

MAHLE

Driven by performance

POWERFUL AND HIGH EFFICIENCY

Wide range of starter motors for diesel and petrol engines.

STARTER MOTORS

ELECTRIC DRIVES
AND APPLICATIONS



MORE PERFORMANCE, PRECISION, AND PASSION FOR YOUR SUCCESS.

» We see ourselves not just as a supplier, but much more as a reliable guide and expert partner that helps you better reach your goals. «



MAHLE is a leading global development partner for the automotive and engine industry with unique systems competence in the areas of engine systems, filtration, electrics/mechatronics, and thermal management. Automobile and engine manufacturers worldwide rely on products and solutions from **MAHLE**.

This unique expertise and outstanding development competence can be found in our products and solutions around the globe: in commercial vehicles, ships, trains, agricultural and construction machinery, electric vehicles, and other demanding industrial applications such as forklifts, mobile hydraulics and factory equipment.

As your development, systems, and service partner, we know your requirements and processes. We know what you and your customers need and, together with you, we create added value that brings fresh power to your success: tailor-made solutions with the highest performance and reliability, durability, and economic efficiency, which sustainably contribute to increasing energy efficiency and ecological added value.

WE DRIVE YOUR SUCCESS. WORLDWIDE.
WITH PERFORMANCE, PRECISION, AND PASSION.
MAHLE — DRIVEN BY PERFORMANCE.

STARTER MOTORS

The range of our starter motors is a result of our long-standing cooperation with manufacturers of internal combustion engines. The liaison with our partners, their requirements and expectations, and an in-depth knowledge of cranking requirements are reflected in the optimized design of our starter families. Today we can provide starters of all capacities for starting diesel and petrol engines used by the automotive, truck, tractor, and other industries.

We pay special attention to the latest developments in the field of starters and to continuous technological advances. Our experts are acutely aware of the need for starter motors to be smaller, lighter and more efficient. The result of this approach is cutting edge reduction gear starters which are gradually replacing all direct drive starter motors.

High performance starter motors are based on long-term co-operation with our customers in different industries, their specific requirements and expectations, the requirements of many complex applications, and our long years' experience in planning, production, and testing in our own laboratories, as well as in the application. We guarantee quality by applying procedures defined in the international standard ISO 9001: 2000. All business processes from the customers' requirements and expectations through development and production to after-sales activities are carefully planned and controlled. High reliability in exploitation is guaranteed by considering different applications and conditions and is proved by tests of specific versions carried out in our own laboratories.

Various versions of the starters ensure long life in adverse operating conditions. They provide outstanding resistance to salt fog, humidity, water, dust, mud, vibration, high and low temperatures, and aggressive liquids. Their design complies with the standards of electromagnetic compatibility and with other international directives and standards.

Starter motors are produced using environmentally conscious technologies and environmentally friendly materials.

The power ratings of starters in this catalog are of an informative nature since they are valid for a typical battery at temperature -20°C and 80% charged. Real power ratings will vary depending on the vehicles electrical circuit, battery and temperature. Precise values can be provided on request.

AZD PERMANENT MAGNET REDUCTION GEAR STARTER MOTORS

The diameter of these starter motors is 70 mm. They are used for starting petrol engines from 1.4 to 3.0-litre displacement. They are designed for use on automotive engines and for light commercial vehicles.

These reduction gear starter motors are excited by permanent magnets. They are started and engaged by a solenoid switch and an efficient helical pinion. The advantages of these starter motors are low weight, small size, high specific power and efficiency.

AZE PERMANENT MAGNET REDUCTION GEAR AND DIRECT DRIVE STARTER MOTORS

The diameter of these starter motors is 80 mm. They are used for starting diesel engines up to 3-litre displacement and petrol engines up to 5-litre. They are designed for use on automotive engines, light commercial vehicles, agricultural machinery, and other applications.

The motor part of the starter motor is excited by permanent magnets. The units are started and engaged by a solenoid switch and an efficient helical pinion. The direct drive starter motors are

available with powers of up to 1kW 12V. Starters of higher powers are available in reduction gear versions. The advantages of the reduction gear starters are in low weight, small size, high specific powers and efficiency.

For especially harsh operating conditions, we offer a sealed noseless starter.

AZE AND AZF REDUCTION GEAR STARTERS WITH ELECTRICAL EXCITATION

The diameters of the AZE starter motors are 82 and 90 mm, while the diameter of the AZF starter motors is 95 mm. They are all four-pole coil excited machines used for starting diesel engines with 1 to 12 litre displacement. They are designed for commercial vehicles, trucks, tractors, agricultural machinery, construction equipment, ships, stationary motor sets, and for some other applications.

Both starter motor families are reduction gear starters with electrical excitation of the motor part. They are started and engaged by a switch and a helical pinion. These starters are distinguished for low weight, small dimensions, high specific power and high efficiency.

The AZE starters are available in light duty version with outputs 12V 2.4kW, 24V 2.8kW (diameter 82 mm) and 12V 2.6kW and 24V 3kW and medium duty version with outputs 12V 3.2kW and 24V 3.5kW. The AZF starter motors are available in medium duty and heavy duty versions with two stage engagement.

Specially sealed noseless versions are available for harsh operating conditions.

AZG REDUCTION GEAR STARTERS WITH ELECTRICAL EXCITATION

AZG reduction gear starter motors are four-pole coil excited machines with a yoke diameter of 110 mm. They are distinguished by their high specific power output, efficiency, and excellent cold crank capability with low current drain from battery.

The 12V starter motors are used for starting diesel engines with 6 to 15 litre displacement. The 24V version of the starter motors are used for starting diesel engines with 7 to 19 litre displacement. All have two stage soft engagement.

In the AZG reduction gear starter motors high quality thermal resistant materials have been used.

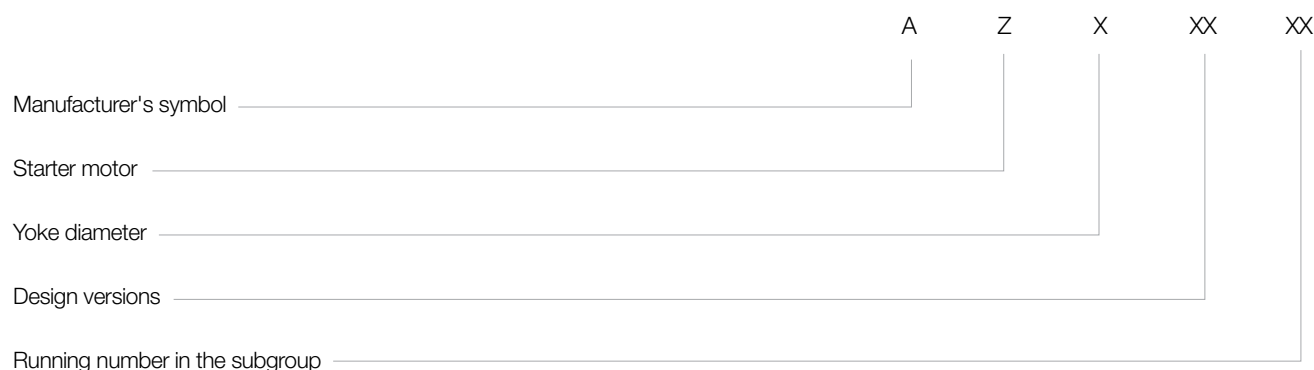
AZJ DIRECT DRIVE STARTERS WITH ELECTRICAL EXCITATION

The AZJ family of starter motors is suitable for starting diesel engines with 3 to 9 litre displacement. They are used in commercial vehicles, trucks, tractors, agricultural machinery, construction equipment, ships, stationary engines, and other applications.

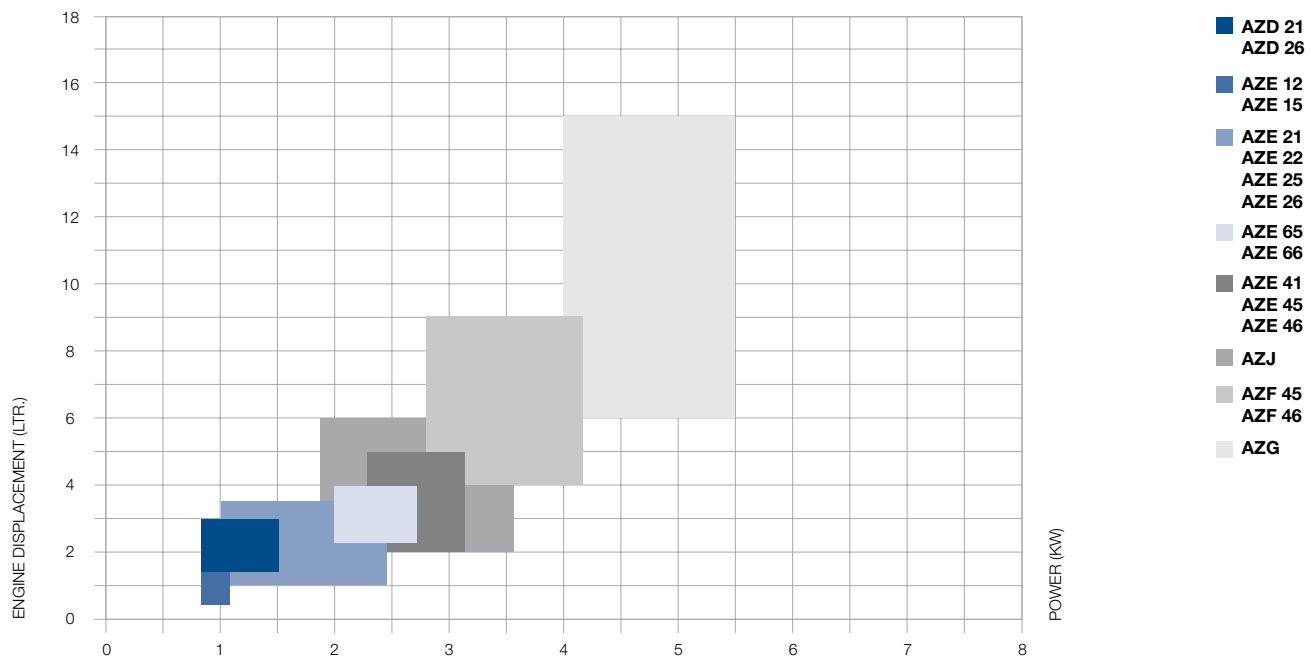
The starter motors are designed as direct drive starter motors. The base diameter of the AZJ starter motors is 115 mm. The power is

supplied by a four-pole series wound electric motor. The solenoid switch with pull-in and hold-in windings establishes the engagement of the drive assembly into the ring gear by means of a lever. The roller clutch permits operation in extreme conditions. These starter motors are built with different pinions, flanges and electrical connections corresponding to their installation on various engines; different versions are available for a variety of ambient conditions.

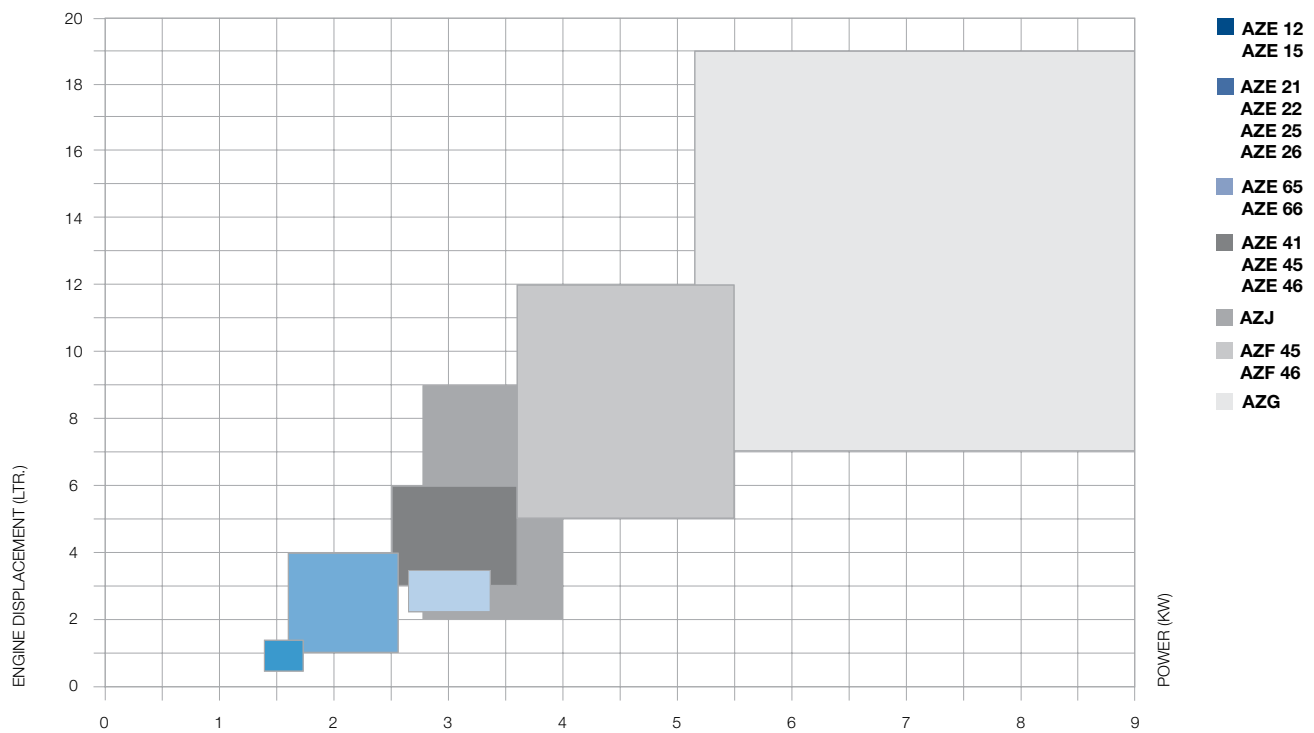
MEANING OF THE TYPE DESIGNATION



Starter motors 12 V



Starter motors 24 V



AZD Permanent magnet reduction gear starter motors

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from the battery.
- Reduced weight and size in comparison to direct drive starter motors.
- High reliability and long life operation.

Options

- Nosed or noseless versions for specific applications.
- Pinion, flange, electrical terminals and direction of rotation are customized for specific engines.
- Dust protection of bushing in drive end bracket.
- Special versions are available on request.
- Drain holes on request.

Design

- Pre-engaged style of a starter motor.
- High quality ferrite permanent magnets.
- Plastic or metallic low-noise planetary reduction gear using a coaxial pinion with an armature.
- Drive assembly with a five roller clutch.
- Pinion shift mechanism with solenoid and fork lever.
- Solenoid switch with pull-in and hold-in windings.
- High quality thermally resistant materials.
- Drive end brackets from die cast aluminum.
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.

Applications

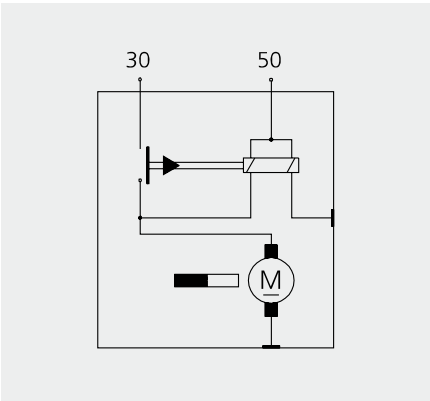
Starter motors for petrol engines from 1.4 to 3 litre of capacity for passenger cars and light commercial vehicles.



Main technical data

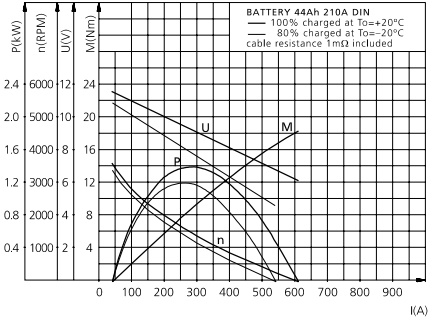
Type	AZD 21 .. - Nose / AZD 26 .. - Noseless
Nominal voltage (V)	12
Rated power (kW)	1.1 - 1.4
Length-nose (mm)	< 200
Length-noseless (mm)	< 201
Weight-nose (kg)	< 2.9
Weight-noseless (kg)	< 2.8
Yoke diameter (mm)	70
Stator	6 permanent magnets
Drive assembly	5 rollers
Control signal (T50)	Pull-in current < 50A
Solenoid 12V	Hold-in current < 10A
Terminals	30 – M8 50 – M4, M5 or M6 Blade 6.3 x 0.8 Integrated VW connector with blade 4.7x0.7
Basic protection	Protection against ingress of dust, solid foreign objects and splashing water (IP56)
Operating temperature	- 30°C to + 100°C
Ambient temperature	- 40°C to + 130°C

Connection diagrams

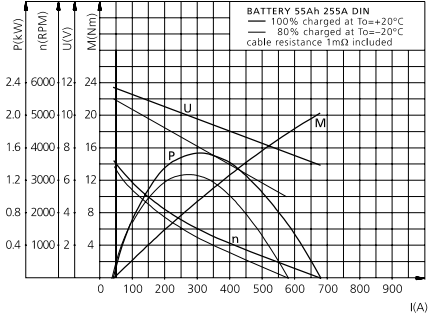


Characteristics

12 V 1.1 kW



12 V 1.4 kW



AZE Permanent magnet direct drive starter motors

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from the battery.
- Reduced weight and size in comparison to starter motors with field windings.
- Highly efficient drive assembly for idle run of the pinion.

Options

- Pinion, flange, electrical terminals and direction of rotation are customized for specific engines.
- Dust protection of bushing in drive end bracket.
- Special versions are available on request.
- Drain holes on request.

Design

- Pre-engaged style of a starter motor.
- Excitation by high quality 6-pole ferrite permanent magnets for high torque output.
- Magnetic shunts improve the output power and enable high stability and resistance to demagnetisation.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Drive assembly with a five roller clutch.
- Solenoid switch with pull-in and hold-in windings.
- High quality thermally resistant materials.
- Drive end brackets from die cast aluminum.
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.

Applications

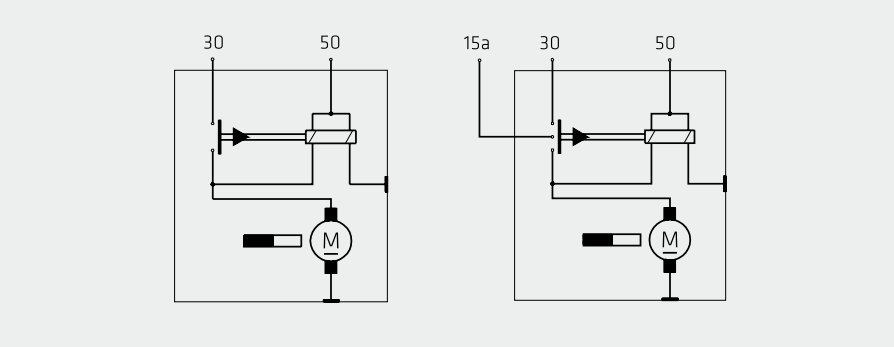
Petrol engines of up to 1.5 litre displacement for passenger cars. Small diesel engines with up to 0.5 litre displacement, for marine and agricultural applications.



Main technical data

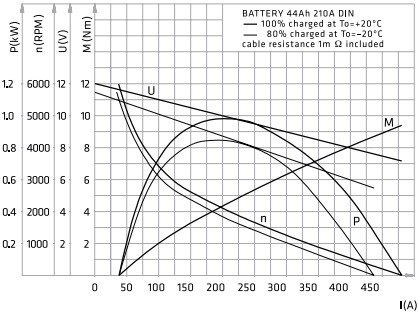
Type	AZE12.. / AZE15..		
Nominal voltage (V)	12		24
Rated power (kW)	0.9	1.0	1.6
Length-nose (mm)	< 157	< 170	<157
Length-noseless (mm)			
Weight-nose (kg)	3.8 to 4.0	3.5	3.8 to 4.0
Weight-noseless (kg)			
Yoke diameter (mm)	80		
Stator	6 permanent magnets		
Drive assembly	5 rollers		
Control signal (T50) (+20°C)	pull-in current < 50A hold-in current < 10A		
Solenoid 12V			
Solenoid 24V			
Terminals	30 – M8 31 – M8 50 – M4, M5 or M6, Blade 6.3 x 0.8 Integrated VW connector with blade 4.7x0.7 15a – 6.3 x 0.8, M5 (option)		
Basic protection	Protected against ingress of dust, solid foreign objects and splashing water (IP 56)		
Operating temperature	-30°C to +100°C		
Ambient temperature	- 40°C to + 130°C		

Connection diagrams

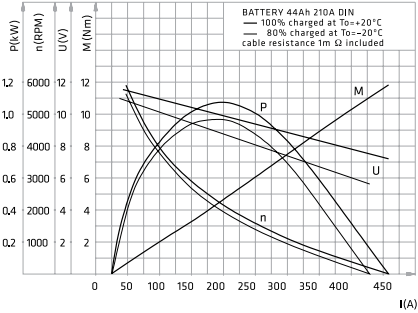


Characteristics

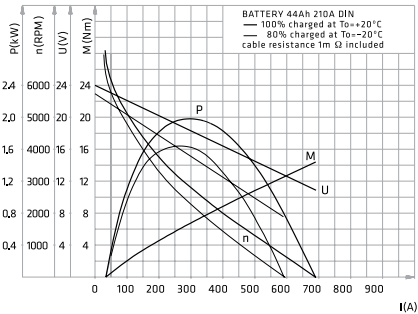
12 V 0.9 kW



12 V 1 kW



24 V 1.6 kW



AZE Permanent magnet reduction gear starter motors

These are starter motors for starting diesel engines in light commercial vehicles, small tractors and agricultural machinery, ships, stationary generator sets, and other applications.

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from battery.
- Reduced weight and size in comparison to direct drive starter motors.
- Highly efficient drive assembly for idle run of the pinion.
- High reliability and long life operation.

Design

- Pre-engaged style of a starter motor.
- Nosed or noseless versions for specific engine applications.
- Excitation by high quality 6-pole ferrite permanent magnets for high torque output.
- Magnetic shunts improve the output power and enable high stability and resistance to demagnetisation.
- Plastic or metallic low-noise planetary reduction gear using a coaxial pinion with an armature.
- Drive assembly with a five or six-roller clutch.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding.
- High quality thermally resistant materials.
- Drive end brackets made of die cast aluminum.
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.

Applications

Petrol engines of 1 to 5 litre and diesel engines of 1 to 3 litre displacement. Passenger cars, light commercial vehicles, agricultural equipment, marine applications.

AZE 21 / AZE 26

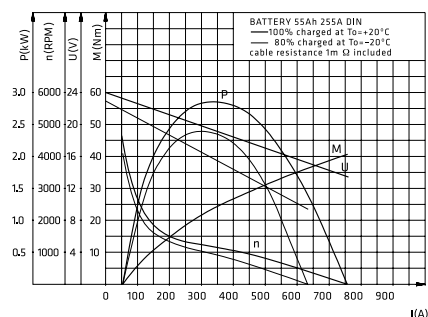


Main technical data

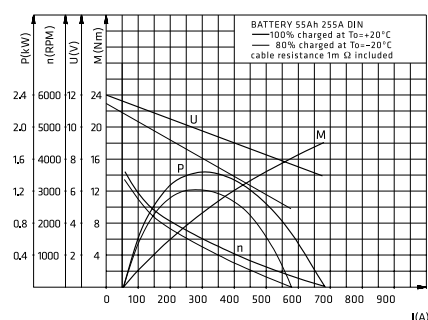
Type	AZE21.. / AZE22.. / AZE25..- nose AZE26..- noseless			
Nominal voltage (V)	12			24
Rated power (kW)	1.2	1.4	2.1	2.5
Length-nose (mm)	< 161	< 175	<186	<186
Length-noseless (mm)	< 196	< 210	< 221	< 221
Weight-nose (kg)	3.3	3.75	4.05	4.05
Weight-noseless (kg)	3.6	3.9	4.2	4.2
Yoke diameter (mm)	80			
Stator	6 permanent magnets			
Drive assembly	5 rollers or 6 rollers			
Control signal (T50) (+20°C) Solenoid 12V	pull-in current < 50A hold-in current < 10A			
Solenoid 24V	pull-in current < 30A hold-in current < 7.5A			
Terminals	30 - M8 31 - M8 50 - M4,M5 or M6, Blade 6.3 x 0.8 Integrated VW connector with blade 4.7x0.7 15a - 6.3 x 0.8, M5 (option)			
Basic protection	protected against ingress of dust, solid foreign objects and splashing water (IP56)			
Operating temperature	- 30°C to + 100°C			
Ambient temperature	- 40°C to + 130°C			

Characteristics

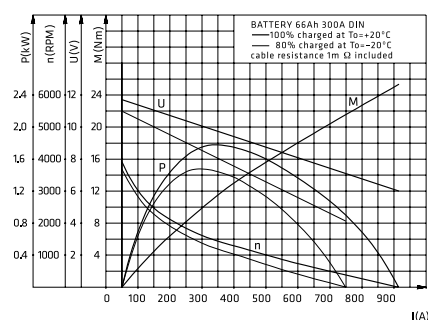
24 V 2.5 kW



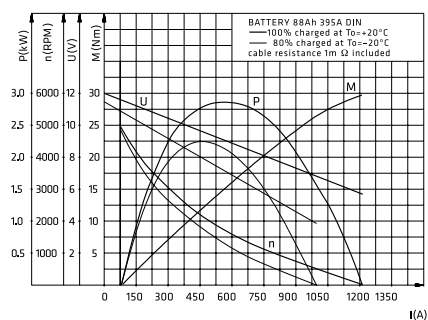
12 V 1.2 kW



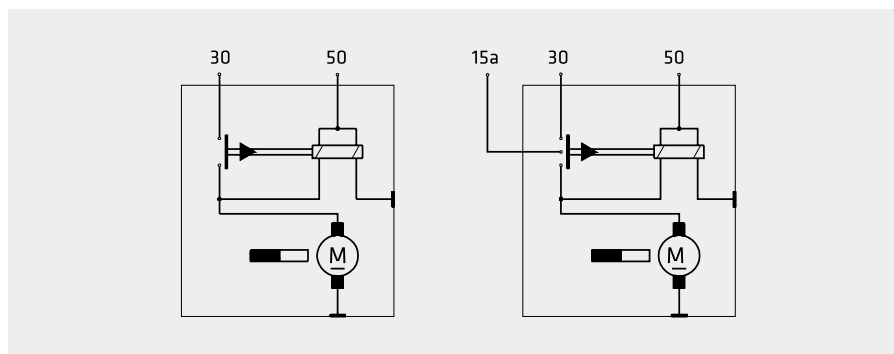
12 V 1.4 kW



12 V 2.1 kW



Connection diagrams



AZE Field coil reduction gear starter motors - Light Duty (NEW FAMILY)

These are starter motors for starting diesel engines in light commercial vehicles, small tractors and agricultural machinery, ships, stationary generator sets, and other applications.

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from battery.
- Reduced weight and dimensions in comparison to direct drive starter motors.
- Highly efficient drive assembly for idle run of the pinion.
- High reliability and long life operation.

Design

- Pre-engaged system of starter motor.
- Nose or noseless versions for specific applications of the engine.
- Metallic low-noise planetary reduction gear using a coaxial pinion with an armature.
- Drive assembly with six-rollers clutch.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding designed to effectively break off main contact.
- High quality thermal resistant materials.
- Drive end brackets made of die cast aluminum.
- End-of-life Directive 2000/53/EC respected and also free of asbestos, beryllium and ammonia.

Applications

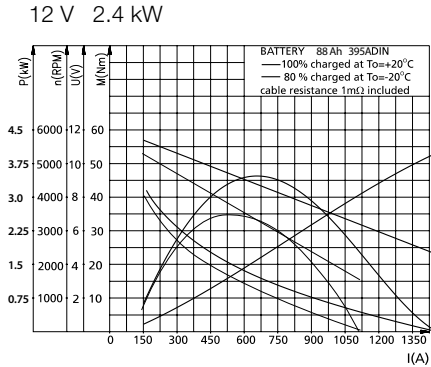
Petrol engines of 1 to 5 litre and diesel engines of 1 to 3 litre displacement. Passenger cars, light commercial vehicles, agricultural equipment, marine applications.



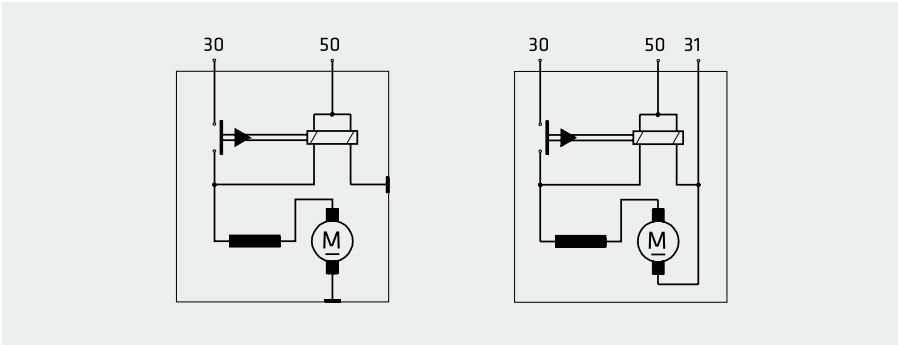
Main technical data

Type	AZE65..- nose AZE66..- noseless	
Nominal voltage (V)	12	24
Rated power (kW)	2.4	2.8
Length-nose (mm) Length-noseless (mm)	< 216 < 251	< 216 < 251
Weight-nose (kg) Weight-noseless (kg)	5.1 5.3	5.1 5.3
Yoke diameter (mm)	82	
Stator	4-pole windings	
Drive assembly	6 rollers	
Control signal (T50) (+20°C) Solenoid 12V	pull-in current < 50 A hold-in current < 10A	
Solenoid 24V	pull-in current < 30 A hold-in current < 7.5 A	
Terminals	30 - M8 31 - M8 50 - M4,M5 or M6, Blade 6.3 x 0.8 Integrated VW connector with blade 4.7x0.7 15a - 6.3 x 0.8, M5 (option)	
Basic protection	protection against ingress of dust, solid foreign objects and splashing water (IP56)	
Operating temperature	- 30°C to + 100°C	
Ambient temperature	- 40°C to + 130°C	

Characteristics



Connection diagrams



AZE Field coil reduction gear starter motors - Light Duty

These are starter motors for starting diesel engines in light commercial vehicles, small tractors and agricultural machinery, ships, stationary generator sets, and other applications.

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from battery.
- Reduced weight and size in comparison to direct drive starter motors.
- Different pinions, flanges, and electrical connections adjusted to the specific engines.
- Special versions are available on request for harsh ambient condition

Options

- Pinion, flange, electrical terminals and the direction of rotation are customized for specific engines.
- Can be equipped with an auxiliary electro-mechanical start relay which enables low current ($< 2A$) triggering of the starter motor.
- Additional dust protection is available with a lip seal on the pinion.
- Noseless version is oil-proof for wet clutch applications.
- Insulated ground return version.

Design

- Pre-engaged style of a starter motor.
- Nosed or noseless versions for specific engine applications.
- Electrical excitation of the motor part.
- Rubber shock absorber, low-noise metallic planetary reduction gear using a coaxial pinion with an armature.
- Drive assembly with a six roller clutch.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding is designed for effective breaking of the main contacts.
- High quality thermally resistant materials.
- Drive end brackets of die cast aluminium.
- Water protection is achieved using drain holes, O-rings and a rubber boot.
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.

Applications

For diesel engines from 2 to 3.5 litre of capacity.

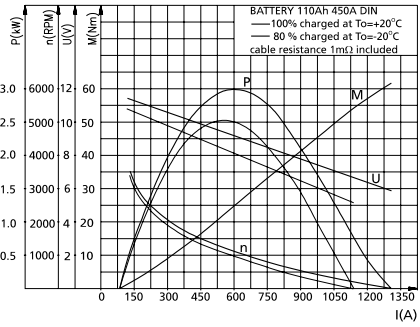


Main technical data

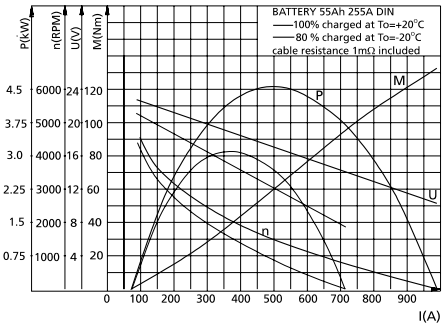
Type	AZE65..- nose AZE66..- noseless	
Nominal voltage (V)	12	24
Rated power (kW)	2.6	3.0
Length-nose (mm)	< 205	< 205
Length-noseless (mm)	< 243	< 243
Weight-nose (kg)	5.2	5.2
Weight-noseless (kg)	5.5	5.5
Yoke diameter (mm)	90	
Stator	4-pole windings	
Drive assembly	6 rollers $\varnothing$ 58 mm	
Control signal (T50) (+20°C) Solenoid 12V	pull-in current < 50A hold-in current < 10A	
Solenoid 24V	pull-in current < 30A hold-in current < 7,5A	
Terminals	30 - M8, M10 31 - M8 50 - M4, M5, M6, Blade 6.3 x 0.8 Integrated VW connector with blade 4.7x0.7	
Basic protection	protected against ingress of dust, solid foreign objects and splashing water (IP56)	
Operating temperature	- 30°C to + 100°C	
Ambient temperature	- 40°C to + 130°C	

Characteristics

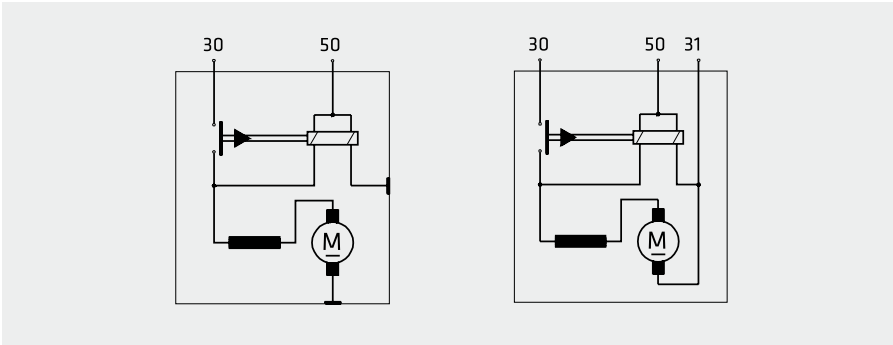
12 V 2.6 kW



24 V 3 kW



Connection diagrams



AZE Field coil reduction gear starter motors - Medium Duty

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from battery.
- Reduced weight and size in comparison to direct drive starter motors.
- Highly efficient drive assembly for idle run of the pinion.

Applications

Diesel engines of 2 to 6 litre displacement.

Options

- Pinion, flange, electrical terminals and sense of rotation are customized to the specific engines.
- Can be equipped with an auxiliary electro-mechanical start relay which enables low current ($< 2A$) triggering of the starter motor.
- Additional dust protection is available with a lip seal on the pinion.
- Oil-proof versions for wet clutch applications.
- Insulated return versions are available.

Design

- Pre-engaged style of a starter motor.
- Nosed or noseless versions for specific engine applications.
- Electrical excitation of the motor part.
- Rubber shock absorber, low-noise, metallic planetary reduction gear using a coaxial pinion with an armature.
- Drive assembly with a six roller clutch.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding is designed for effective breaking of the main contacts.
- High quality thermally resistant materials.
- Drive end brackets made of grey cast iron (GCI), nodular cast iron (NCI) or die cast aluminium (DCA).
- Water protection is achieved using drain holes, O-rings and a rubber boot.
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.

AZE 45 / AZE 46

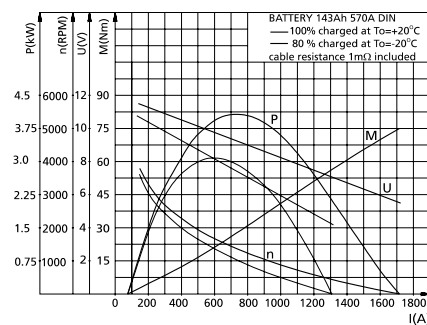


Main technical data

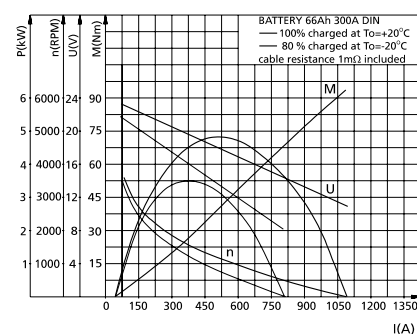
Type	AZE41 / AZE45..- nose AZE46..- noseless	
Nominal voltage (V)	12	24
Rated power (kW)	3.2	3.5
Length-nose (mm)	< 246	< 246
Length-noseless (mm)	< 274	< 274
Weight-nose (kg)	6.5 - 8.3	6.5 - 8.3
Weight-noseless (kg)	6.5 - 8.5	6.5 - 8.5
Yoke diameter (mm)	90	
Stator	4-pole windings	
Drive assembly	6 rollers 62 mm	
Control signal (T50) (+20°C) Solenoid 12V	pull-in current < 68A hold-in current < 20A	
Solenoid 24V	pull-in current < 30A hold-in current < 6A	
Terminals	30 - M8, M10 31 - M8, M10 50 - M4, M6, M5, 6.3 x 0.8	
Basic protection	protected against ingress of dust, solid foreign objects and splashing water (IP 56)	
Operating temperature	- 30°C to + 100°C	
Ambient temperature	- 40°C to + 130°C	

Characteristics

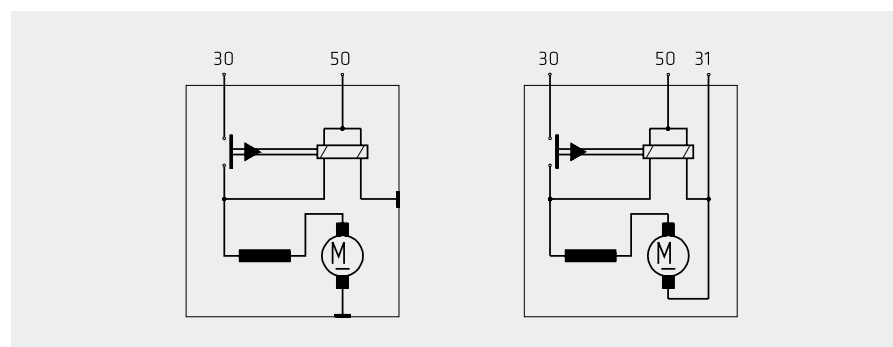
12 V 3.2 kW



24 V 3.5 kW



Connection diagrams



AZF

Field coil reduction gear starter motors - Medium & Heavy Duty

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from battery.
- Reduced weight and size in comparison to direct drive starter motors.
- Highly efficient drive assembly for idle run of the pinion.

Applications

Diesel engines of 4 to 12 litre displacement.

Options

- Pinion, flange, electrical terminals are customized for specific engines.
- Can be equipped with an auxiliary electro-mechanical start relay which enables low current ($< 2A$) triggering of the starter motor.
- For the nosed version additional dust protection with a lip seal on the pinion is available.
- Oil-proof versions for wet clutch applications.
- Insulated return versions are available
- Waterproof versions are available.

Design

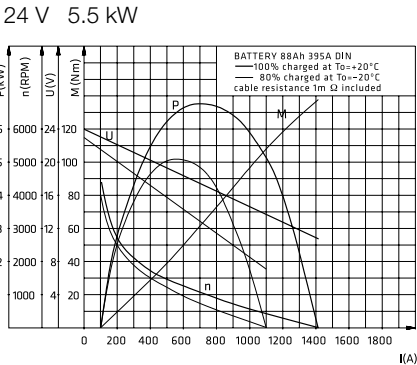
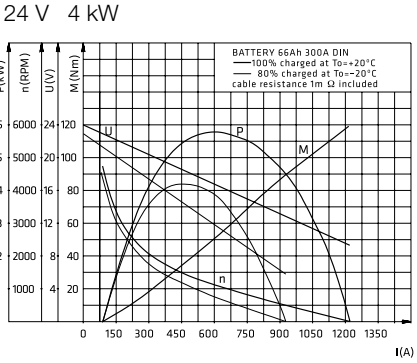
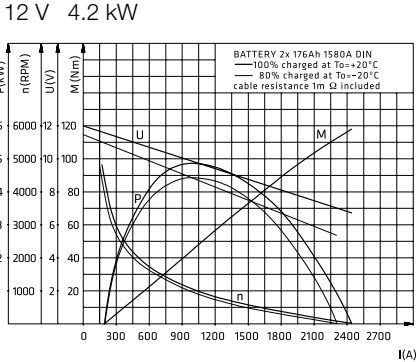
- Pre-engaged style of a starter motor in the medium duty version; two-stage engagement in the heavy duty version.
- Nosed or noseless versions for specific engine applications.
- Electrical excitation of the motor part.
- Drive assembly with a six roller clutch.
- Rubber shock absorber, low-noise, metallic planetary reduction gear with pinion and armature in one axis.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding is designed for effective breaking of the main contacts.
- High quality thermally resistant materials.
- Drive end brackets made of grey cast iron (GCI), nodular cast iron (NCI) or die cast aluminium (DCA).
- Water protection is achieved with drain holes, O-rings and a rubber boot.
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.
- The heavy duty version uses two-stage soft engagement. It controls the starting process and prevents damage and overloading of the starter pinion and the engine ring gear.



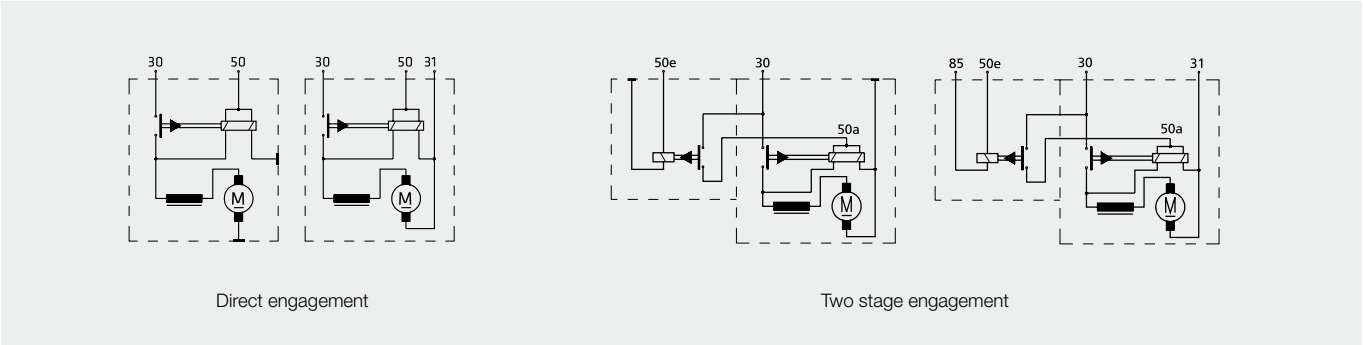
Main technical data

Type	AZF45..- nose AZF46..- noseless		AZF46..HD
Nominal voltage (V)	12	24	24
Rated power (kW)	4.2	4.0	5.5
Length-nose (mm)	< 274		-
Length-noseless (mm)	< 321		< 321
Weight-nose (kg)	9.8 to 10.3		-
Weight-noseless (kg)	11		13
Engagement	direct		two stage
Yoke diameter (mm)	95		95
Stator	4-pole windings		4-pole windings
Drive assembly	6 rollers $\varnothing$ 62 mm		6 rollers $\varnothing$ 66 mm
Control signal (T50) (+20°C) Solenoid 12V	pull-in current < 68 A hold-in current < 20 A		-
Solenoid 24V	pull-in current < 30 A hold-in current < 7.5 A		Start relay current < 2 A
Terminals	30 - M8, M10 31-M8, M10 50 - M4, M5, M6, 6.3 x 0.8 50e - M6		30 - M10 31 - M10 50, 85 - connector 50e - M6
Basic protection	protected against ingress of dust, solid foreign objects and splashing water (IP 56)		
Operating temperature	- 30°C to + 100°C		
Ambient temperature	- 40°C to + 130°C		

Characteristics



Connection diagrams



AZG Field coil reduction gear starter motors – Heavy Duty

Features

- High specific power output and efficiency.
- Excellent cold crank capability with low current drain from battery.
- Reduced weight and size in comparison to direct drive starter motors.
- Highly efficient drive assembly for idle run of the pinion.

Applications

The 12V version is used for starting diesel engines of 6 to 15 litre displacement while the 24V version for diesel engines of 7 to 19 litre displacement.

Options

- Pinion, flange, electrical terminals are customized for specific engines.
- Oil-proof versions for wet clutches are available.
- Insulated return versions are available.
- Over crank protection available.
- Parallel starting system with two or three starter motors in combination with the appropriate electronic unit is able to start diesel engines of up to 80 litres of displacement or gasoline engines of up to 150 litres of displacement.

Design

- Starters use effective two-stage engagement which prevents damage and overloading of the starter pinion and the engine ring gear.
- Noseless versions for specific engine applications.
- Electrical excitation of the motor part.
- Drive assembly with a six roller clutch.
- Rubber shock absorber, low-noise, metallic planetary reduction gear with pinion and armature in one axis.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding designed for effective breaking of the main contacts.
- High quality thermally resistant materials.
- Drive end brackets made of die cast aluminium (DCA).
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.
- Water protection is achieved with drain holes, O-rings.

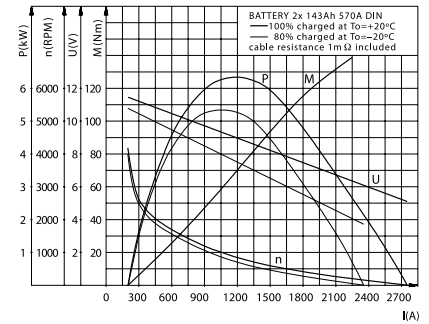


Main technical data

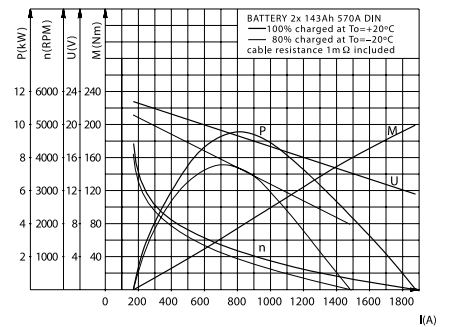
Type	AZG	
Nominal voltage (V)	12	24
Rated power (kW)	5.5	6.5
Length (mm)	< 360	< 354
Weight (kg)	13.6 - 14	13.6 - 14
Engagement	two-stage	two-stage
Yoke diameter (mm)	110	
Stator	4-pole windings	
Drive assembly	8 rollers $\varnothing$ 80 mm	
Control signal (T50) 12V	start relay current < 2A	
24V	start relay current < 2A	
Terminals	30 - M10, M12 31 - M10, M12 50 - M4, M5, M6, 6.3 x 0.8 integrated watertight connector GHW	
Basic protection	protected against ingress of dust, solid foreign objects and splashing water (IP 56)	
Operating temperature	- 30°C to + 100°C	
Ambient temperature	- 40°C to + 130°C	

Characteristics

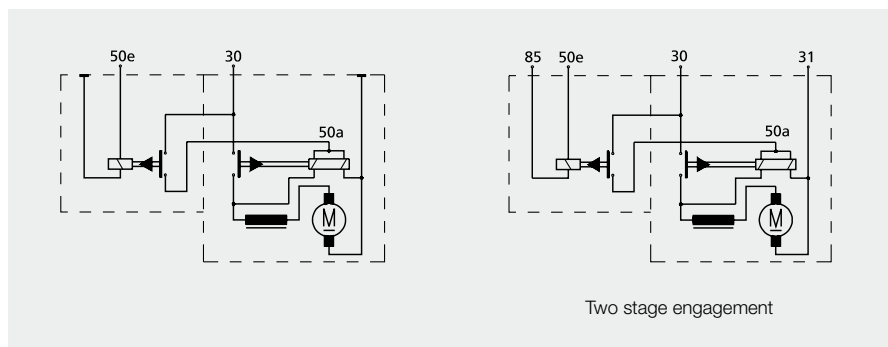
12 V 5.5 kW



24 V 6.5 kW



Connection diagrams



AZJ Field coil direct drive starter motors

Features

- High specific power output and efficiency.
- High cold crank capability.
- Highly efficient drive assembly for idle run of the pinion.

Applications

Diesel engines with 3 to 9 litre displacement.

Options

- Pinion, flange, electrical terminals and direction of rotation are customized for specific engines.
- Additional dust protection with a lip seal on the pinion.
- Oil-proof versions for wet clutch applications.
- Insulated return versions are available.

Design

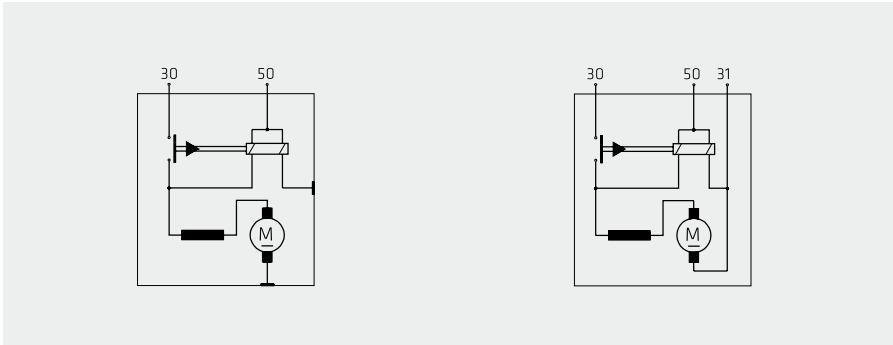
- Pre-engaged style of a starter motor.
- Nosed versions for specific engine applications.
- Direct drive.
- Electrical excitation of the motor part.
- Drive assembly with a six roller clutch.
- Pinion shift mechanism with solenoid, fork lever and helix.
- Solenoid switch with pull-in and hold-in winding.
- High quality thermally resistant materials.
- Drive end brackets made of grey cast iron (GCI), nodular cast iron (NCI) or die cast aluminium (DCA).
- End-of-life Directive 2000/53/EC respected, and also free from asbestos, beryllium and ammonia.
- Water protection is achieved with drain holes, O-rings and rubber boot.



Main technical data

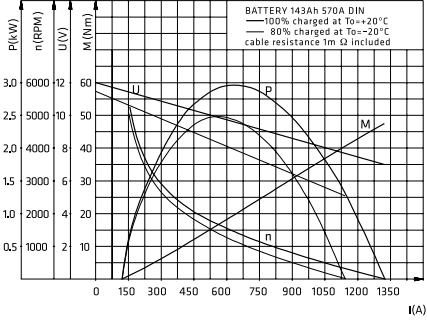
Type	AZJ			
Nominal voltage (V)	12		24	
Rated power (kW)	2.7	3.0	3.2	4.0
Length (mm)	< 239.5	< 281	< 239.5	< 281
Weight (kg)	12.5	13.9	12.5	13.9
Yoke diameter (mm)	115			
Stator	4-pole windings			
Drive assembly	6 rollers			
Control signal (T50) (+20°C) Solenoid 12V	pull-in current < 62A hold-in current < 14A			
Solenoid 24V	pull-in current < 30A hold-in current < 6A			
Terminals	30 - M8, M10 31 - M8, M10 50 - M4, M6, M5, 6.3 x 0.8			
Basic protection	protected against ingress of dust, solid foreign objects and splashing water (IP 56)			
Operating temperature	- 30°C to + 100°C			
Ambient temperature	- 40°C to + 130°C			

Connection diagrams

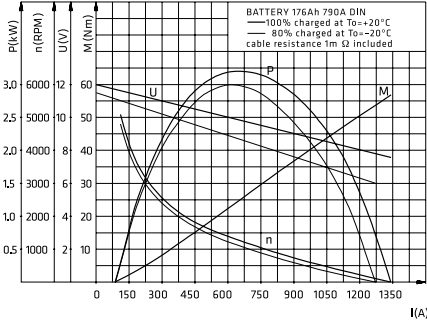


Characteristics

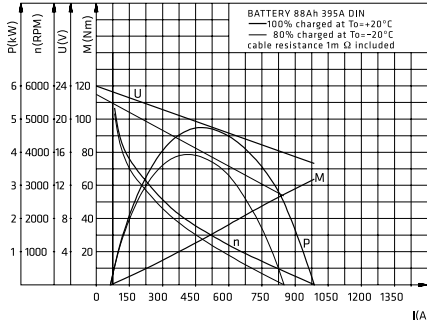
12 V 2.7 kW



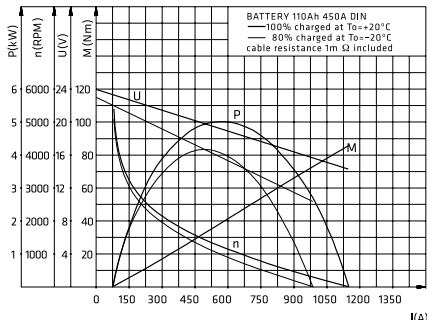
12 V 3 kW



24 V 3.2 kW



24 V 4 kW



PRODUCT REQUIREMENTS FORM

1 . Customer data

Company: _____

Address: _____ Country: _____

Responsible person: _____ Phone: _____

Fax: _____ E-mail: _____

2 . Project data

Project: _____ Project No.: _____

Enquiry: ☐ New project: ☐ Modification: ☐

Brief Description / Timing: _____

Application:

Engine: _____

Vehicle: _____

Application type: _____

Drawing: _____

Starter motor predecessor /equivalent type:

Supplier: _____

Type: _____

Technical data: _____

Drawing: _____

Remarks: _____

3. Engine data

Petrol: ☐	No. of cylinders: _____	Cooling: _____ water /air
Diesel: ☐	No. of valves: _____	Fuel supply: _____
	Compression _____ : 1	Rated output at: _____ kW
	Displacement: _____ litres	Nom. speed: _____ min ⁻¹
	Bore/stroke: _____ /mm	Engine inertia: _____ kgm ²
Ring gear	No. of teeth: _____	Module: _____
Rotation direction (looking at flywheel)	Clockwise: ☐	Center Distance: _____ mm
	Counter clockwise: ☐	

Cold starting temperature limit: _____ °C using engine oil/viscosity: _____

Cranking torque: _____ Nm at _____ min⁻¹ at _____ °C

Minimum starting speed: _____ min⁻¹ at _____ °C

Break away torque: _____ Nm at _____ °C

Additional parasitic loads: _____ Nm at _____ °C

Starting aid: _____ Required current: _____ A _____

Glow plugs: _____ Duration: _____ s _____

Flame start: _____ Engine preheating below: _____ °C up to _____ °C

Other: _____ Battery preheating below: _____ °C up to _____ °C

Remarks: _____

4. Vehicle data

Battery Nominal voltage: _____ V Number of batteries: _____

Capacity (per battery): _____ Ah Standard DIN: ☐ SAE: ☐ IEC: ☐

Cold discharged current: _____ A Standard DIN: ☐ SAE: ☐ IEC: ☐

Internal resistance: _____ mΩ

Manufacturer / Type: _____

Electric circuit Ground type: _____ body ground ☐ additional ground ☐ isolated return ☐

Cables total length (feed + return): _____ m Cross section _____ mm²

Number of connections: _____

Total resistance: _____ mΩ

Starter control circuit key switch: ☐ key switch + relay: ☐

Cables total length (feed + return): _____ m Cross section _____ mm²

Number of connections _____

Total resistance _____ mΩ

Flywheel housing type _____ open: ☐ closed: ☐

Additional inertia (referred to flywheel, e.g. clutch, gear box etc.): _____ kgm²

Remarks: _____

5. Starter motor features

Direct drive: ☐	Reduction gear: ☐	
Drive end shield	preferred type: yes ☐ no ☐	modification _____
Pinion	preferred type: yes ☐ no ☐	No. of teeth _____ module _____
—		
Solenoid	Preferred type	
	Terminal 31 yes ☐ insulated ☐	type _____
	Terminal 50 right ☐ left ☐	type _____
	Terminal 30 length _____ mm	diameter M _____
	Terminal 45 length _____ mm	diameter M _____
	Max. current Terminal 50 _____ A	hold _____ A pull _____ A
	Additional start relay Terminal 50 yes ☐ no ☐	current _____ A
Water/Dust protection	Starter IP: _____ Solenoid IP: _____	
Additional requirements: _____		

Remarks: _____

6. Customer specific requirements

Specifications _____

Remarks _____

Date: _____ Signature: _____



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SHIPPING ADDRESSES AND BRANCHES ELECTRIC DRIVES AND APPLICATIONS

BELARUS

MAHLE Letrika Bel Ltd.

Ul. Dombrovskogo 69
230002 Grodno
T: +375 152 487 484
F: +375 152 487 485

BIH

MAHLE Letrika

Laktaši d.o.o.
Nemanjina 63a
78250 Laktaši
T: +387 51 53 53 15
F: +387 51 53 07 85

BRAZIL

Letrika do Brasil Ltda.

Rua Testa, no 81
Jardim Sao Sebastiao
Jaguariúna - (SP)
CEP.: 13820-000
T: +55 19 3837 6060
F: +55 19 3837 3185

CHINA

MAHLE Letrika (Suzhou) Automotive Electrics Co., Ltd.

No. 11, Ou'jiang Road
Shuangfeng Town
Taicang City 215400
T: +86 512 8160 6888
F: +86 512 8160 7799

FRANCE

MAHLE Letrika France S.A.S.

22 rue du Chapeau Rouge
56000 Vannes
T: +33 2 97 45 59 90
F: +33 2 97 45 59 99

GERMANY

MAHLE Letrika Deutschland GmbH

Danziger Straße 1
D-71691 Freiberg am Neckar
T: +49 714 1702 69 0
F: +49 714 1702 69 33

GREAT BRITAIN

MAHLE Letrika UK Ltd.

Redlands, Ullswater Crescent
Coulsdon, Surrey CR5 2HT
T: +44 208 668 7141
F: +44 208 668 3108

ITALY

MAHLE Letrika Italia S.r.l.

Via Ragazzi del '99 n. 39
42124 Reggio Emilia
T: +39 0522 506 285
F: +39 0522 272 025

USA

MAHLE Letrika USA Inc.

4814 American Road
Rockford, IL 61109
T: +1 800 474 1996
F: +1 815 874 4024

www.letrika.mahle.com

MAHLE Letrika d.o.o.

Polje 15

5290 Šempeter pri Gorici, Slovenia

T: +386 5 33 93 000

F: +386 5 33 93 801

si_info@si.mahle.com

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