1,7 v-pulley - 2,5 flat pulley

2.3.2 Input

When the radial load is not on the centre line of the shaft, it is necessary to adjust the admissible radial load Fr1 with the following formula: **Frx=(Fr1*a)/(b+x)**

- **a** , **b** = values given in the tables
- **x** = distance from the point of application of the load to the shaft shoulder



SF-ST	003	005	010	020	030	050	100
a	46	59	75	85	117	117	141
b	35	44	55	60	87	87	101
Fr1 max	460	660	880	910	1480	1480	5900

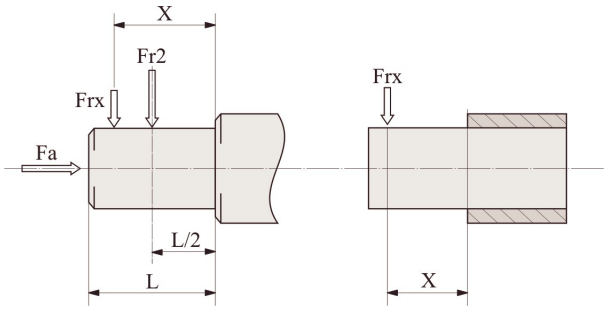
(**Fr1 max) Max admissible value of the reducer in static conditions and/or for limited operations. For continuous overhung loads please check the values on the performances tables calculated according to the casing, the shaft and bearings.

2.3 OVERHUNG LOAD

2.3.3 Output

When the radial load is not on the centre line of the shaft, it is necessary to adjust the admissible radial load Fr2 with the following formula: **Frx=(Fr2*a)/(b+x)**

- **a** , **b** = values given in the tables
- **x** = distance from the point of application of the load to the shaft shoulder



TXF	002	005	010
a	43	63	74
b	28	43	49
Fr2 max	550	1050	1350

SF	003	005	010	020	030	050	100
a	62	75	94	107	154	154	169
b	47	55	69	77	114	114	129
Fr2 max	760	1120	1910	2290	4540	4540	5890

ST	003	005	010	020	030	050	100
a	73	111	135	161	189	189	228
b	58	91	110	131	149	149	188
Fr2 max	1000	2080	2500	3000	5600	5600	7160

H	A41	A51	A61	A32/A33	A42/A43	A52/A53	A62/A63
a	81	83	103	105	115	135	155
b	61	58	73	85	90	105	115
Fr2 max(**)	1100	3000	4500	2000	4300	6000	8000

HR	041	051	061	081	101	121
a	89	98	115	151	210	232
b	79	73	85	111	155	177
Fr2 max(**)	1000	2500	3700	4000	5000	6000
Fa max(*)	5500	6500	7000	8500	11500	13500

H	032/033	042/043	052/053	062/063	082/083	102/103	122/123
a	120	138	169	195	238	281	331
b	96	108	134	155	188	221	261
Fr2 max(**)	5500	6600	8000	12000	18000	22000	30000

NMRV NMRV-P	030	040	050	063	075	090	110	130	150
a	65	84	101	120	131	162	176	188	215
b	50	64	76	95	101	122	136	148	174
Fr2 max(**)	1830	3490	4840	6270	7380	8180	12000	13500	18000

(**Fr2 max) Max admissible value of the reducer in static conditions and/or for limited operations. For continuous overhung loads please check the values on the performances tables calculated according to the casing, the shaft and bearings.

(*Fa) Maximum permissible value of the gearbox with tapered roller bearings. Axial loads are not allowed with ball bearings. Sizes 041-051-061 in the STANDARD version are supplied with ball bearings.

2.4 LUBRICATION

2.4.1 Information

In cases of ambient temperatures not envisaged in the table, call our Technical Service. In the case of temperatures under -30°C or over 60°C it is necessary to use oil seals with special properties. For operating ranges with temperatures under 0°C it is necessary to consider the following:

1. The motors need to be suitable for operation at the envisaged ambient temperature.
2. The power of the electric motor needs to be adequate for exceeding the higher starting torques required.
3. In case of variator with reducer with a cast-iron case, pay attention to impact loads since cast iron may have problems of fragility at temperatures under -15°C.
4. During the early stages of service, problems of lubrication may arise due to the high level of viscosity taken on by the oil and so it is wise to have a few minutes of rotation under no load.

Oil (NON Atex products) must be changed after approx. 10000 hours (5000 for variator)/2 years of operation; this time varies based on the type of service and on the environment inside which the gear reducer is installed. Units not featuring any oil plug are life-lubricated, and therefore maintenance-free.

2.4.2 Lubricants

Specifications of lubricants recommended by Motovario.
The units **TX002 ÷ 010 and S003 ÷ 100** are supplied with ENI BLASIA 32 oil, unless otherwise specified by the client.
The units **H032/3 ÷ 101/2/3 and H121** are supplied with ENI BLASIA 220 oil, unless otherwise specified by the client.
The units **H122/3** are supplied without lubricant.
The units **NMRV030 ÷ 150 and NMRV-P063 ÷ 110** are supplied with ENI TELIUM VSF320 oil, unless otherwise specified by the client.

	TX002 ÷ 010 S003 ÷ 100	**HA30 ÷ A60 H030 ÷ 125 HR041 ÷ 121**		**NMRV030 ÷ 150 NMRV-P063 ÷ 110**
	Mineral oil	**Mineral oil**		**Synthetic oil**
***T_{amb}°C ISO**	**(-10) ÷ (+40) ISO VG32**	**(-5) ÷ (+40) ISO VG220**	**(-15) ÷ (+25) ISO VG150**	**(-25) ÷ (+50) ISO VG320**
ENI	BLASIA 32	BLASIA 220	BLASIA 150	TELIUM VSF320
SHELL	SPIRAX S3 ATF MD3	OMALA S2 G 220	OMALA S2 G 150	OMALA S4 WE320
KLUBER	-	Kluberoil GEM 1-220N	Kluberoil GEM 1-150N	Klubersynth GH 6-320
MOBIL	ATF 220	MOBILGEAR 600 XP220	MOBILGEAR 600 XP150	SHC 632
CASTROL	DEXRON II	ALPHA SP 220	ALPHA SP 150	ALPHASYN PG320
BP	AUTRAN DX III	ENERGOL GR-XP220	ENERGOL GR-XP150	ENERGOL SG-XP320

2.4 LUBRICATION

2.4.3 Quantity

- For mounting positions B3-B5, speed variators are supplied complete with lubricant. Different mounting positions, should be specified on the order.
- If you need to add lubricant in Open PAM variators, please refer to oil types recommended on the table, by means of the oil level plug. Check oil level when the variator is not working.
- For the gear reducer HA series with 2, 3 stages and for the reducers H series with 1, 2, 3 stages it is always necessary to specify the envisaged position.
- The gear reducer HA series with 1, 2, 3 stages all sizes, HR... series with 1 stage sizes 040, 050, 060 and H... series with 2, 3 stages sizes 030, 040, 050 are supplied complete with lubricant, have no oil plugs and need no maintenance.
- The gear reducer HR... series with 1 stage sizes 80, 100, 125 and H... series with 2, 3 stages sizes 060, 080, 100 are supplied complete with lubricant and are fitted with oil plugs to suit any mounting position included in the catalogue.
- The gear H... series with 2, 3 stages sizes 125 have no lubricant and are fitted with oil plugs to suit any mounting position included in the catalogue. The oil filling can be done on request, in this case it is recommended, after installation, to replace the closed plug used for transportation with the supplied breather plug. When the reduction unit is supplied without lubricant, it is provided with a label to be filled.
- The gear reducers NMRV, NMRV-P series size 030 - 040 - 050 - 063 - 075 - 090 - 105 - 110 - 130 - 150 are supplied complete with lubricant for life, synthetic oil, ENI TELIUM VSF. They can be mounted in any position envisaged in the catalogue, except for NMRV 090 - 110 and NRV 075-090-110 for which you must to specify the mounting position.
- The gear reducers NMRV for sizes 130 and 150 it is necessary to specify the position, otherwise the gear reducers are supplied with the quantity of oil relating to pos. B3.
- The gear reducers NMRV for sizes 130 and 150 are fitted with breather, level and oil drainage plugs.

Oil quantity in the table (litres ~) are indicative; for a proper use you will have to refer to the level plug or the dipstick. Any level difference could depend on construction tolerances, but also by the placement of the unit or by the mounting surface at the customer's premises. It is appropriate to check and, if necessary, restores the level when the units are installed.

TX	002	005	010
B5 - B6 - B7	0,11	0,15	0,4
B8 - V1 - V5	0,3	0,5	0,9
V3 - V6	0,3	0,5	0,9

Var S	003	005	010	020	030/050	100
B3 - B5 - B6 - B8	0,17	0,24	0,4	0,7	1,4	2,3
V1 - V5	0,24	0,4	0,8	1,2	2,5	4,1
V3 - V6	0,26	0,4	0,4	0,7	2,5	3,7

H - CH	HA41	CHA41	A51	A61	A32	A42	A52	A62	A33	A43	A53	A63
B3-B5	0,23	0,13	0,25	0,62	0,68	0,7	1,2	1,9	1,1	1,16	1,9	2,4
B8												
B6-B7												
V5-V1							1,6	2,1			2,5	3,1
V6-V3												

HR - CHR	041	051	061	081	101	121	041M	051M	061M	081M	101M	121M
B3-B5	0,5	0,7	0,7	1,45	3,5	4,7	0,5	0,5	0,5	1,5	3,5	3,9
B5R	0,5	0,5	0,5	1,5	3,5	3,9	-	-	-	-	-	-
B8	0,5	0,5	0,5	1,5	3,5	3,9	0,5	0,7	0,7	1,45	3,5	4,7
B6-B7	0,5	0,7	0,7	1,5	3,5	4,1	0,5	0,7	0,7	1,5	3,5	4,1
V5-V1	0,5	0,7	0,9	1,5	3,5	4,7	0,5	0,7	0,9	1,5	3,5	4,7
V6-V3	0,5	0,7	0,7	1,5	3,5	4,1	0,5	0,7	0,7	1,5	3,5	4,1

2.4 LUBRICATION

H - CH	032/033	042/043	052/053	062/063	082/083	102/103	122/123
B3-B5	0,8	1,2	1,4	2,4	4,5	8,1	12,5
B8	0,85	1,2	1,4	3,1	5	8,9	12,5
B6-B7	1	1,2	1,8	3	4,6	8,4	12,1
V5-V1	1,3	1,75	2,15	3,9	7,6	12,7	20,5
V6-V3	1,2	1,7	2,1	4,4	7,5	14,2	21

NMRV	030	040	050	130	150
B3	0,04	0,08	0,15	4,5	7
B8				3,3	5,1
B6-B7				3,5	5,4
V5				4,5	7
V6				3,3	5,1

NMRV-P	063	075	090	110
B3	0,33	0,55	1,15	1,6
B8				
B6-B7				
V5				
V6				

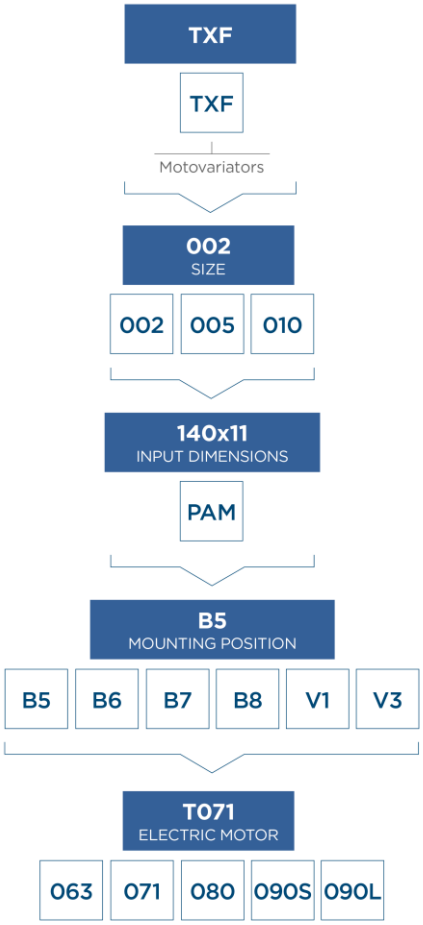
MOTOVARIATORS

TXF

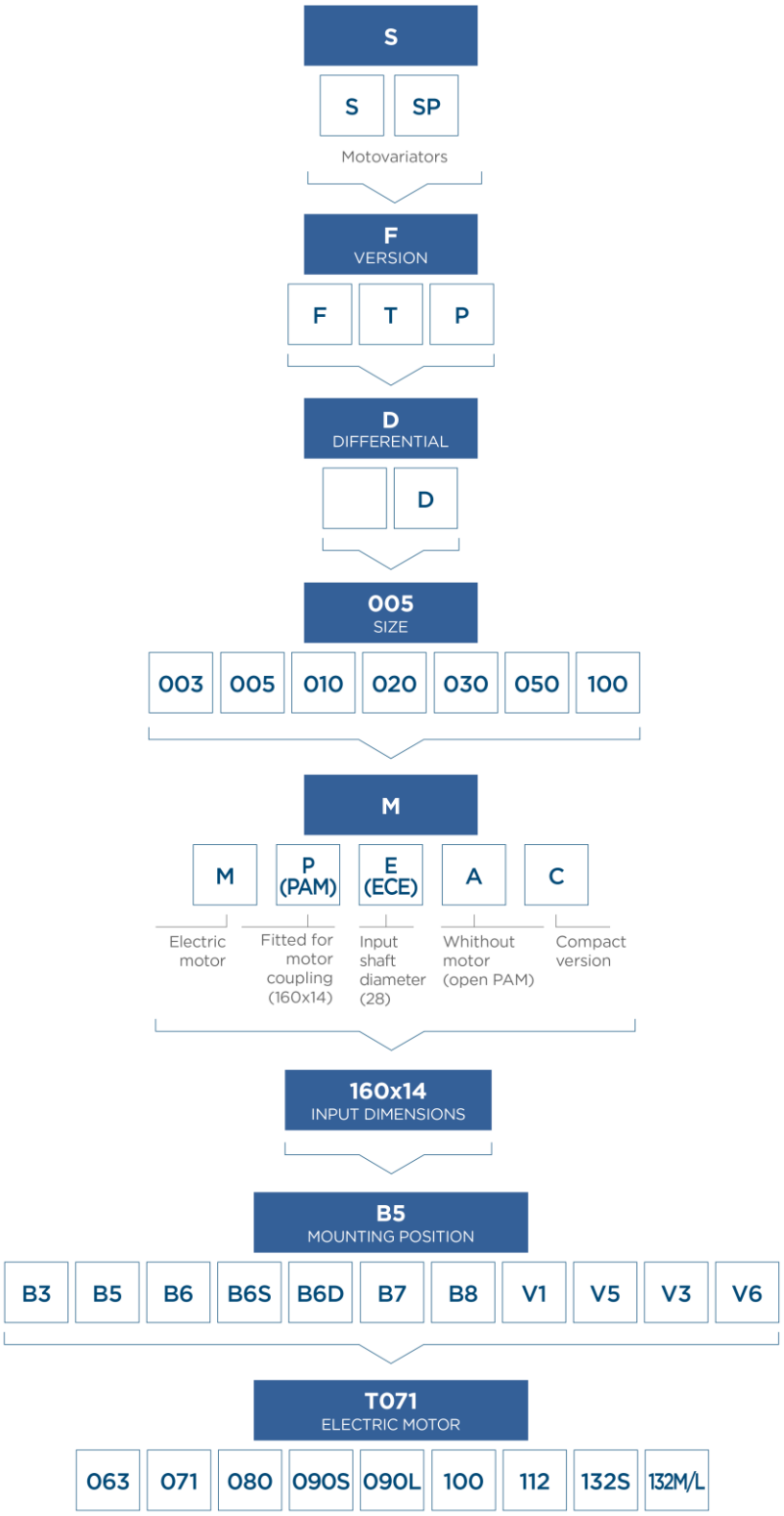
S

4.1 TYPOLOGY

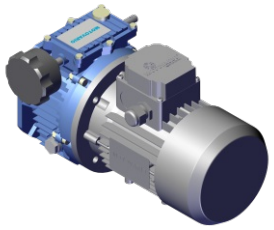
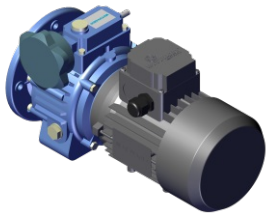
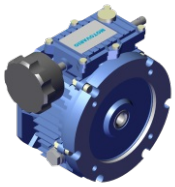
4.1.1 Designation



4.1 TYPOLOGY

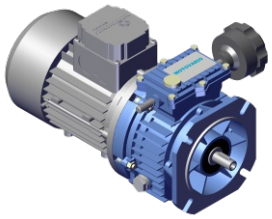
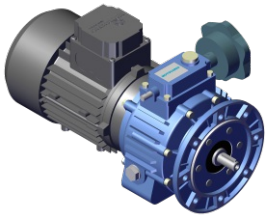
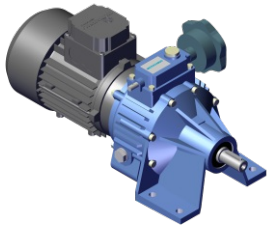
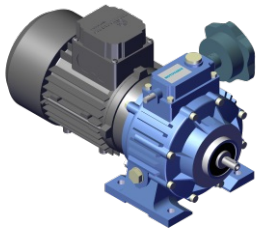
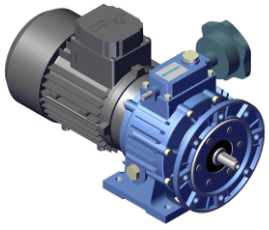


4.1.2 Versions

	ENTRANCE
TXF - Electric motor	
S - Electric motor	
TXF - Compact version	
S - Compact version	
S - Fitted for motor coupling	
S - Input shaft	

4.1 TYPOLOGY

EXIT

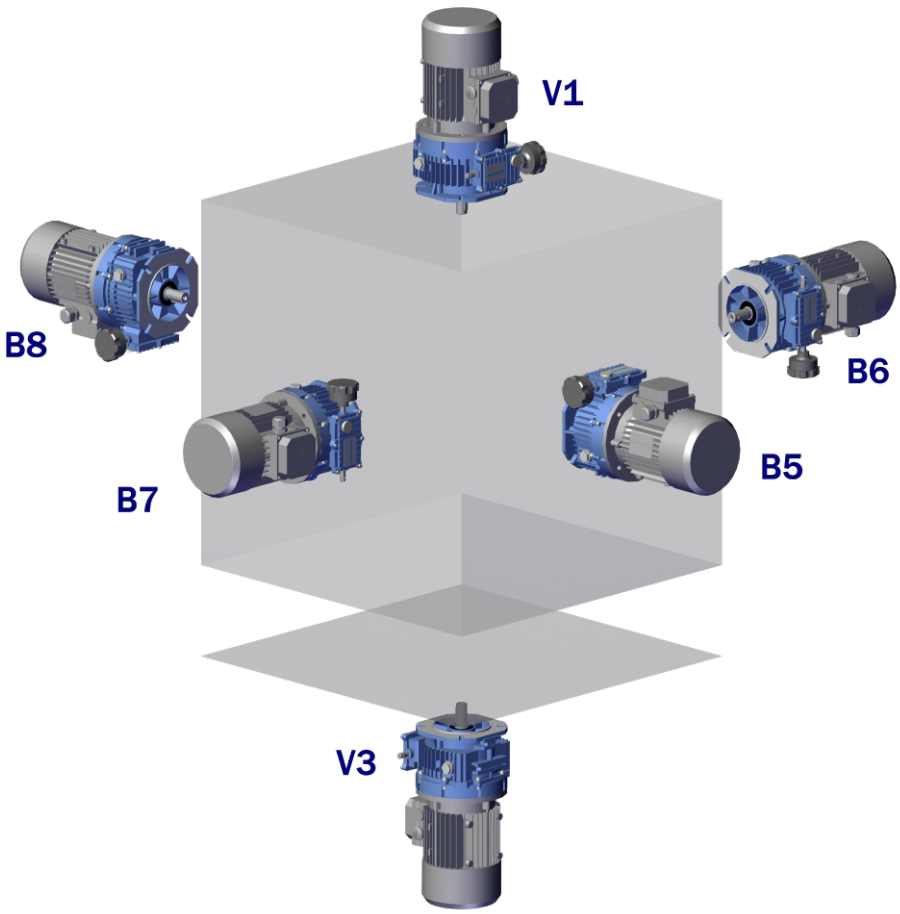
TXF	
SF	
ST	
SP	
SPF	

4.2 MOUNTING POSITIONS

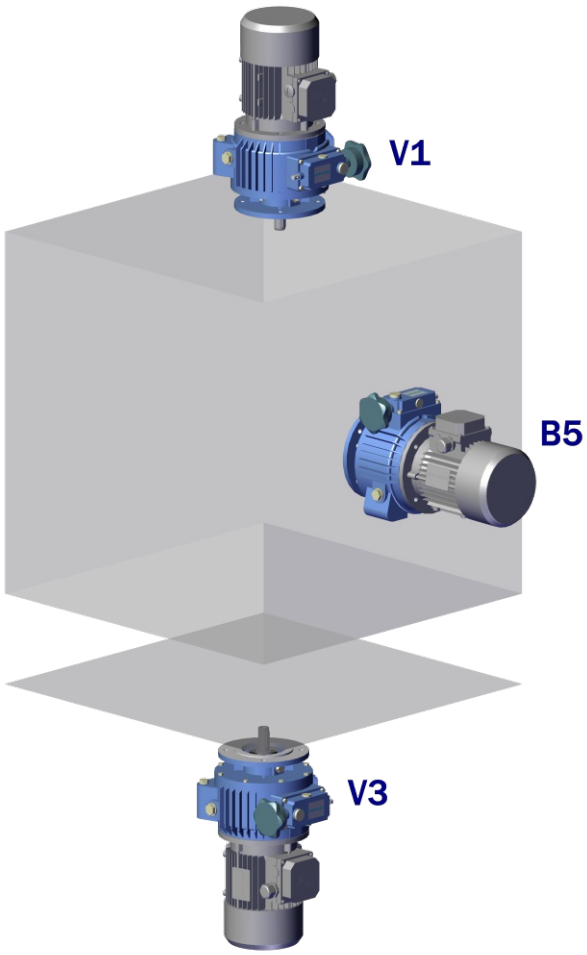
4.2.1 Mounting positions

The mounting position of the variator unit identifies its space orientation. B3/B5 mounting position, as from a technical point of view, ensures lower oil splash, better lubrication and less heating.

TXF

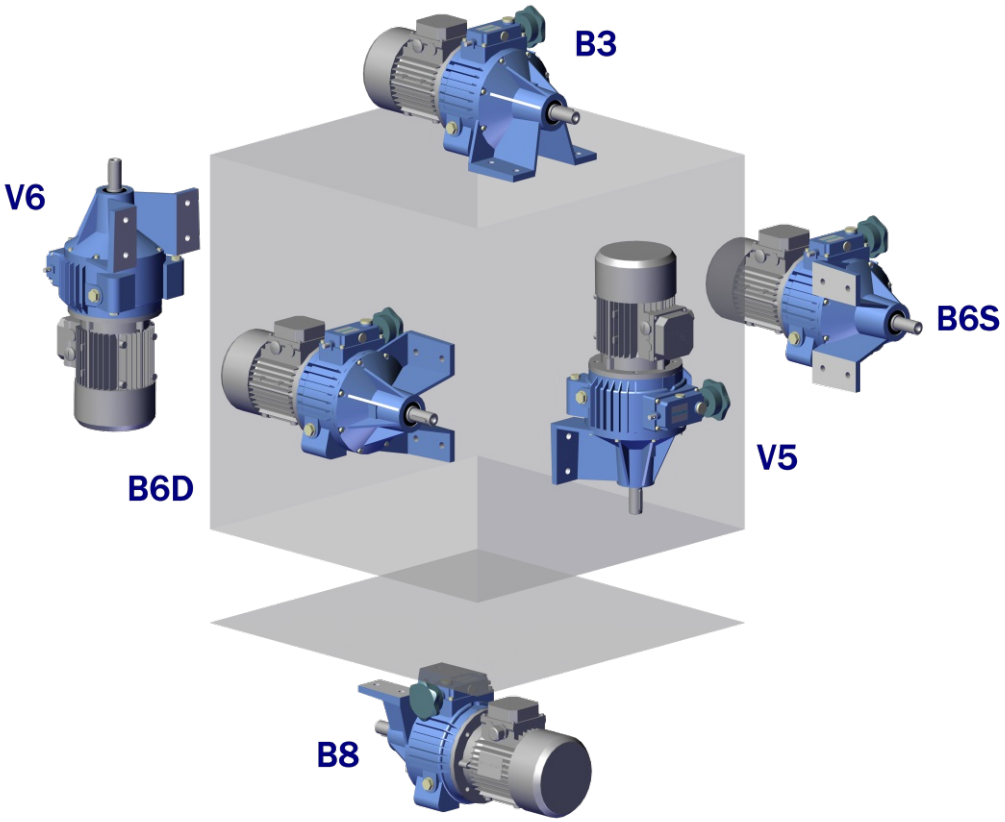


4.2 MOUNTING POSITIONS

SF


4.2 MOUNTING POSITIONS

ST

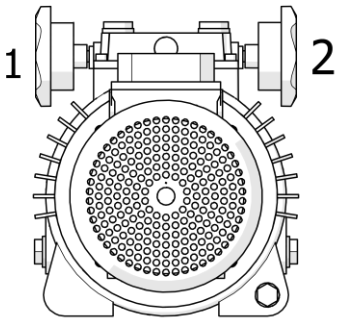


4.2 MOUNTING POSITIONS

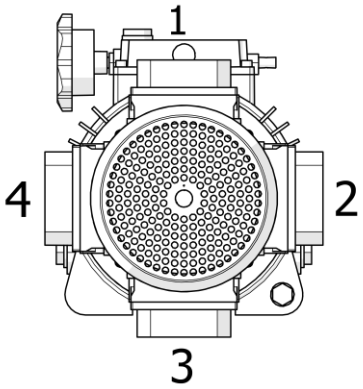
4.2.2 Position of terminal box

In the case of specific requirements, when ordering, specify the position of the terminal box as shown in the diagram. Unless otherwise specified, the gear reducer is supplied with terminal box in position 1.

Control handwheel

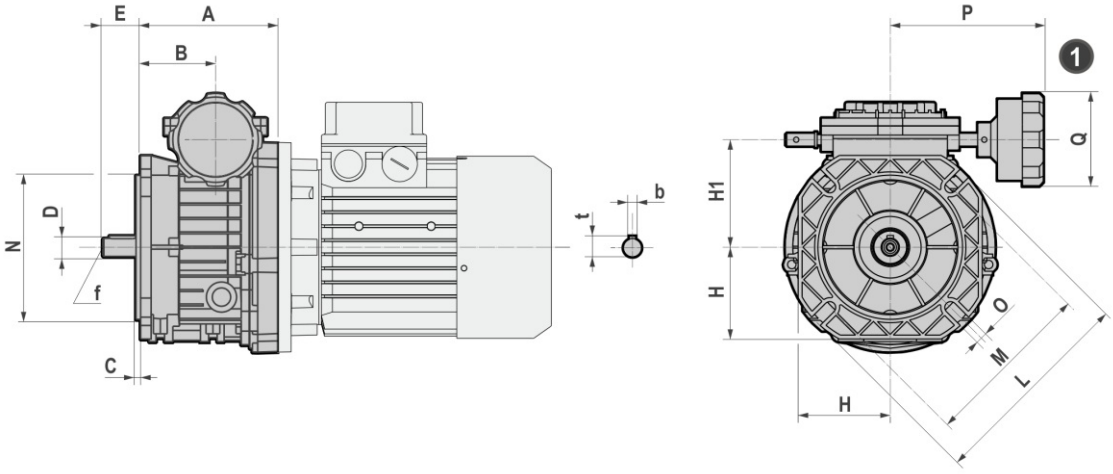


Position of terminal box



5.1 TXF

5.1.1 TXF



TXF	A	B	C	D j6	E	H	H1	L	M
002/063	82,5	40	3	11 (14)	23 (30)	62,5	69	140	115
005/071	103,5	57	3,5	14 (19)	30 (40)	70	82	160	130
005/080	114,5	57	3,5	14 (19)	30 (40)	70	82	160	130
010/080	131,5	68,5	3,5	19 (24)	40 (50)	90	103	200	165
010/090	131,5	68,5	3,5	19 (24)	40 (50)	90	103	200	165

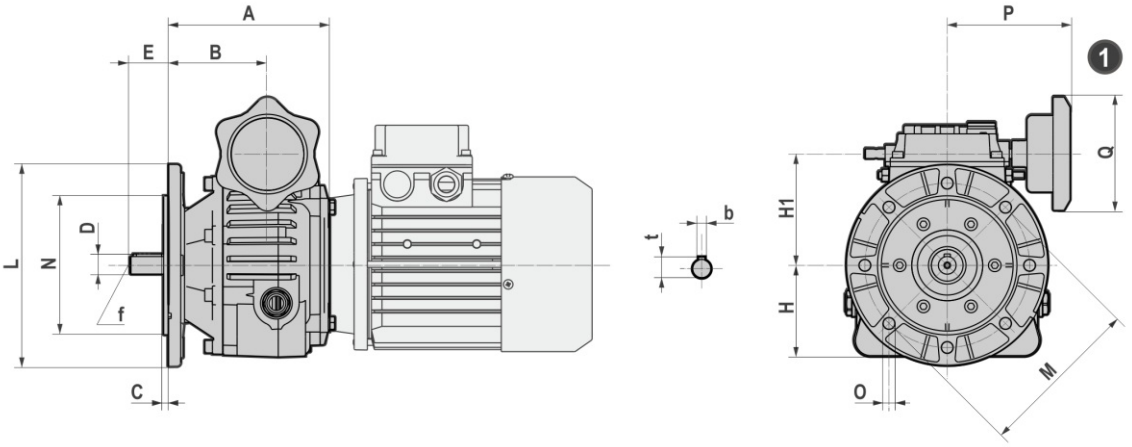
TXF	N f8	O	P	Q	b	t	f
002/063	95	9	116,5	71	4 (5)	12,5 (16)	- (M6)
005/071	110	9	116,5	71	5 (6)	16 (21,5)	M6 (M6)
005/080	110	9	116,5	71	5 (6)	16 (21,5)	M6 (M6)
010/080	130	11	126,5	71	6 (8)	21,5 (27)	M6 (M8)
010/090	130	11	126,5	71	6 (8)	21,5 (27)	M6 (M8)

5.1.2 Weight

The values reported in the tables are referred to the weight of the gearbox with lubricant included.
*Weight without motor

TXF	-kg
TXF002/063	2,3
TXF005/071	3,3
TXF005/080	4
TXF010/080	6,1
TXF010/090	6,7

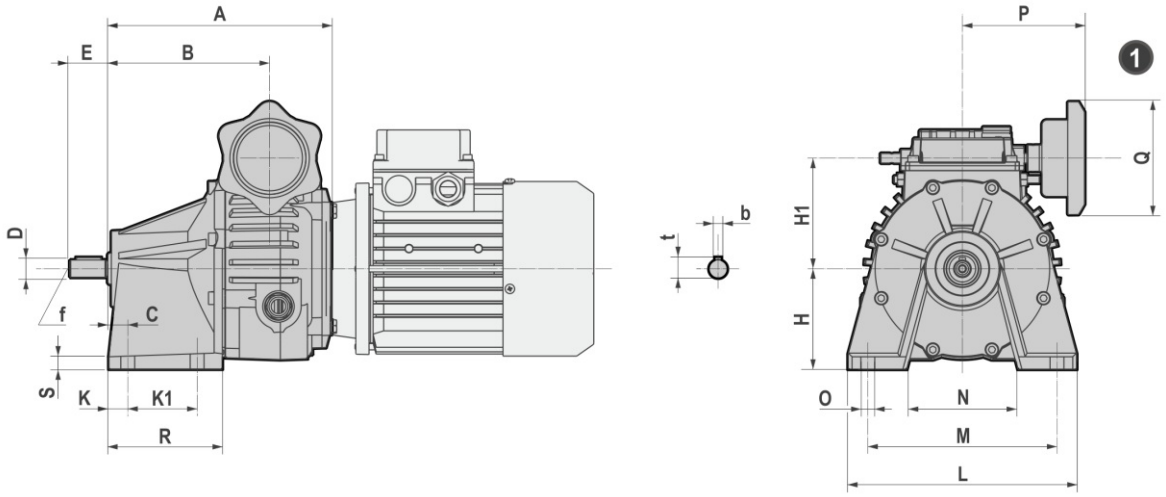
5.2.1 SF



SF	A	B	C	D	E	H	H1	L
003	103	65,5	3	11 j6	23	58	75	140
			3,5	14 j6	30			160
005	127,5	78,5	3,5	14 j6	30	72,5	88	160
			3,5	19 j6	40			200
010	151	94,5	3,5	19 j6	40	90	107	160
			3,5	24 j6	50			200
020	173	105,5	3,5	24 j6	50	108	126	200
			4	28 j6	60			250
030/050	208	123,5	4	28 j6	60	134	158,5	250
			4	38 k6	80			300
100	266	164,5	4	38 k6	80	165	205,5	300
			5	42 k6	80			350

SF	M	N	O	P	Q	b	t	f
003	115	95	9	97	90	4	12,5	M4
	130	110	9			5	16	M5
005	130	110	9	97	90	5	16	M5
	165	130	11			6	21,5	M6
010	130	110	9	107	90	6	21,5	M6
	165	130	11			8	27	M8
020	165	130	11	117	90	8	27	M8
	215	180	14			8	31	M10
030/050	215	180	14	154	120	8	31	M10
	265	230	14			10	41	M12
100	265	230	14	184	120	10	41	M12
	300	250	18			12	45	M12

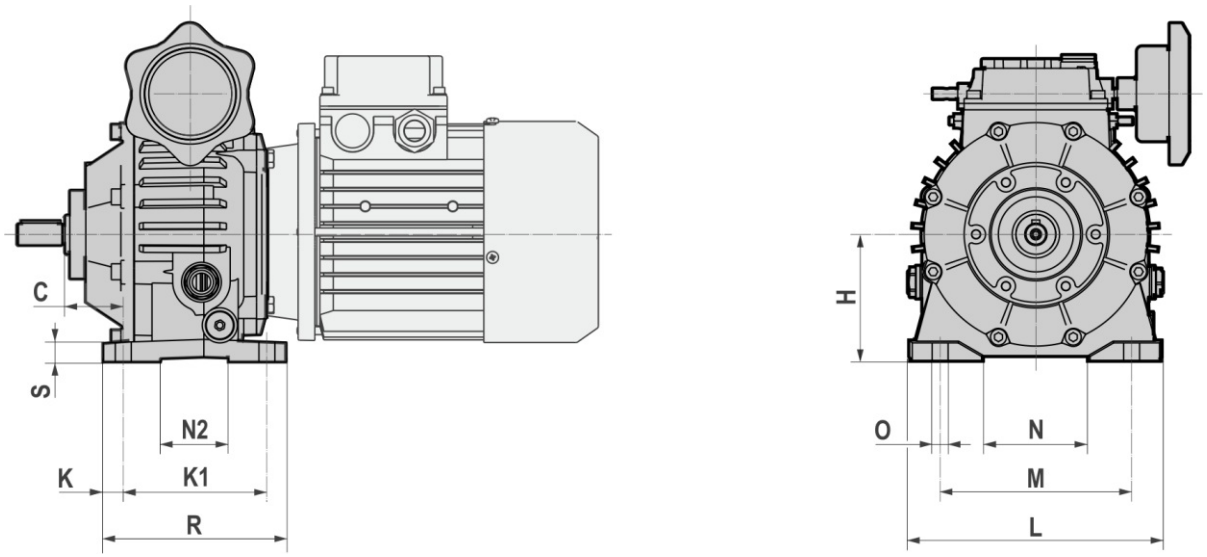
5.2.2 ST



ST	A	B	C	D	E	H	H1	K	K1	L
003	131	93,5	16	11 j6	23	70	75	15	25	130
				14 j6	30					
005	177,5	128,5	16	14 j6	30	80	88	15	55	180
				19 j6	40					
010	213	156,5	19,5	19 j6	40	102	107	18,5	65	220
				24 j6	50					
020	251,5	184,5	25,5	24 j6	50	125	126	23,5	75	250
				28 j6	60					
030/050	294,5	210,5	27	38 k6	80	150	158,5	25	85	310
100	353,5	252,5	32	42 k6	80	190	205,5	29	120	384

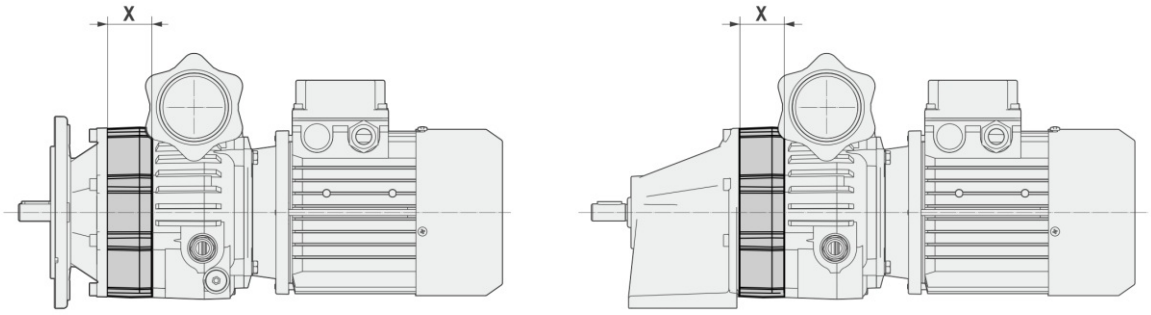
ST	M	N	O	P	Q	R	S	b	t	f
003	95	60	9	97	90	60	8	4	12,5	M4
								5	16	M6
005	150	90	11	97	90	90	10	5	16	M6
								6	21,5	M6
010	165	108	11	107	90	110	12	6	21,5	M6
								8	27	M8
020	185	118	14	117	90	130	14	8	27	M8
								8	31	M8
030/050	240	149	18	154	120	150	16	10	41	M10
100	295	193	20	184	120	186	20	12	45	M10

5.2.3 SP



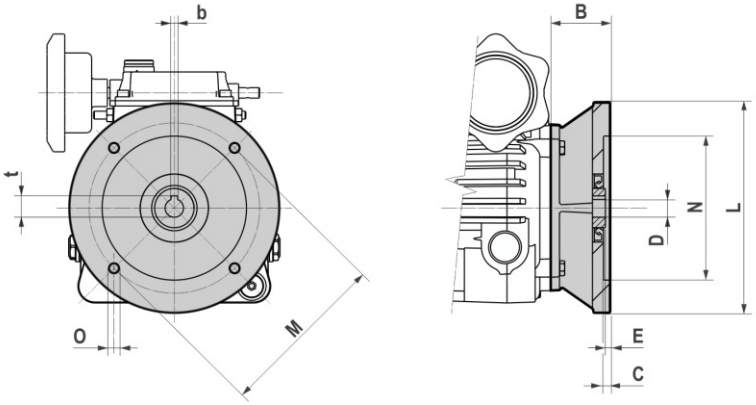
SP	C	H	K	K1	L	M	N	N2	O	R	S
005	36,5	80	12,5	90	155	120	42	65	10	115	12
010	42,5	102	12,5	110	200	150	86	75	11	135	13
020	55,5	125	12,5	115	235	205	103	90	11	140	16
030/050	25,5	150	15	220	290	255	118	140	14	250	20
100	55,5	180	25	255	365	320	140	175	18	305	25

5.2.4 S.D



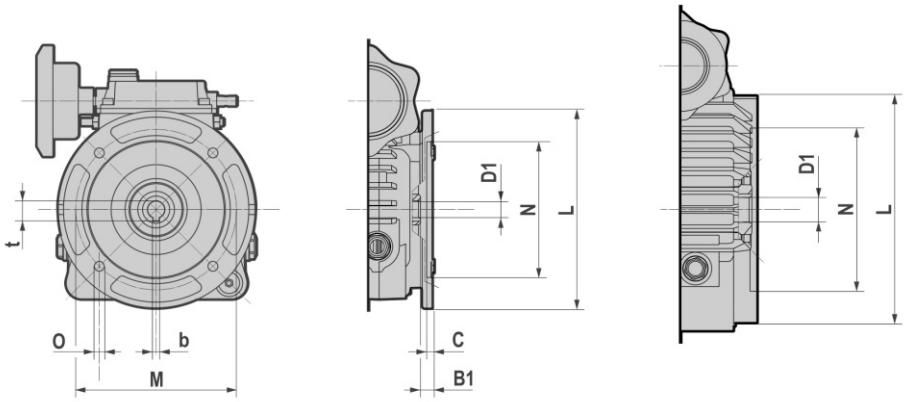
S.D	X
005	37,5
010	33,5
020	37
030/050	54
100	54

5.2.5 S - PAM



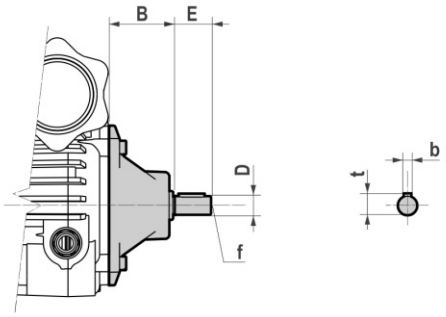
S	B	C	D	E	L	M	N	O	b	t
003	50	4	14	2	105	85	70	6,5	5	16,3
			11		140	115	95	M8	4	12,8
005	45	4	19	3	120	100	80	6,5	6	21,8
		4,5	14		160	130	110	M8	5	16,3
		4,5	19		200	165	130	M10	6	21,8
010	62	5	19	3,25	200	165	130	M10	6	21,8
			24						8	27,3
020	63	4,5	24	1,9	200	165	130	M10	8	27,3
	73	5	28		250	215	180	M12	8	31,3
030/050	72,5	5	28	2	250	215	180	M12	8	31,3
	87,5		38		300	265	230		10	41,3
100	95	5,5	38	5	300	265	230	13,5	10	41,3
	125	6	42	25	350	300	250	M16	12	45,3

5.2.6 S - PAM C



S	B1	C	D1	L	M	N	O	b	t
003	17,5	4	11	140	115	95	M8	4	12,8
005	10	4	14	160	130	110	M8	5	16,3
010	11	5	19	200	165	130	M10	6	21,8
020	/	/	24	200	165	130	M10	8	27,3
030/050	/	/	28	250	215	180	M12	8	31,3
100	/	/	38	300	265	230	M12	10	41,3

5.2.7 S - ECE



S	B	D	E	f	b	t
003	50	11	23	M4	4	12,5
005	50	14	30	M6	5	16
010	65	19	40	M6	6	21,5
020	70	24	50	M8	8	27
030/050	94,5	28	60	M8	8	31
100	110	38	80	M10	10	41

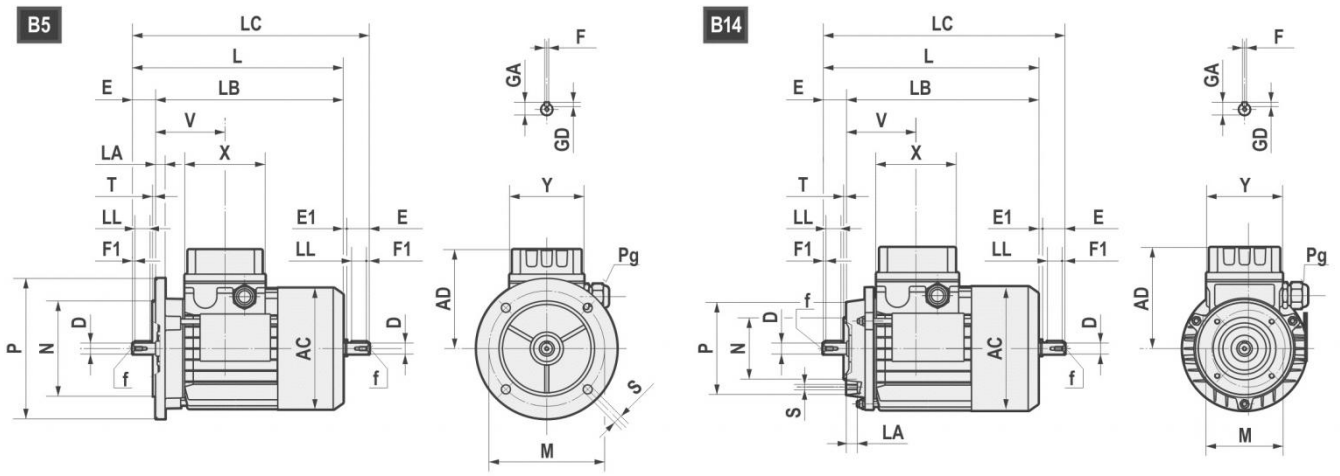
5.2.8 Weight

The values reported in the tables are referred to the weight of the gearbox with lubricant included.
*Weight without motor

SF	-kg
003	2,7
005	5,9
010	11,4
020	22,3
030/050	40,5
100	73

ST	-kg
003	3
005	8,7
010	16,1
020	27,3
030/050	41,5
100	74,5

5.3.1 Electric motors



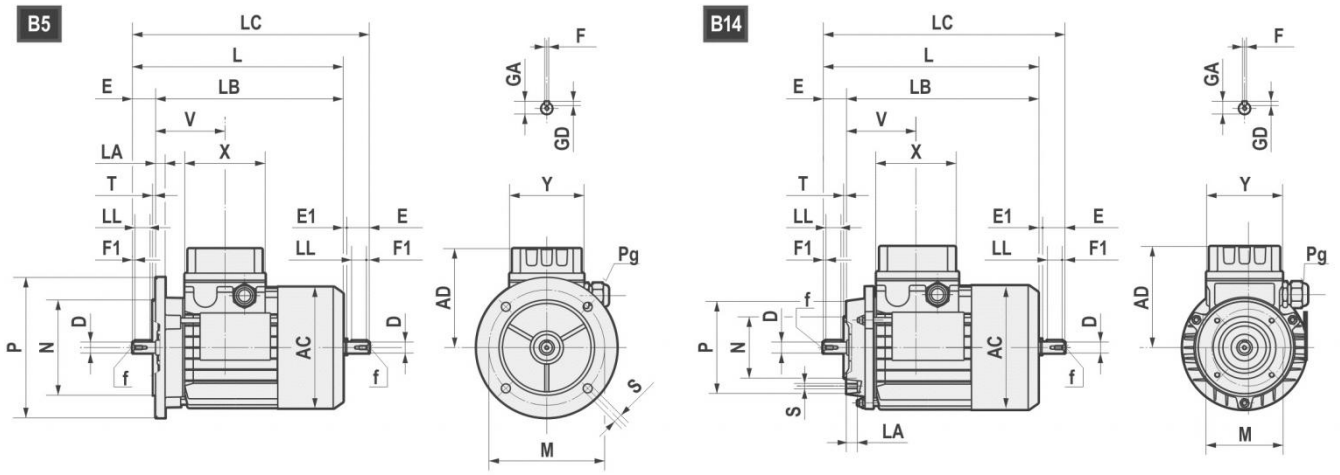
	AC	AD	L	LB	LC	X	Y	V	D	E	E1	f	F1	GA	F	GD
63	121	104	211	188	235,5	80	74	69	11 j6	23	1,5	M4x10	2,5	12,5	4	4
71	139	112	238,5	208,5	271	80	74	74,5	14 j6	30	2,5	M5x12.5	3	16	5	5
80	158	122	272,5 *(296)	232,5 *(256)	314 *(337)	80	74	78	19 j6	40	1,5	M6x16	5	21,5	6	6
90S	173	146	298 *(331)	248 *(281)	349,5 *(381)	98	98	89,5	24 j6	50	1,5	M8x19	5	27	8	7
90L	173	146	323 *(356)	273 *(306)	374,5 *(408)	98	98	89,5	24 j6	50	1,5	M8x19	5	27	8	7
100	191	155	368	308	431,5	98	98	97,5	28 j6	60	3,5	M10x22	7,5	31	8	7
112	211	170	382,5 *(408)	322,5 *(348)	447 *(472)	98	98	100	28 j6	60	3,5	M10x22	7,5	31	8	7
132S	249	195	452	372	536,5	118	118	115,5	38 k6	80	4	M12x28	10	41	10	8
132L	249	195	490	410	574,5	118	118	115,5	38 k6	80	4	M12x28	10	41	10	8
160S	249	195	520	410	/	118	118	115,5	42k6	100	/	M16x36	10	45	12	8

*TP80B4,TP90S4, TP90L4, TP90S6, TP112M4, TP112M6

B5	M	N	P	LA	S	T
63	115	95	140	10	9	3
71	130	110	160	10	9,5	3,5
80	165	130	200	12	11	3,5
90	165	130	200	12	11	3,5
100	215	180	250	15	14	4
112	215	180	250	14,5	14	4
132	265	230	300	20	14	3,5
160	300	250	350	13	18,5	3,5

B14	M	N	P	LA	S	T
63	75	60	90	10	M5	2,5
71	85	70	105	10,5	M6	2,5
80	100	80	120	10,5	M6	3
90	115	95	140	11,5	M8	3
100	130	110	160	15	M8	3,5
112	130	110	160	11,5	M8	3,5
132	165	130	200	20,5	M10	3,5
160	215	180	250	-	M12	4

5.3 ELECTRIC MOTORS



		AC	AD	L	LB	X	D	E	f	GA	F	GD	LL	Pg	
160M	2-4-6	314	251	600	490	158	42	110	M16	45	12	8	90	2-M40x1,5	1-M16x1,5
160L	2-4-6	314	251	645	535	158	42	110	M16	45	12	8	90	2-M40x1,5	1-M16x1,5
180M	2-4	355	267	680	570	158	48	110	M16	51,5	14	9	100	2-M40x1,5	1-M16x1,5
180L	4-6	355	267	720	610	158	48	110	M16	51,5	14	9	100	2-M40x1,5	1-M16x1,5
200L	2-4-6	397	300	785	675	187	55	110	M20	59	16	10	100	2-M50x1,5	1-M16x1,5
225S	4	446	325	820	680	187	60	140	M20	64	18	11	125	2-M50x1,5	1-M16x1,5
225M	2	446	325	815	705	187	55	110	M20	59	16	10	100	2-M50x1,5	1-M16x1,5
225M	4-6	446	325	845	705	187	60	140	M20	64	18	11	125	2-M50x1,5	1-M16x1,5
250M	2-4-6	485	360	910	770	238	60	140	M20	64	18	11	125	2-M63x1,5	1-M16x1,5
250M	2-4-6	485	360	910	770	238	65	140	M20	69	18	11	125	2-M63x1,5	1-M16x1,5
280S	2-4-6	547	390	970	830	238	65	140	M20	69	18	11	125	2-M63x1,5	1-M16x1,5
280S	2-4-6	547	390	970	830	238	75	140	M20	79,5	20	12	125	2-M63x1,5	1-M16x1,5
280M	2-4-6	547	390	1025	885	238	65	140	M20	69	18	11	125	2-M63x1,5	1-M16x1,5
280M	2-4-6	547	390	1025	885	238	75	140	M20	79,5	20	12	125	2-M63x1,5	1-M16x1,5

B5	M	N	P	LA	S	T
160	300	250	350	13	19	5
180	300	250	350	15	19	5
200	350	300	400	17	19	5
225	400	350	450	20	19	5
250	500	450	550	22	19	5
280	500	450	550	22	19	5

5.3.2 Standard high efficiency (TS), high (TH) and premium (TP) motors

Motovario, three-phase, single polarity motors are available in three different versions (IE1-IE2-IE3) in compliance with standard 60034-30-1 (see table). The efficiency value is calculated according to the method set forth in standard IEC 60034-2-1.

1. IE1: Standard efficiency TS series.
2. IE2: High efficiency TH series
3. IE3: Premium efficiency TP series.

Table of Motovario commercial availability

		EFFICIENCY LEVEL		
NOMINAL POWER [kW]	POLES	IE1	IE2	IE3
0,09 ≤ Pn < 0,75	2 - 4 - 6	TS-TBS	-	-
0,75 ≤ Pn ≤ 11	2 - 4	TBS	-	-
0,75 ≤ Pn ≤ 5,5	6	TBS	TH-TBH	TP-TBP
0,75 ≤ Pn ≤ 9,2	2 - 4	-	TH-TBH	-
0,75 ≤ Pn ≤ 7,5	2 - 4	-	-	TP-TBP
7,5 ≤ Pn ≤ 22	6	TBS (*)	-	TP
11 ≤ Pn ≤ 90	4	-	-	TP
15 ≤ Pn ≤ 37	2	TBS (*)	-	TP
15 ≤ Pn ≤ 55	4	TBS (*)	-	-

(*) Series available on request.

5.3.3 Nominal power - [kW]

	63A	63B	63C	71A	71B	71C	80A			80B		
Poles	TS	TS	TS	TS	TS	TS	TS	TH	TP	TS	TH	TP
2	0,18	0,25	0,37	0,37	0,55	-	-	0,75	0,75	-	1,1	1,1
4	0,12	0,18	0,22	0,25	0,37	0,55	0,55	-	-	-	0,75	0,75
6	0,09	0,12	0,15	0,18	0,25	0,37	0,37	-	-	0,55	-	-

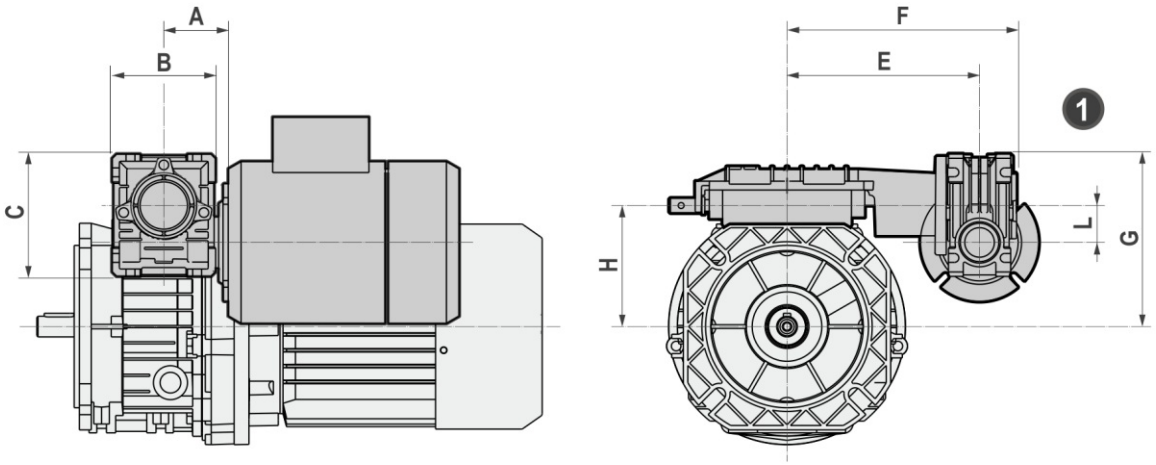
	90S		90L		100LR	100L	100LA		112MR	112MS	112MA	112M
Poles	TH	TP	TH	TP	TP	TP	TH	TP	TP	TP	TH	TP
2	1,5	1,5	2,2	2,2	-	3	3	-	-	-	4	4
4	1,1	1,1	1,5	1,5	-	-	2,2	2,2	2,2	3	4	4
6	-	0,75	0,75	-	1,1	1,5	1,1	-	-	-	2,2	2,2

	112MR	112MS	132S	132SA	132MS	132SB	132M	132MA		132MB	
Poles	TP	TP	TP	TH	TP	TH	TP	TH	TP	TH	TP
2	-	-	5,5	5,5	-	7,5	7,5	9,2	-	-	-
4	2,2	3	-	5,5	5,5	-	7,5	7,5	-	9,2	-
6	-	-	3	3	-	-	-	4	4	5,5	5,5

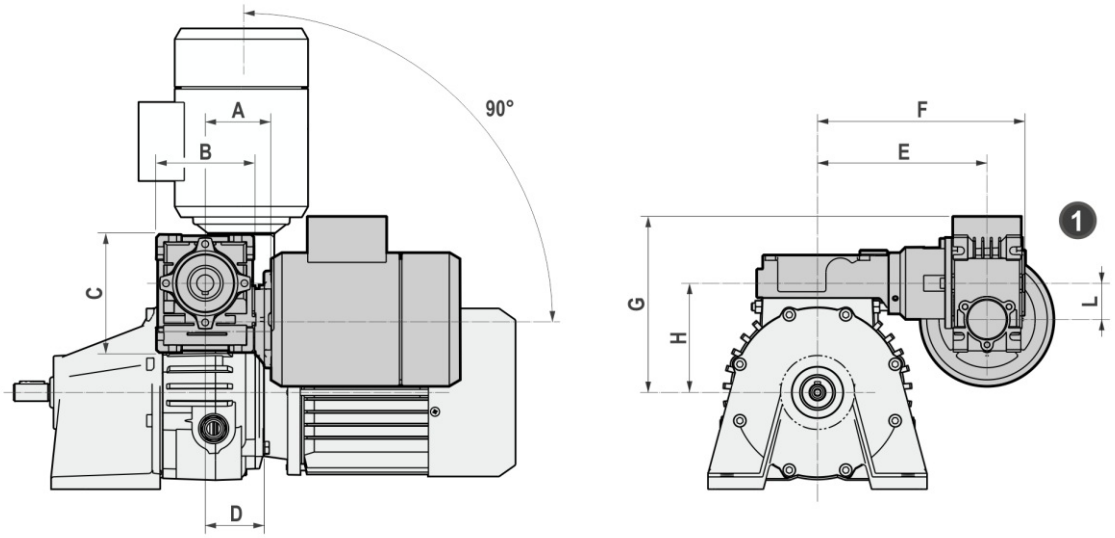
	160M	160MA	160MB	160L	160LA	180M	180L
Poles	TP	TP	TP	TP	TP	TP	TP
2	-	11	15	18,5	-	22	-
4	-	11	-	-	15	18,5	22
6	7,5	-	-	11	-	-	15

	200L	200LA	200LB	225S	225M	250M	280S	280M
Poles	TP	TP	TP	TP	TP	TP	TP	TP
2	-	30	37	-	-	-	-	-
4	30	-	-	37	45	55	75	90
6	-	18,5	22	-	-	-	-	-

6.1 ELECTRICAL SERVOCONTROL



TXF	A	B	C	E	F	G	H	L
002	45	70	83	130	155	104	69	25
005	45	70	83	130	155	117	82	25
010	45	70	83	140	165	138	103	25



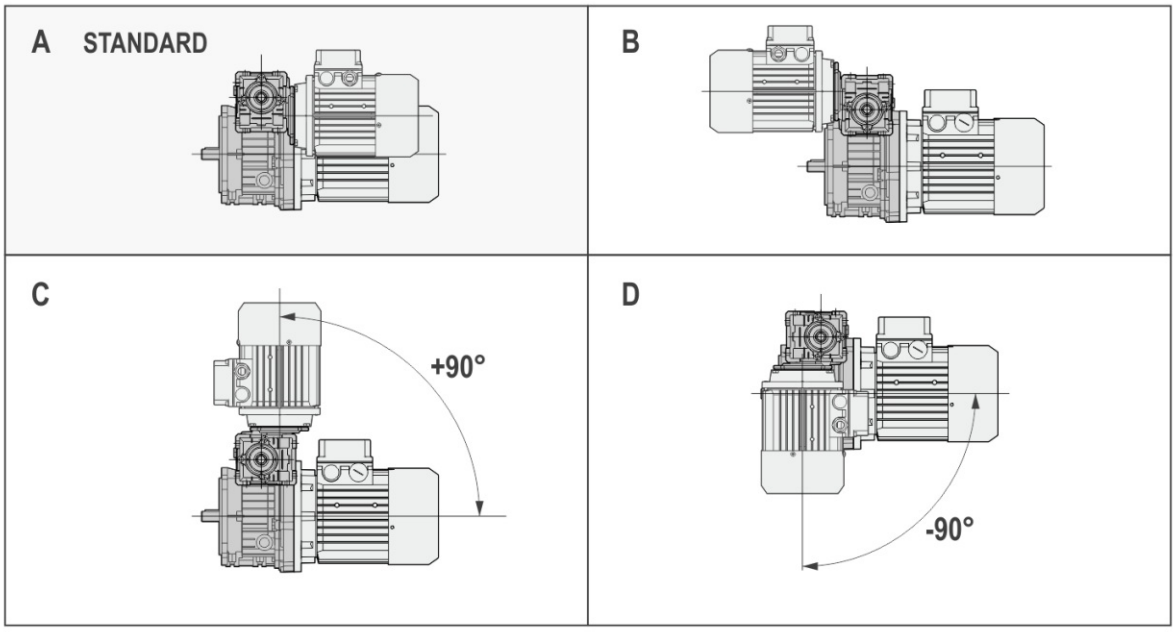
S	A	B	C	D	E	F	G	H	L
005	55	80	97	49	140,5	172	130,5	90,5	30
010	55	80	97	56,5	150,5	182	148,5	108,5	30
020	55	80	97	67,5	160,5	192	167,5	127,5	30
030/050	55	80	97	84,5	164	195,5	198,5	158,5	30
100	55	80	97	102	204	235,5	245,5	205,5	30

TXF002-005-010 / S005-010-020-030-050 P1=0.09 kW/4 - i=30

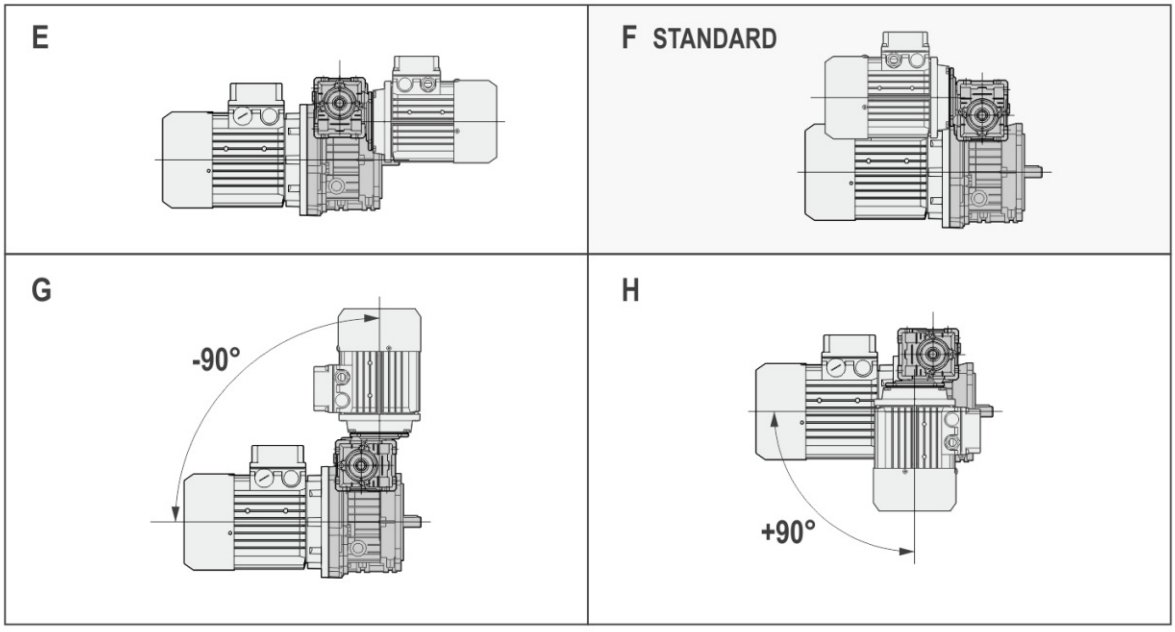
S100 P1=0.18 kW/4 - i=30

6.1 ELECTRICAL SERVOCONTROL

POS.1



POS.2



6.1 ELECTRICAL SERVOCONTROL

TXF	A	B	C	D	E	F	G	H
TXF002/063	✔	✔	✔	✔	✔	✔	✔	✔
TXF005/071	✔	✔	✔	✔	✔	✔	✔	-
TXF005/080	-	✔	✔	✔	✔	✔	✔	-
TXF010/080	✔	✔	✔	-	✔	✔	✔	-
TXF010/090	✔	✔	✔	-	✔	✔	✔	-

S	A	B	C	D	E	F	G	H
S005/071	✔	✔	✔	-	-	✔	✔	✔
S010/080	✔	✔	✔	-	✔	✔	✔	-
S010/090	✔	✔	✔	-	✔	✔	✔	-
S020/090	✔	✔	✔	-	✔	✔	✔	-
S030/100	✔	✔	✔	-	✔	✔	✔	-
S050/112	✔	✔	✔	-	✔	✔	✔	-
S100/132	✔	✔	✔	-	✔	✔	✔	-
S005-PAM120	✔	✔	✔	-	-	✔	✔	✔
S005-PAM140	✔	✔	✔	-	-	✔	✔	✔
S005-PAM160	✔	✔	✔	-	-	✔	✔	✔
S005-PAM200	-	✔	✔	-	-	✔	✔	✔
S010-PAM200	✔	✔	✔	-	✔	✔	✔	-
S020-PAM200	✔	✔	✔	-	✔	✔	✔	-
S020-PAM250	✔	✔	✔	-	✔	✔	✔	-
S030-PAM250	✔	✔	✔	-	✔	✔	✔	-
S030-PAM300	✔	✔	✔	-	✔	✔	✔	-
S050-PAM250	✔	✔	✔	-	✔	✔	✔	-
S050-PAM300	✔	✔	✔	-	✔	✔	✔	-
S100-PAM300	✔	✔	✔	-	✔	✔	✔	-
S100-PAM350	✔	✔	✔	-	✔	✔	✔	-

✔ Available position.
- Not available position.

The servomotor must be linked to the main variator drive motor since the speed setting must only be varied while the motovariator is running.

6.2 OTHER ACCESSORIES AND OPTIONS

Following accessories are available on request (ask for technical sheets):

- Gravitational indicator;
- Adjustable right-angle control;
- Electrical limit stop;
- Transducer;
- Tacho device digital.

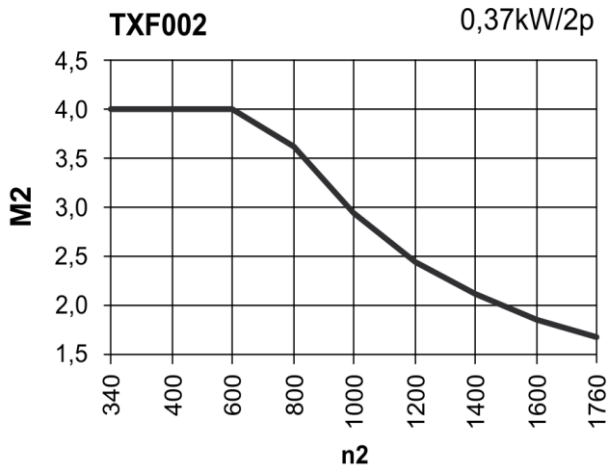
7.1 TXF - PERFORMANCE

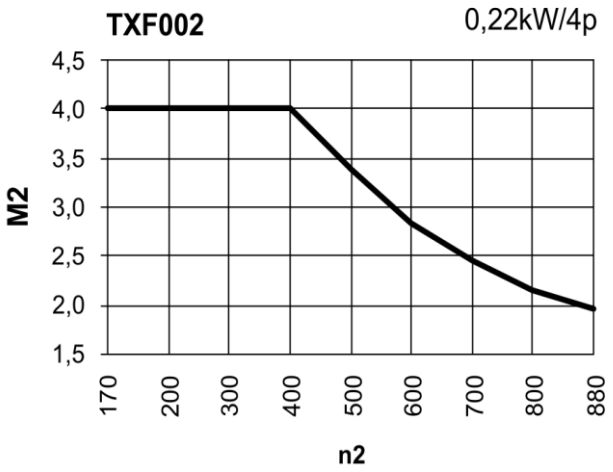
7.1.1 TXF

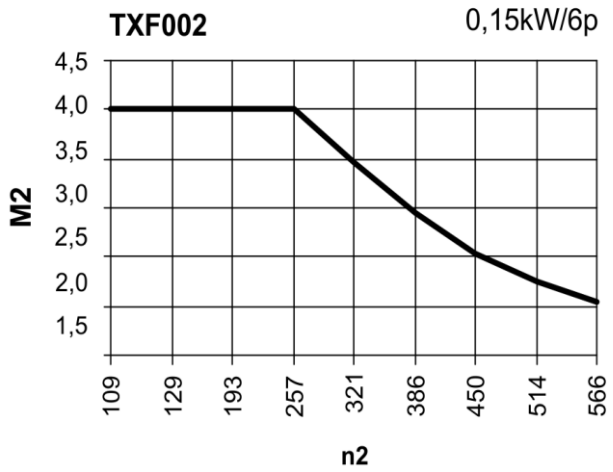
0,15	TXF002	63C6	900	566	109	2,1	4	320	550
0,22	TXF002	63C4	1400	880	170	2	4	270	480
0,25	TXF005	71A4	1400	1000	170	2	6	580	1050
0,25	TXF005	71B6	900	643	109	3	6	670	1050
0,37	TXF002	63C2	2800	1760	340	1,7	4	220	380
0,37	TXF005	71B4	1400	1000	170	3	6	580	1050
0,55	TXF005	71B2	2800	2000	340	2,2	6	460	800
0,55	TXF005	71C4	1400	1000	170	4,4	6	580	1050
0,55	TXF005	80A4	1400	950	270	4,6	6	590	900
0,55	TXF005	80B6	900	611	174	6	6	680	1050
0,55	TXF010	80A4	1400	1000	170	4,4	12	650	1150
0,55	TXF010	80B6	900	643	109	6,6	12	750	1350
0,75	TXF005	71C2	2800	2000	340	3	6	460	800
0,75	TXF005	80A2	2800	1900	540	3,2	6	480	710
0,75	TXF005	80B4	1400	950	270	6	6	590	900
0,75	TXF010	80B4	1400	1000	170	6	12	650	1150
0,75	TXF010	90S6	900	611	174	9,5	12	760	1140
0,92	TXF010	80C4	1400	1000	170	7,2	12	650	1150
1,1	TXF005	80B2	2800	1900	540	4,7	6	480	710
1,1	TXF010	80B2	2800	2000	340	4,4	12	510	930
1,1	TXF010	90S4	1400	950	270	9,1	12	660	900
1,5	TXF005	80C2	2800	1900	540	6	6	480	710
1,5	TXF010	80C2	2800	2000	340	6	12	510	930
1,5	TXF010	90S2	2800	1900	540	6,3	12	520	790
1,5	TXF010	90L4	1400	950	270	12	12	660	900
2,2	TXF010	90L2	2800	1900	540	9,3	12	480	710

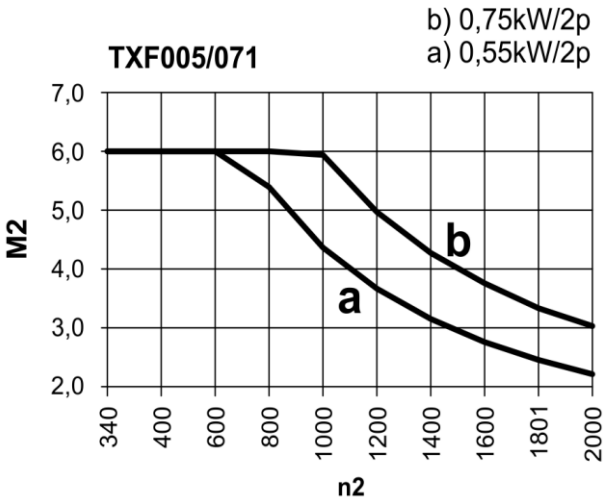
(a) Values relating to maximum speed
(b) Values relating to minium speed

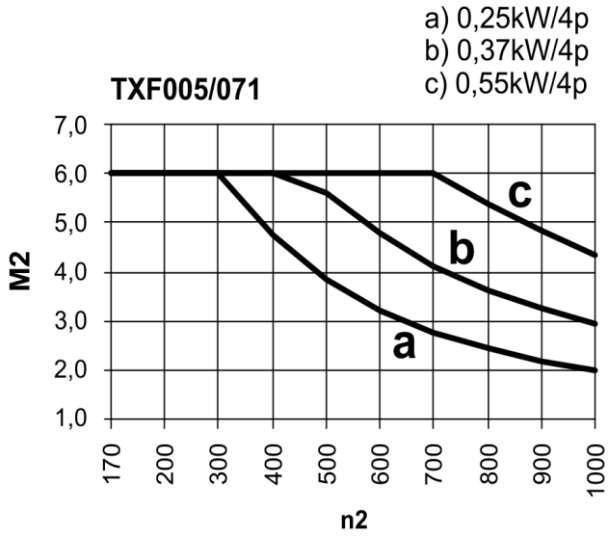
7.1.2 TXF - Performance curves

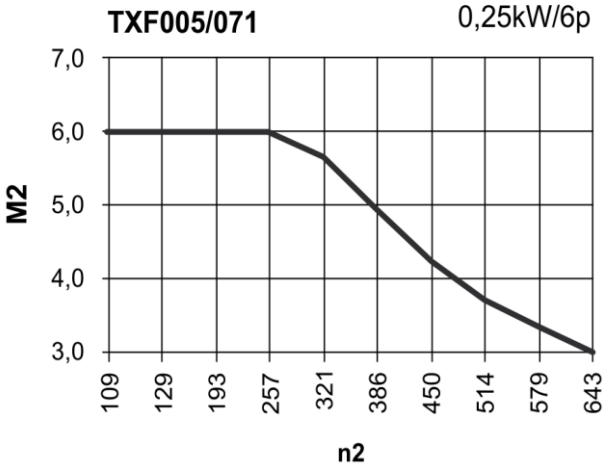






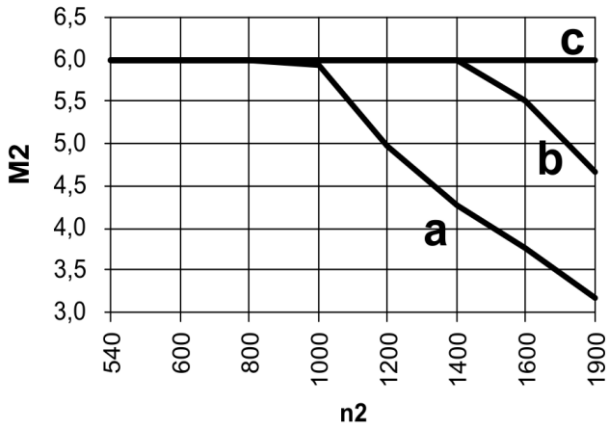




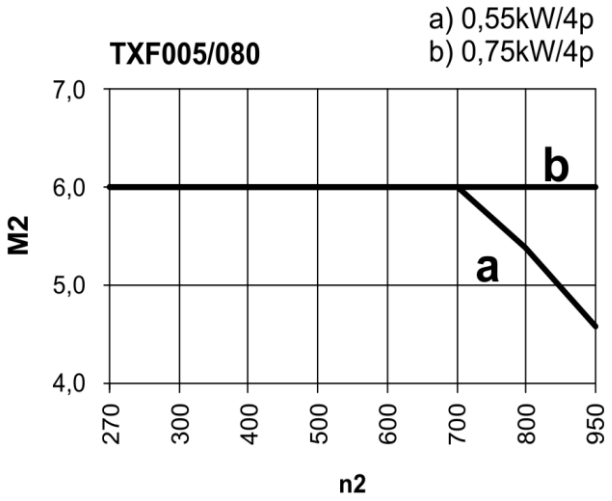


7.1 TXF - PERFORMANCE

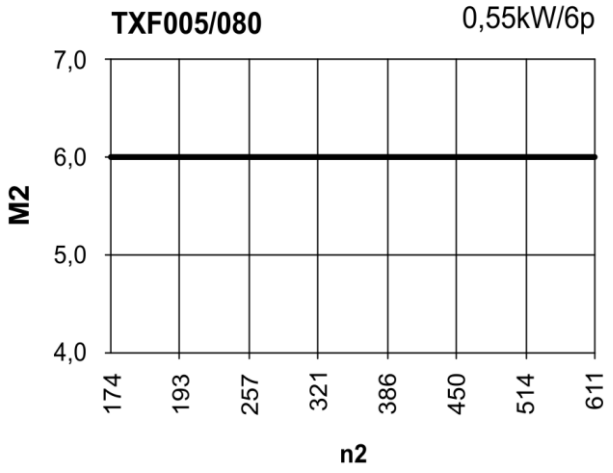
a) 0,75kW/2p
b) 1,1kW/2p
c) 1,5kW/2p



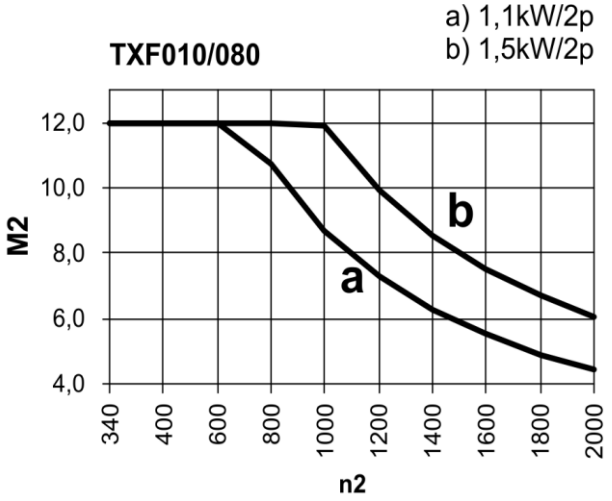
a) 0,55kW/4p
b) 0,75kW/4p



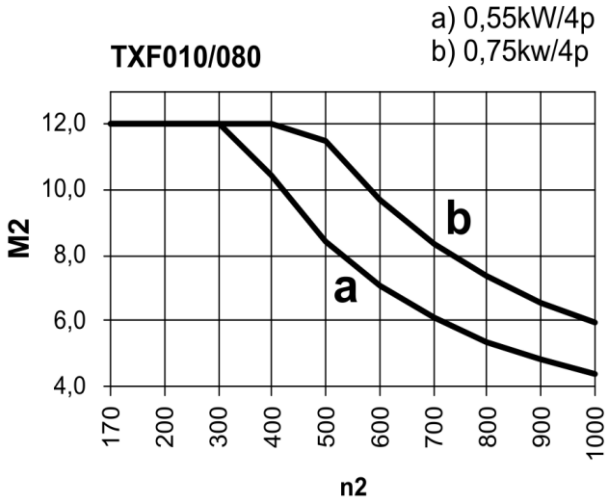
0,55kW/6p



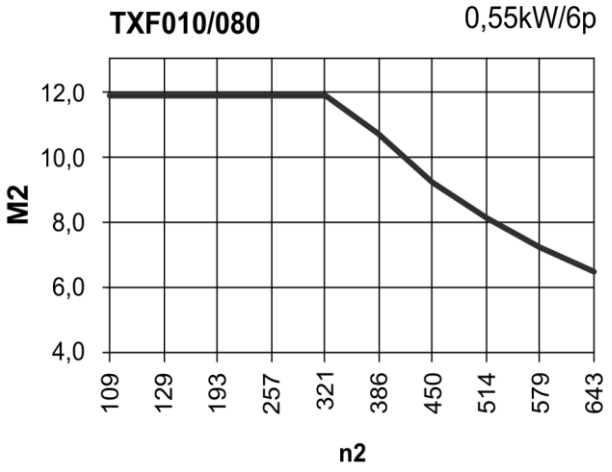
a) 1,1kW/2p
b) 1,5kW/2p



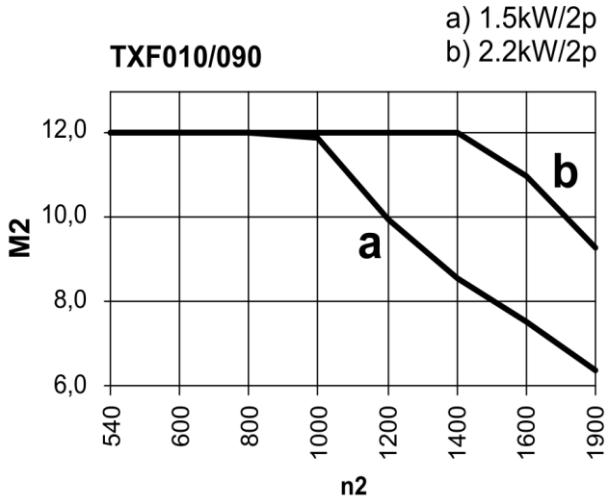
a) 0,55kW/4p
b) 0,75kw/4p

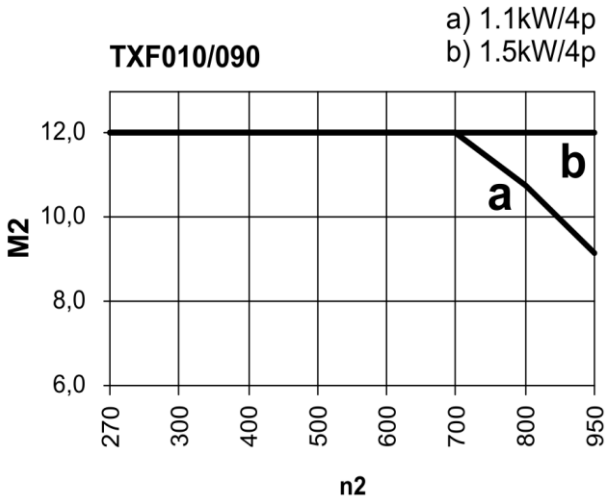


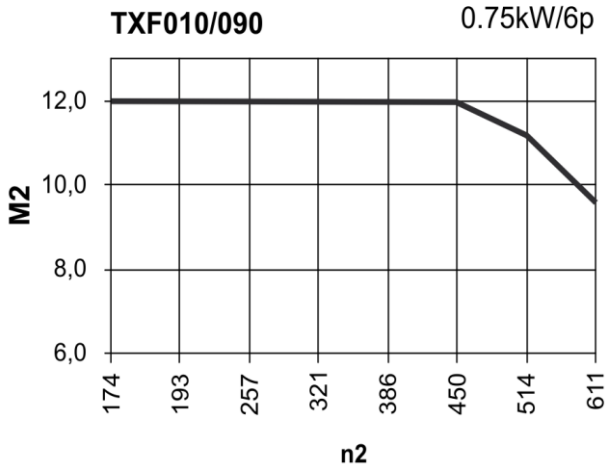
0,55kW/6p



7.1 TXF - PERFORMANCE







7.2 S - PERFORMANCE

7.2.1 S

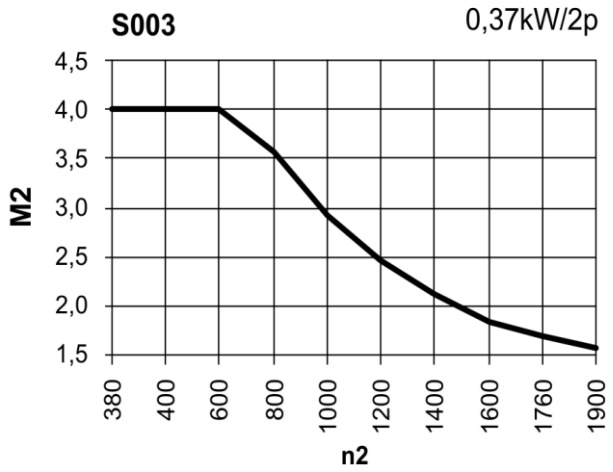
0,15	S003	63C6	900	620	125	2,1	4	500	700
0,22	S003	63C4	1400	950	190	2	4	440	760
0,25	S005	71A4	1400	950	190	2	6	802	1120
0,25	S005	71B6	900	610	122	3	6	930	1120
0,37	S003	63C2	2800	1900	380	1,7	4	340	670
0,37	S005	71B4	1400	950	190	3	6	810	1120
0,55	S005	71B2	2800	1900	380	2,2	6	640	1120
0,55	S005	71C4	1400	950	190	4,4	6	720	1120
0,55	S010	80A4	1400	950	190	4,4	12	930	1910
0,55	S010	80B6	900	610	122	6,6	12	1080	1910
0,75	S005	71C2	2800	1900	380	3	6	640	1120
0,75	S010	80B4	1400	950	190	6	12	940	1640
0,92	S010	80C4	1400	950	190	7,5	12	870	1640
1,10	S010	80B2	2800	1900	380	4,4	12	740	1300
1,10	S020	90S4	1400	1000	190	9	24	1130	1960
1,10	S020	90L6	900	660	122	13,5	24	1300	2290
1,50	S010	80C2	2800	1900	380	6	12	740	1300
1,50	S020	90S2	2800	2000	380	6	24	890	1560
1,50	S020	90L4	1400	1000	190	12	24	1130	1960
1,50	S030	100LA6	900	660	122	18	48	2570	4540
1,84	S020	90LL4	1400	1000	190	15	24	1050	1960
2,20	S020	90L2	2800	2000	380	9	24	890	1560
2,20	S030	100LA4	1400	1000	190	18	48	2240	3890
2,20	S050	112M6	900	660	122	27	64	2570	4540
3,00	S030	100LB4	1400	1000	190	24	48	2240	3890
4,00	S050	112M4	1400	1000	190	32	64	2240	3890
4,80	S050	112MS4	1400	1000	190	40	64	2010	3890
5,50	S100	132S4	1400	1000	190	44	144	2900	5050
5,50	S100	132M6	900	660	122	66	144	3330	5890
7,50	S100	132L4	1400	1000	190	60	144	2900	5050
9,20	S100	132M4	1400	1000	190	74	144	2900	5050

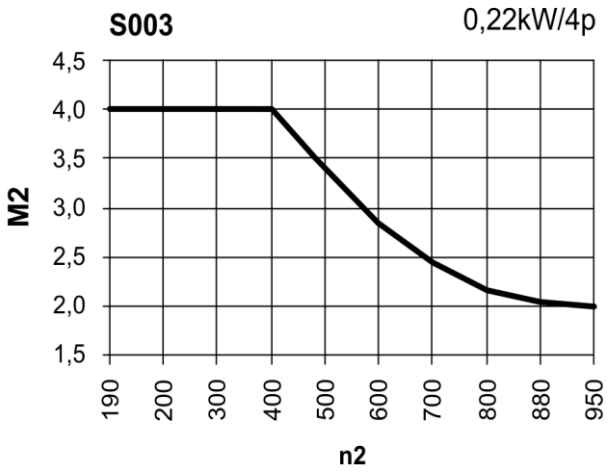
(a) Values relating to maximum speed
(b) Values relating to minium speed

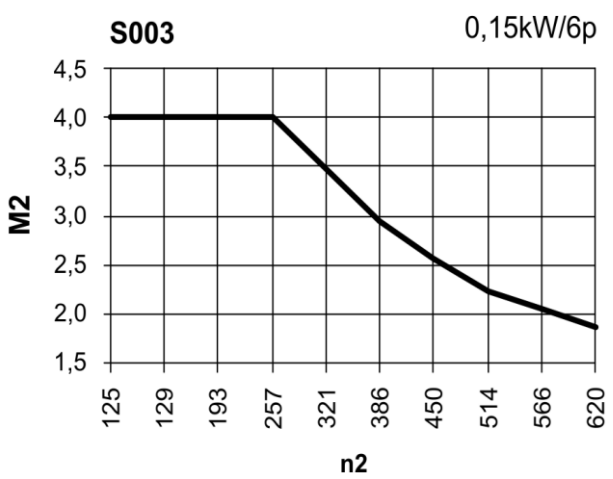
7.2.2 S.D

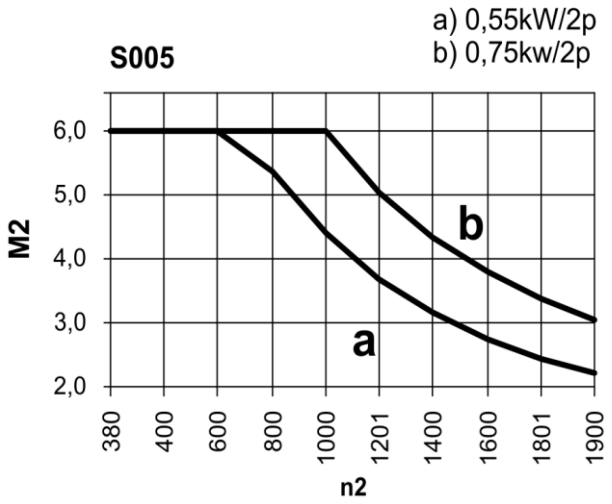
SD005	610	0	6
SD005	950	0	6
SD005	1900	0	6
SD005	950	0	6
SD010	610	0	12
SD005	1900	0	6
SD010	950	0	12
SD010	950	0	12
SD010	1900	0	12
SD020	1000	0	24
SD020	660	0	24
SD010	1900	0	12
SD020	2000	0	24
SD020	1000	0	24
SD030	660	0	48
SD020	1000	0	24
SD020	2000	0	24
SD030	1000	0	48
SD050	660	0	64
SD030	1000	0	48
SD050	1000	0	64
SD050	1000	0	64
SD100	1000	0	144
SD100	660	0	144
SD100	1000	0	144
SD100	1000	0	144

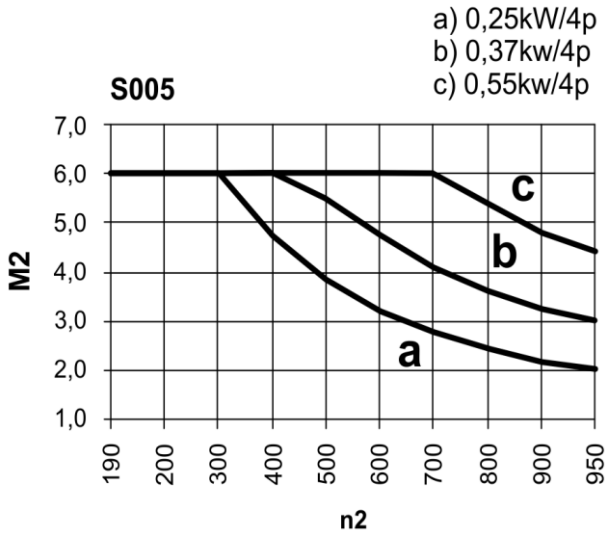
7.2.3 S - Performance curves

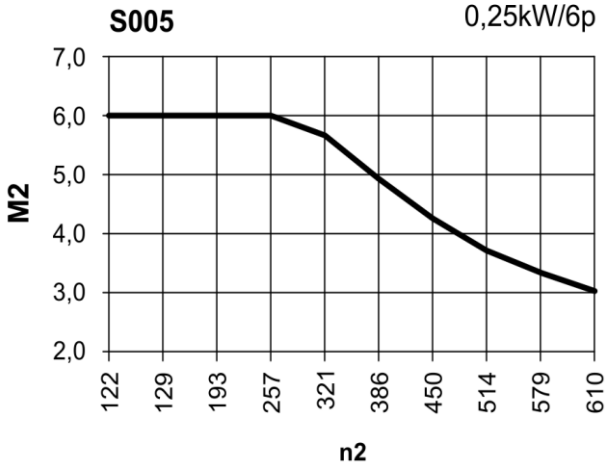




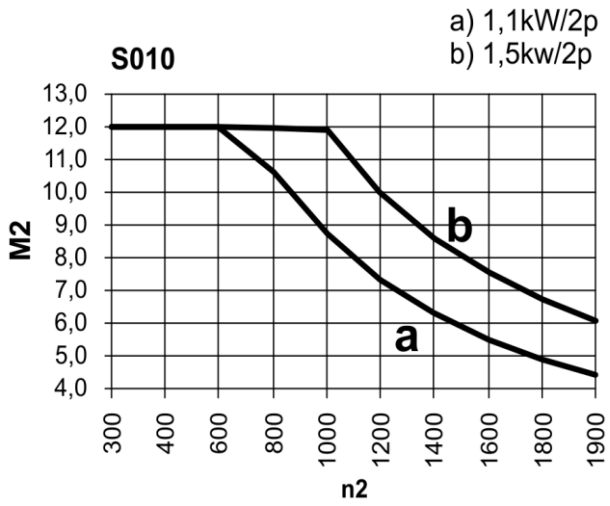


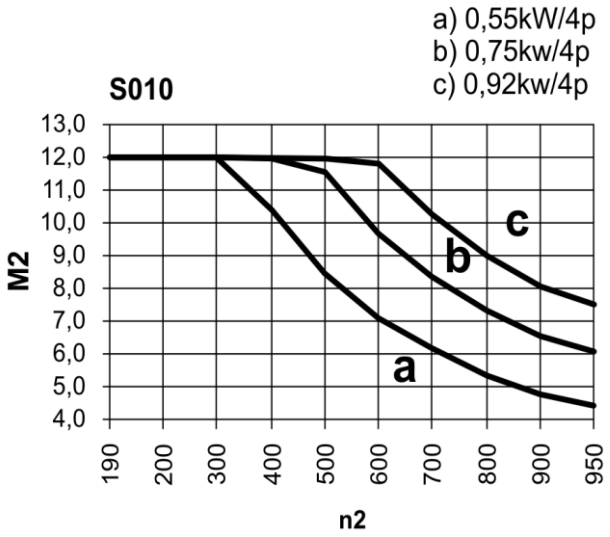


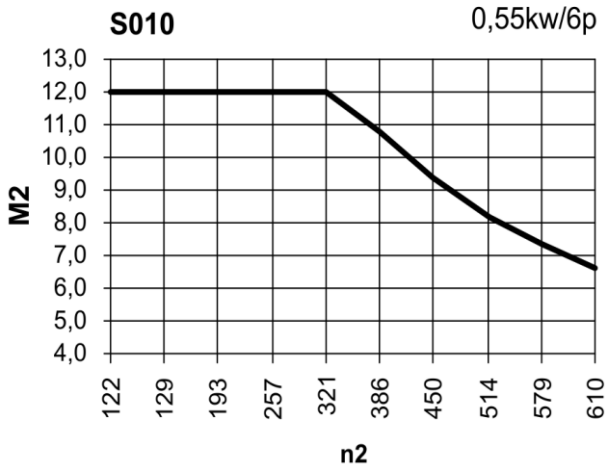


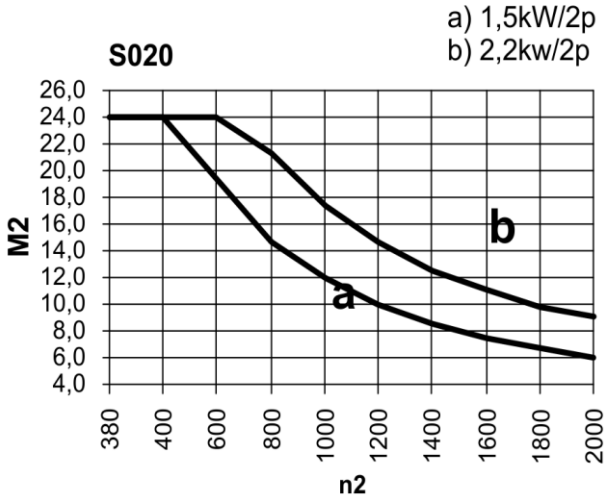


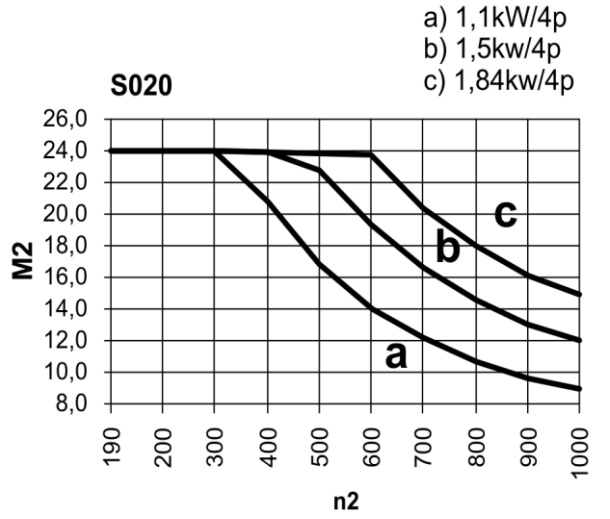
7.2 S - PERFORMANCE

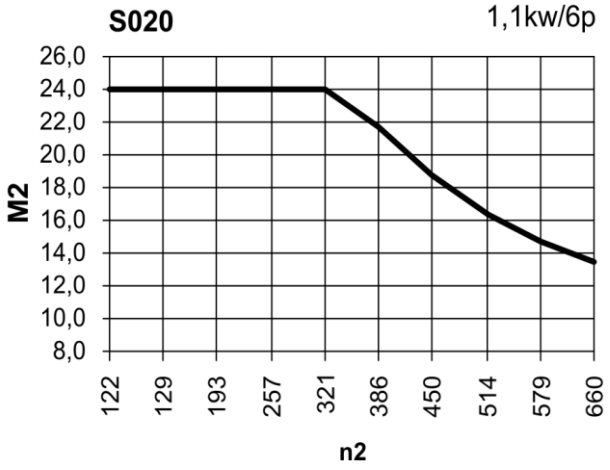






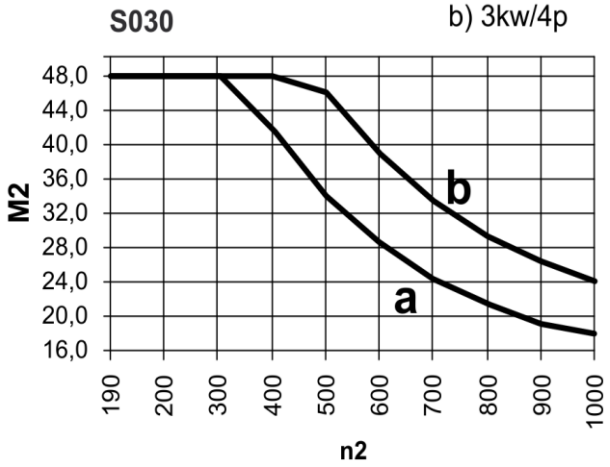


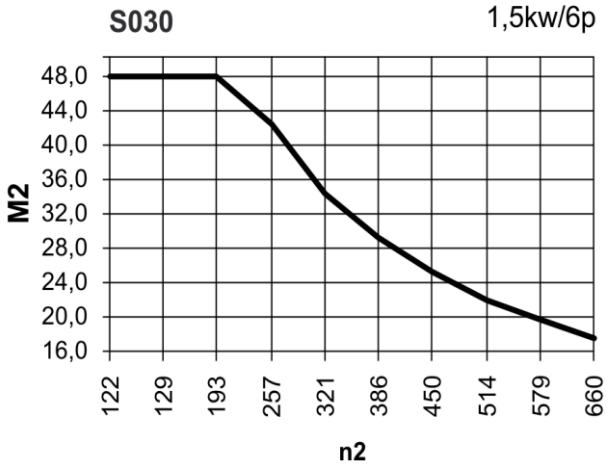




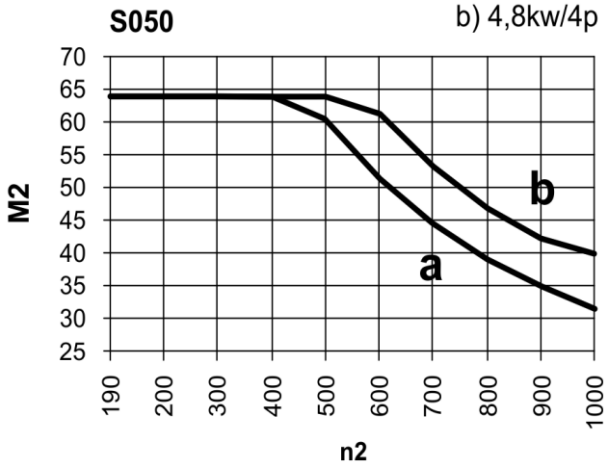
7.2 S - PERFORMANCE

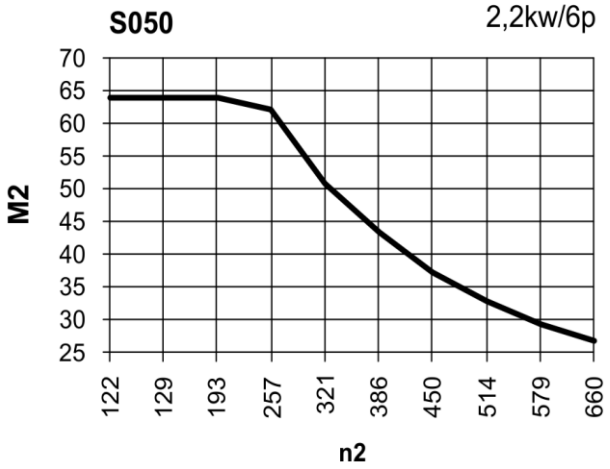
a) 2,2kW/4p
b) 3kw/4p



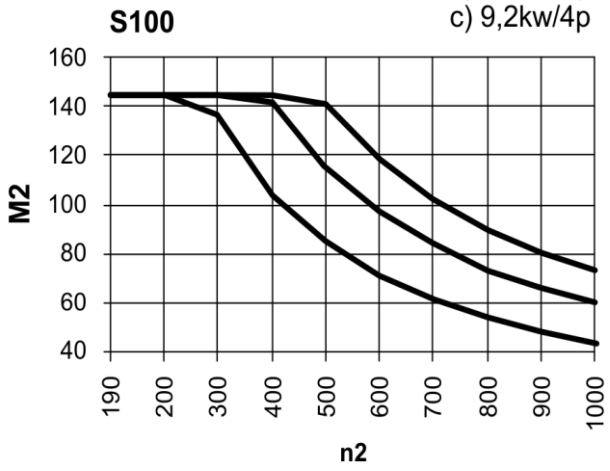


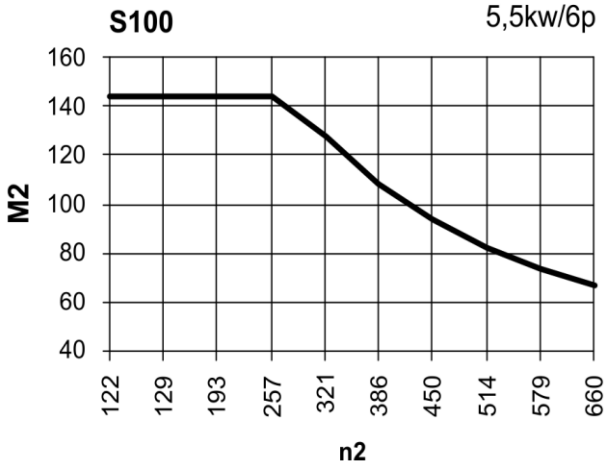
a) 4kW/4p
b) 4,8kw/4p



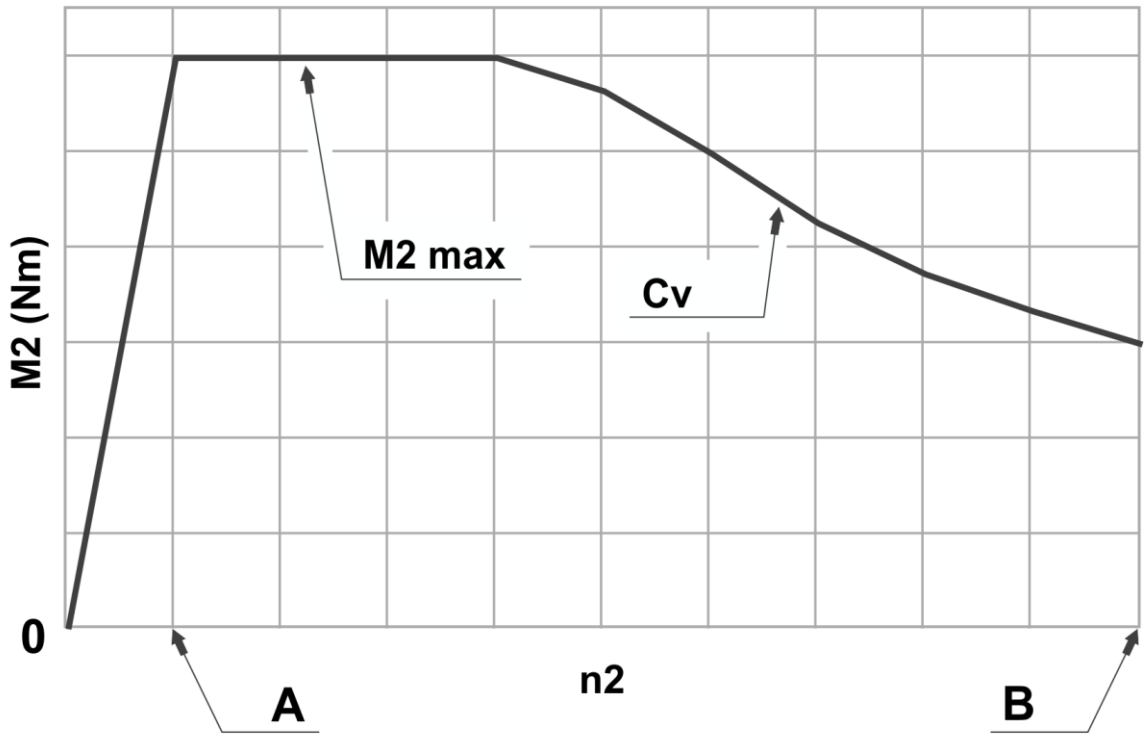


a) 5,5kW/4p
b) 7,5kw/4p
c) 9,2kw/4p





7.2.4 S.D - Torque curve with differencial device



"Cv" torque curve of the motovariator with differencial device, from "n(b)" to "n(a)", corresponds to the same motovariator without differencial device. Close to point "n(b)", torque curve of motovariator with differencial goes gown to 0, in this area the performance could be irregular and cause slipping problems to satellite. Therefore it is necessary to accurately verify application torque.