

MAHLE

Driven by performance

RELIABLE, EFFICIENT POWER SUPPLY

Designed for long life and maintenance free operation under heavy duty conditions.

ALTERNATORS

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.**

ALTERNATORS

Performance of alternators is based on long-term relationships with our customers, their high requirements and expectations and our own long-standing experience in development and production. Quality is guaranteed by applying procedures defined in the international standard ISO 9001. All business processes from customer requirements and expectations, through development and production to after-sales activities, are planned and controlled in detail. High operating reliability is assured by optimizing the design for use in different operating conditions, together with numerous validations of different alternators in our own laboratories and with field tests on vehicles.

The requirements of the Directive 2000/53/EC – End of Life Vehicles (ELV), amended by Commission Decisions 2005/438/EC and 2000/673/EC, which deal with prohibition and restriction of the use of some hazardous substances, entered into force on July 1, 2007, are fully met. As are the legal obligations under the EU regulation 1907/2006 on the registration, evaluation, authorization and restriction of chemicals - REACH valid from June 1, 2007.

Full attention is paid to the environment.

Applications

Alternators are designed to meet a wide range of engineering specifications and applications. They are used on petrol and diesel engines in the automotive industry, on trucks, buses, agricultural and construction machinery and other applications. Different versions of our alternators are designed taking into account the demands of each application and are designed for long life, maintenance free operation under extreme conditions.

External fan alternators are specially designed for operation in hard environmental conditions (dust, mud, salt, high vibrations level and high electrical and thermal load); for example agricultural and construction equipment. This is due to the design, which offers better protection of the alternator sub-assemblies giving the bearings and brushes a longer life, and includes the options of

additional tubes for clean air in-take and trash screens.

Compact alternators are designed for wide range of applications, where lower noise, compact design and operation at higher rotational speeds are specifically required; for example automotive and commercial vehicle applications.

Special versions of alternators are also available; for example alternators for battery-less systems used as a power supply for A/C devices, 48V alternators are designed as a power supply for electric motors for E-cut, AC voltage alternators together with electronic controllers as a power supply for special purpose vehicles (fire trucks, ambulance, ... , where an AC voltage 110V~, 230V~ is needed), alternators for heating devices,

MAIN FEATURES

- High specific output power, high efficiency,
- Designed for long life, maintenance free operation under heavy duty conditions,
- High operating reliability is assured by optimizing the design for use in different operating conditions,
- High resistance to salt spray, humidity, water, mud, dust, vibrations, high and low temperatures and other environmental influences,
- Designed to meet electromagnetic compatibility and other international directives and standards,
- Produced using ecologically sound technologies and environmentally friendly materials,
- Designed to meet a wide range of engineering specifications and applications.

DESIGN

Alternators are air-cooled, 3-phase AC synchronous generators with specific claw-pole rotor design. The alternator range includes 6-pole pairs (AAG, AAK, AAL, AAN) and 8-pole pairs versions (AAT). The rotor contains an excitation (field) winding that is energized through slip rings and brushes. An internal electronic voltage regulator controls the amount of rotor field current in order to maintain the alternator output voltage within the required range. A 3-phase full-wave rectifier bridge rectifies the 3-phase AC voltage that is induced in the stator windings. Power Zener diodes of the press-fit type, which are built in rectifier bridge, provide over-voltage protection. Alternator cooling is provided by one external (classic alternators) or two internal fans (compact alternators). The negative terminal is

normally grounded. Insulated ground versions, where the negative terminal is connected directly to the battery, are also available. Alternators are self-excited through excitation diodes (D+, diode trio) or directly from B+ terminal. Alternators are mounted on the internal combustion engine and driven by belt and pulley.

The alternator's construction and approved materials assure improved performance, long life, and maintenance free operation. Alternators are also designed to operate under the harshest environmental conditions: high and low temperatures, salt spray, humidity, water, dust, vibrations, aggressive liquids etc.

MAIN SUBASSEMBLIES

Stator

The stator consists of 3-phase winding, which is wound on to a laminated stator pack. Electrical steel (cold rolled fully processed - Dynamo) of 0.5mm thickness, with controlled electrical and magnetic characteristics, is used as standard for alternators with higher performance requirements, to decrease electric and magnetic losses. Stators are specifically designed to achieve a high winding fill factor, to minimise electrical and magnetic losses, to lower winding temperatures and noise and to assure higher alternator output characteristics.

Rotor

The rotor excitation (field) winding fixed between the claw poles provides excitation of the alternator. The design of the rear part of the alternator (rotor, rear bracket, rectifier, regulator with brush holder) provides higher protection for the slip rings and brushes against environmental influences. Copper or bronze (CuSn5) slip rings together with metal-graphite brushes from established suppliers, are designed to meet long life requirements. The design of claw poles ensures efficient magnetic excitation and lower alternator noise.

Rectifier

The 3-phase full-wave rectifier bridge design with press-fit type power Zener diodes, ensures low temperatures at the rectifier diodes, high resistance to vibrations and over-voltage protection. Rectifiers are mounted on the outer or inner side of the rear end bracket, depending on the type of the alternator. Flexible arrangement of all types of terminals is ensured.

Voltage Regulator

The voltage regulator with brush holder and brushes is fitted on the alternator rear bracket. It is electrically connected to the field winding, and rectifier. Different types are available and can be divided with regard to:

- Electrical design: 14V, 28V and 48V regulating voltage
 - Functions: Mono-function with local or remote sensing, battery-less,... and Multi-function with local or remote sensing, bus interface...

- Technology: Thick-Film Hybrid, Microelectronic,
- Brush holder design (different alternator families, different connection terminals, ...).

Different Regulation voltages and Temperature coefficients are available in order to match different applications.

Bearings

A range of specially sealed roller bearings makes it possible to design alternators for specific applications, operating in the harshest conditions whilst achieving long, maintenance free life. Different bearings types and dimensions are used on different alternator families taking into account the mechanical load, required rotational speed and operating temperature. In addition special needle bearings are used on the AAT alternator family.

Mounting Brackets - Protection covers - Pulleys

A wide range of different standard and special mounting brackets and pulleys are available. A variety of plastic protection covers for different electrical terminal configurations are also available. New designs, if necessary, are made according to customers' requirements.

Electrical terminals

Electrical terminals can be screw or blade type in different configurations, alternatively connectors are offered. The main electrical terminals (B+, D+(L), W) may also be positioned on the side of protection covers. The position and the design of the electrical terminals can be adapted to the specific requirements of the customers. Output terminal B+ is a stud, M6, M8 and M10 are available.

Cooling

Efficient alternator cooling is a very important design issue, which allows high specific output power, lower operating temperatures, high reliability and a long alternator life. There are two different basic alternator designs due to the position of cooling fans:

- External fan (classic alternators) - the fan provides effective through cooling of the alternator and its subassemblies. Protection covers with the facility to mount additional hoses for clean air intake and trash screens for difficult environments are available,
- Internal fans (compact alternators) – two internal fans, positioned on the front and rear of the claw poles, provide more effective cooling particularly of the stator winding, allowing higher alternator rotational speed and lower acoustic noise. Greater protection against accidental contact is assured. Trash screens for protection against harsh environments are also available.

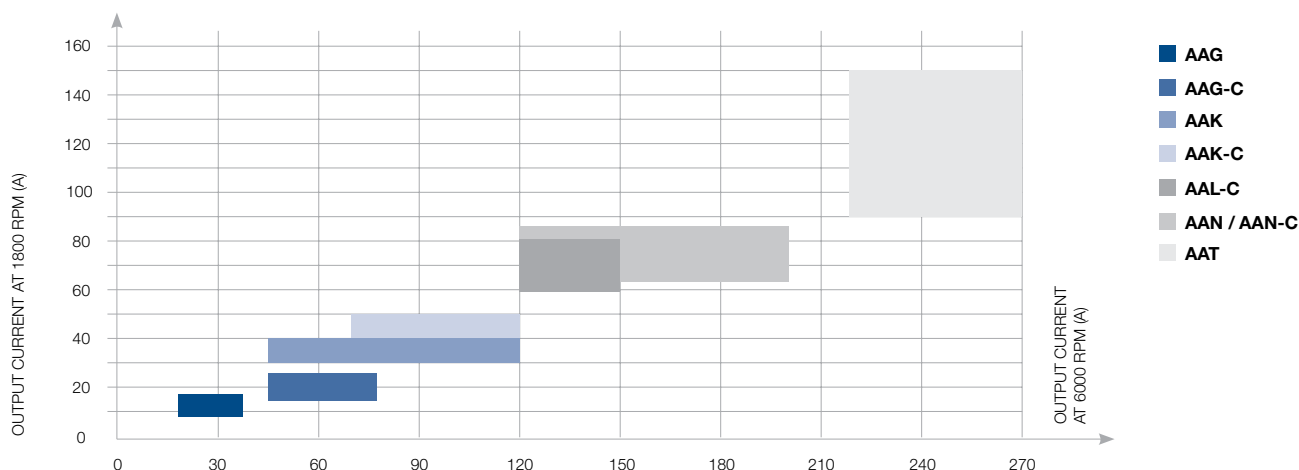
RESEARCH AND DEVELOPMENT

We keep abreast of all technical innovations in the field of alternators. New solutions are regularly applied to the design of new alternators. Energy conservation in vehicles is an absolute necessity. We are working continuously to optimize the design, increase specific output

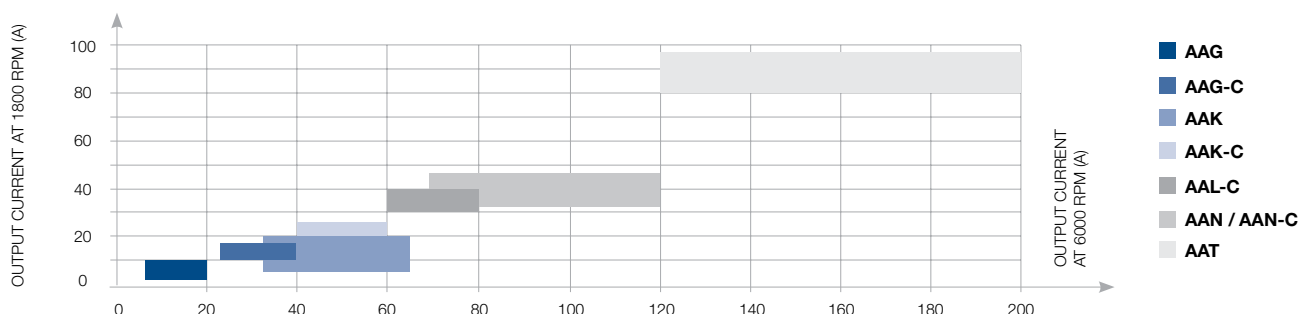
power and efficiency, and to incorporate the latest technology. The R&D laboratories are equipped to perform the majority of tests required in our and our customer's test specifications. Outside laboratory facilities are used for other specific test requirements.

POWER RANGE

Alternators 14 V - output current at 1800/6000 rpm



Alternators 28 V - output current at 1800/6000 rpm



AAG

Applications

Applications with low electrical requirements and limited mounting space such as:

- Gen-sets,
- Small tractors,
- Small agricultural and construction machinery.

Options

Marine versions available.

Features

- Small size,
- Dust-proof,
- CW or CCW rotation fan,
- Over-voltage protection,
- Different configurations and types of electrical terminals available,
- Different types of pulleys and mounting brackets available according to customer's requirements,
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class > 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=215^\circ\text{C}$ max,
- Mono-Function Regulator (14V, 28V):
 - Self-Excitation Supply (D+, diode trio),
 - Thick-Film Hybrid,
- Metal-graphite brushes,
- Copper slip rings,
- External CW or CCW fan,
- Special roller type sealed bearings.

AAG



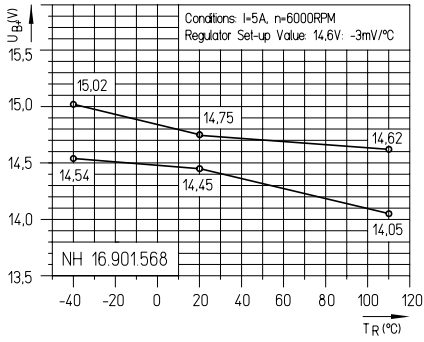
Main technical data

Type	AAG	
Rated Voltage (V)	14	28
Rated Current (A)	33 - 35	18
Stator Diameter (mm)	108	
Cooling	Air cooling / External fan (CW or CCW)	
Weight ¹ (kg)	~3.5	
Max Permanent / Short time Rotational Speed (RPM)	12.000 / 13.500	
Voltage Regulator	Mono-Function (14V / 28V)	
Power diodes Type	Press-fit Zener (35A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals	B+, D+, W, B-	
Drive end bearing / Rear bearing dimension	17X40X12 / 12x28x12	
Protection of the Slip rings and Brushes Compartment	IP 54	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

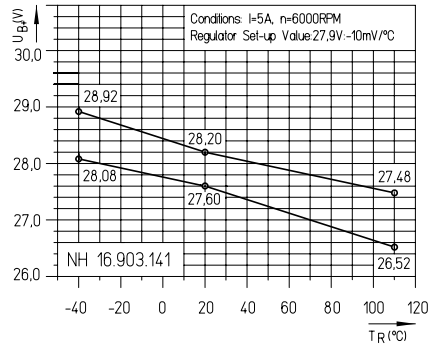
¹ without pulley

Regulator characteristics (Voltage settings - typical)

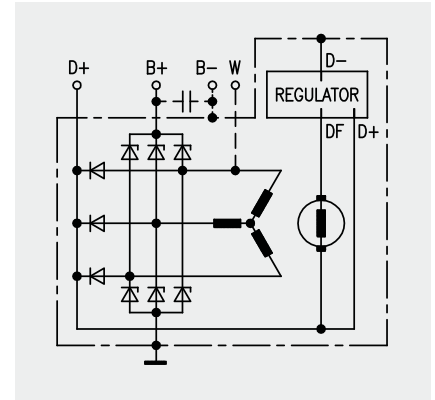
Mono-Function 14V



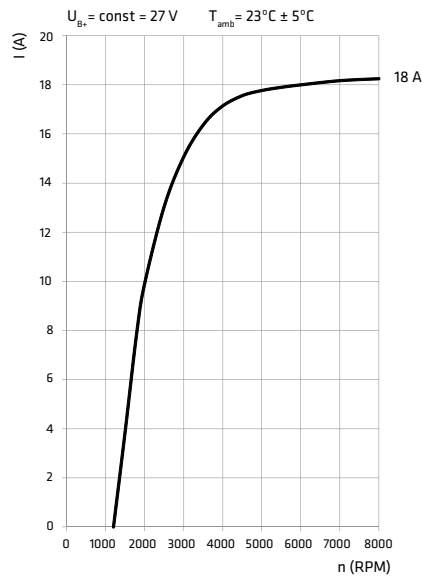
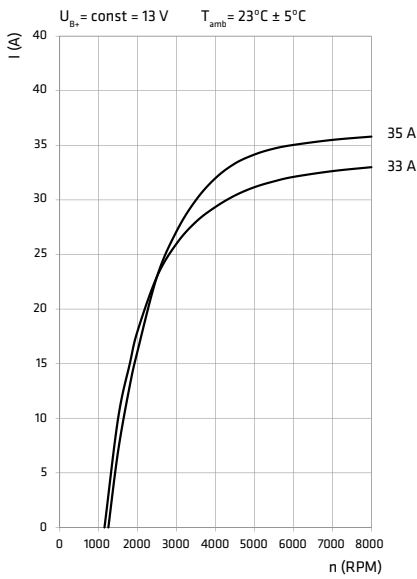
Mono-Function 28V



Connection diagrams



Performance curves



Test methods and conditions are based on standard ISO 8854.

Type	n_o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 33A	1150	15	32
14V 35A	1250	13	35

Type	n_o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 18A	1200	8	18

Note: Alternator thermal stabilized at 3000 RPM, $I = I_{max}$ at $U_{B+} = 13V$ (27V), $T_{amb} = 23°C \pm 5°C$. Performance curves at higher ambient temperatures available.

AAG COMPACT

Applications

Applications with higher electrical requirements and limited mounting space such as:

- Small tractors,
- Small agricultural and construction machinery,
- Gen-sets,
- Small passenger cars,
- Special design for racing cars.

Options

Insulated ground (return).
Marine versions available.

Features

- Compact design and small size,
- Dust-proof,
- CW or CCW rotation fans,
- Multi-function regulator with additional functions (14V),
- Pulleys and mounting brackets available according to customer's requirements
- High specific output power,
- Over-voltage protection,
- Higher protection against accidental contact,
- Lower noise level,
- Long life operation,
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=215^\circ\text{C}$ max,
- Mono-Function Regulator (14V, 28V):
 - Self-Excitation Supply (D+, diode trio),
 - Microelectronic,
- Multi-Function Regulator (14V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes and smaller diameter copper slip rings for higher brushes life,
- Two internal fans for CW or CCW rotation,
- Special roller type sealed bearings.

AAG compact



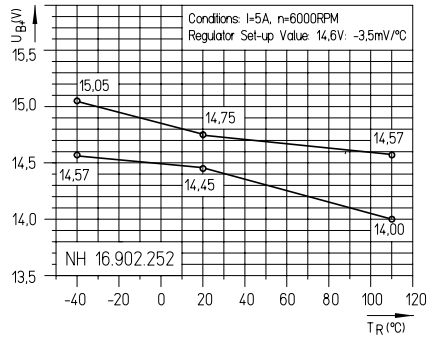
Main technical data

Type	AAG	
Rated Voltage (V)	14	28
Rated Current (A)	45 - 75	30 - 40
Stator Diameter (mm)	108	
Cooling	Air cooling / Two internal fans (CW or CCW)	
Weight ¹ (kg)	~3.5	
Max Permanent / Short time Rotational Speed (RPM)	13.000 / 15.000	
Voltage Regulator	Mono-Function (14V / 28V) / Multi-Function (14V)	
Power diodes Type	Press-fit Zener (35A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals Mono/ Multi-function regulator	(B+, D+, W, B-) / (B+, L, W, B-, DFM)	
Drive end bearing / Rear bearing dimension	17X40X12 / 12x28x12	
Protection of the Slip rings and Brushes Compartment	IP 54	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

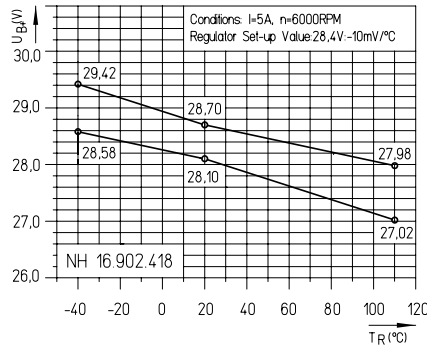
¹ without pulley

Regulator characteristics (Voltage settings - typical)

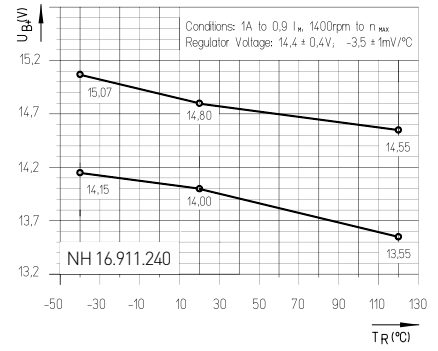
Mono-Function 14V



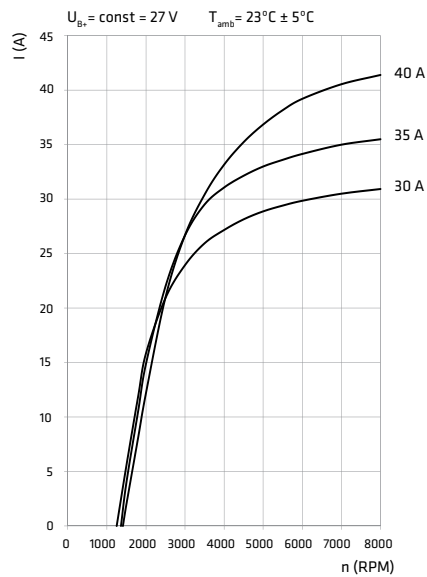
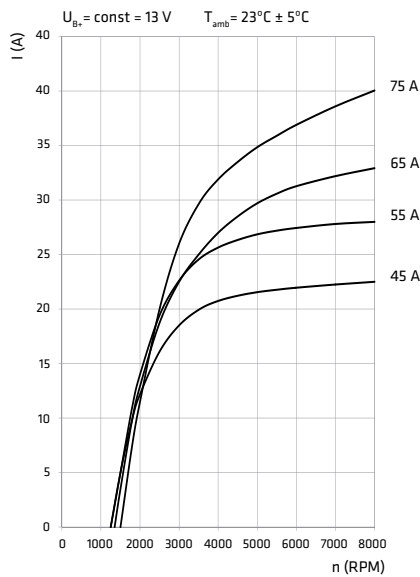
Mono-Function 28V



Multi-Function 14V



Performance curves



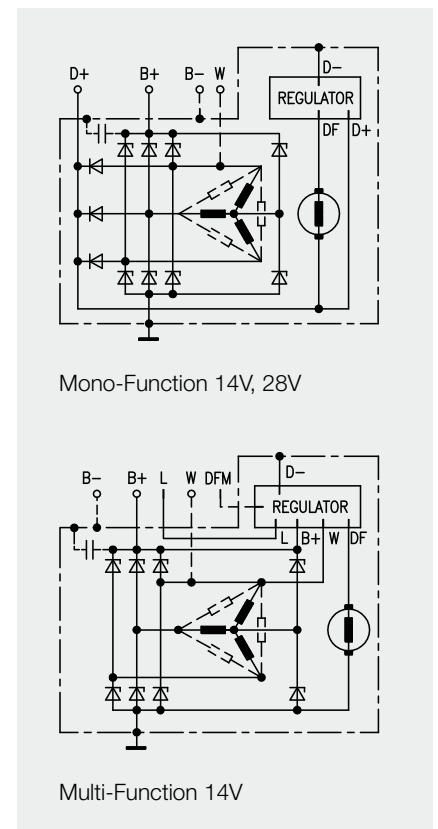
Test methods and conditions are based on standard ISO 8854.

Type	n _o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 45A	1250	20	44
14V 55A	1250	22	55
14V 65A	1350	20	64
14V 75A	1500	13	73

Type	n _o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 30A	1250	12	30
28V 35A	1400	10	34
28V 40A	1450	8	39

Note: Alternator thermal stabilized at 3000 RPM, I = I_{max} at UB = 13V (27V), Tamb = 23°C ± 5°C. Performance curves at higher ambient temperatures available.

Connection diagrams



AAK

Applications

- Agricultural and construction machinery (Mid-range),
- Gen-sets,
- Commercial vehicles,
- Older passenger cars,
- Special applications (air-cooled engines, alternators for heating devices).

Options

Insulated ground (return).
Marine versions available.

Features

- Heavy-duty design,
- Dust-proof,
- CW or CCW rotation fan,
- Multi-function regulator with additional functions (14V),
- Safety fan for hand contact protection available,
- Over-voltage protection,
- Long life operation,
- Better protection of alternator sub-assemblies in harsh environment,
- Additional protective covers available for mounting an additional tube for clean air intake,
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=215^\circ\text{C}$ max mounted on inner or outer side of rear bracket,
- Mono-Function Regulator (14V, 28V):
 - Self-Excitation Supply (D+, diode trio),
 - Thick-Film Hybrid,
- Multi-Function Regulator (14V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes and copper slip rings,
- External CW or CCW fan,
- Special roller type sealed bearings.

AAK



Main technical data

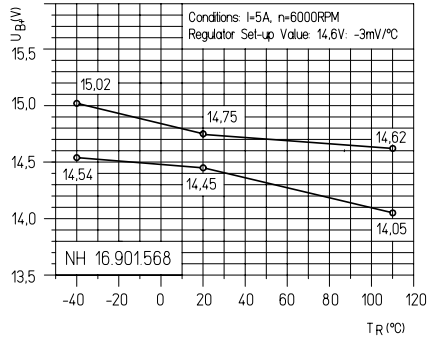
Type	AAK	
Rated Voltage (V)	14	28
Rated Current (A)	45 - 120	35 - 65
Stator Diameter (mm)	125	
Cooling	Air cooling / External fan (CW or CCW)	
Weight ¹ (kg)	4.5 – 5.1	
Max Permanent / Short time Rotational Speed (RPM)	13.000 / 15.000	
Voltage Regulator	Mono-Function (14V / 28V) / Multi-Function (14V)	
Power diodes Type	Press-fit Zener (35A, 50A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals Mono/ Multi-function regulator	(B+, D+, W, B-) / (B+, L, W, B-, DFM) ²	
Drive end bearing / Rear bearing dimension	17x47x14, 17x52x17 / 12x32x10	
Protection of the Slip rings and Brushes Compartment	IP 54	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

¹ without pulley

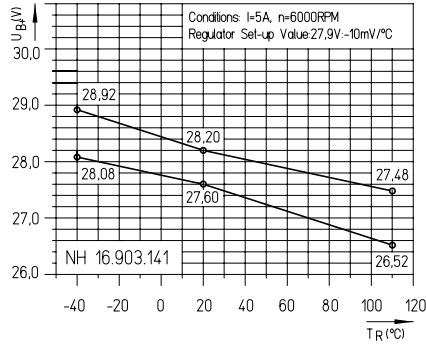
² available also older type Multi-function regulator B+, B-, L, EX (Thick-Film Hybrid technology)

Regulator characteristics (Voltage settings - typical)

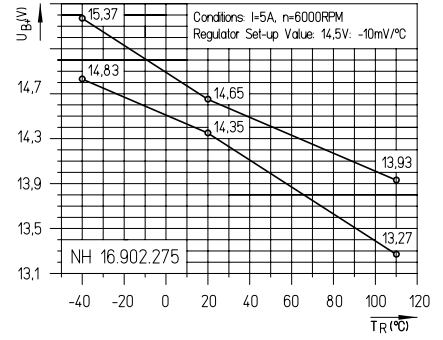
Mono-Function 14V



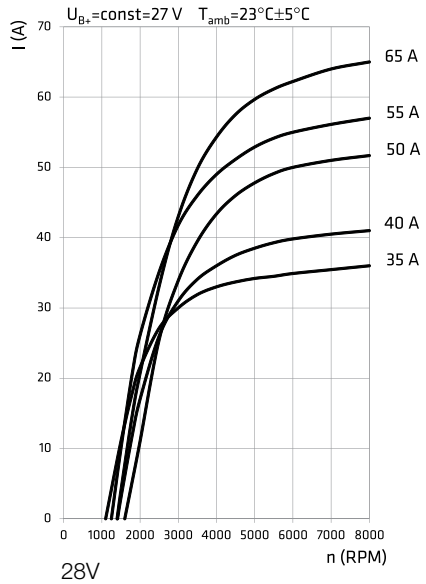
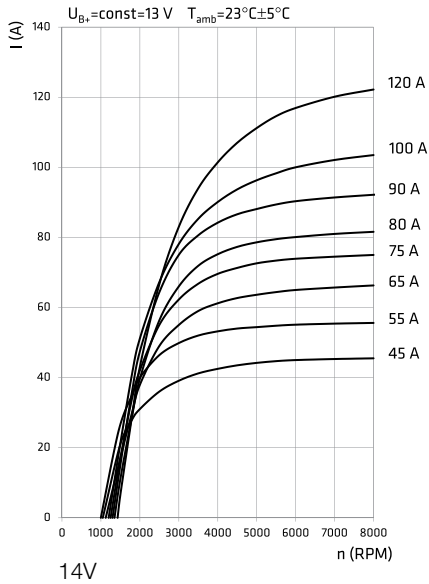
Mono-Function 28V



Multi-Function 14V



Performance curves



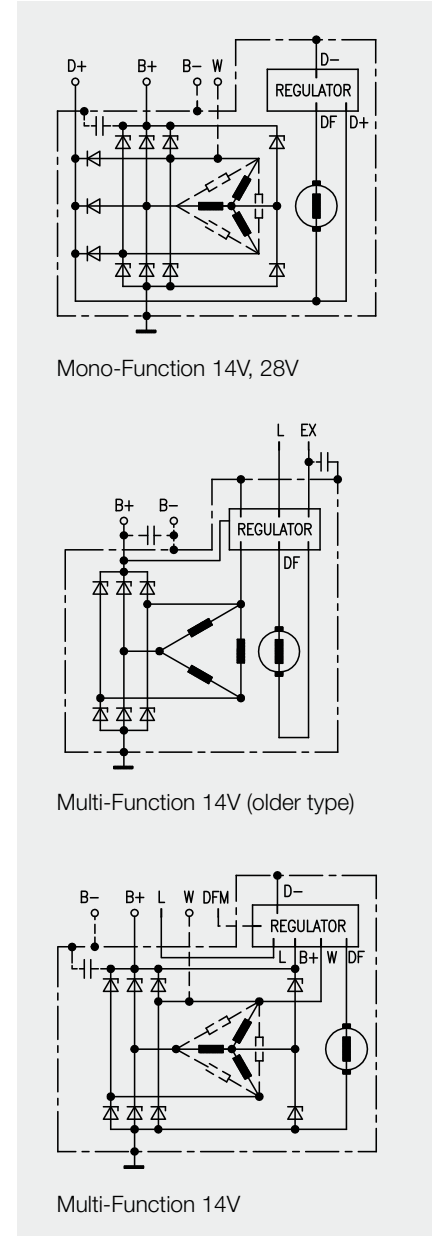
Test methods and conditions are based on standard ISO 8854.

Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 45A	1050	28	45
14V 55A	1000	35	55
14V 65A	1150	30	65
14V 75A	1250	34	74
14V 80A	1350	29	80
14V 90A	1300	36	90
14V 100A	1200	41	100
14V 120A	1400	29	117

Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 35A	1100	18	35
28V 40A	1450	12	40
28V 50A	1550	5	50
28V 55A	1250	21	55
28V 65A	1400	15	63

Note: Alternator thermal stabilized at 3000 RPM, I = I_{max} at UB+ = 13V (27V), Tamb = 23°C ± 5°C. Performance curves at higher ambient temperatures available.

Connection diagrams



AAK COMPACT

Applications

- Agricultural and construction machinery (Mid-range),
- Gen-sets,
- Commercial vehicles,
- Passengers cars,
- Special applications (completely sealed version available).

Options

Insulated ground (return).
Marine versions available.

Features

- Compact design,
- Dust-proof,
- CW or CCW rotation fans,
- Multi-function regulator with additional functions,
- Pulleys and mounting brackets available according to customer's requirements
- High specific output power,
- Over-voltage protection,
- Higher protection against accidental contact,
- Lower noise level,
- Long life operation,
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=215^\circ\text{C}$ max,
- Mono-Function Regulator (14V, 28V):
 - Self-Excitation Supply (D+, diode trio),
 - Microelectronic,
- Multi-Function Regulator (14V, 28V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes and smaller diameter copper slip rings for higher brushes life,
- Two internal fans for CW or CCW rotation,
- Special roller type sealed bearings.

AAK compact



Main technical data

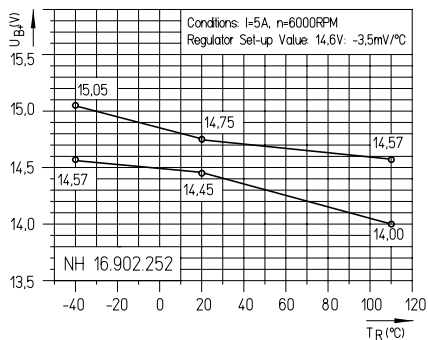
Type	AAK	
Rated Voltage (V)	14	28
Rated Current (A)	70 - 120	40 - 60
Stator Diameter (mm)	125	
Cooling	Air cooling / Two internal fans (CW or CCW)	
Weight ¹ (kg)	~ 5.3	
Max Permanent / Short time Rotational Speed (RPM)	13.000 / 15.000	
Voltage Regulator	Mono-Function (14V / 28V) / Multi-Function (14V/28V)	
Power diodes Type	Press-fit Zener (35A, 50A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals Mono/ Multi-function regulator	(B+, D+, W, B-) / (B+, L, W, B-, DFM), (B+, L, W, B-, DFM, 15, S) ³	
Drive end bearing / Rear bearing dimension	17X47X14, 17x52X17 / 17x35x10	
Protection of the Slip rings and Brushes Compartment	IP 54	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

¹ without pulley

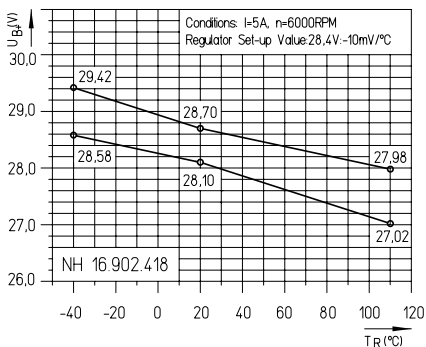
³ Multi-function 28V

Regulator characteristics (Voltage settings - typical)

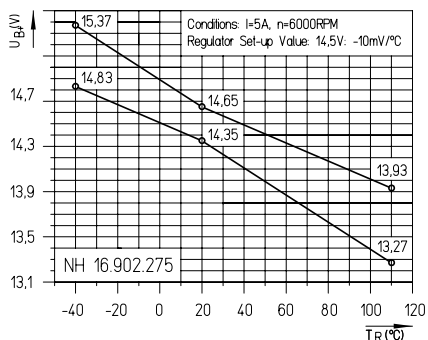
Mono-Function 14V



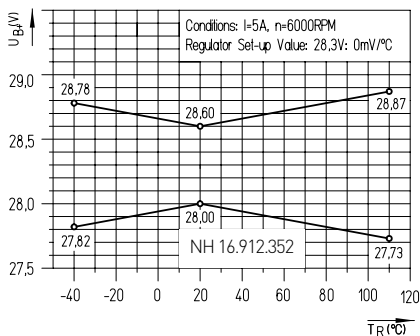
Mono-Function 28V



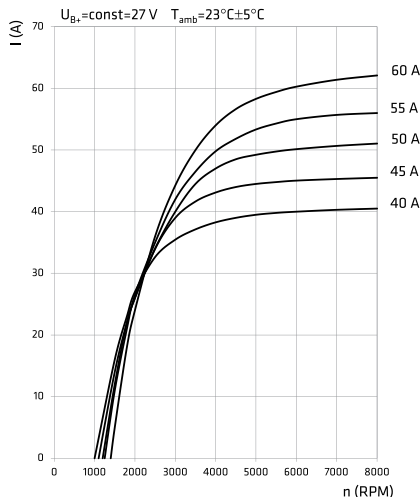
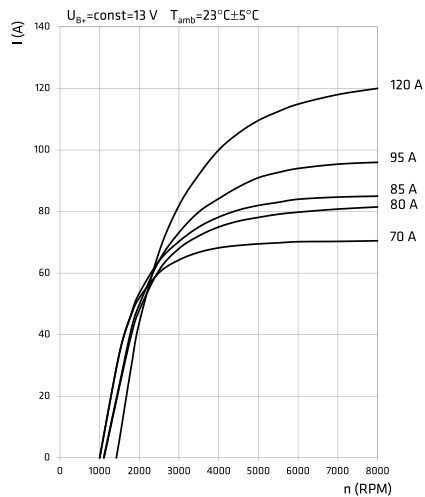
Multi-Function 14V



Multi-Function 28V



Performance curves



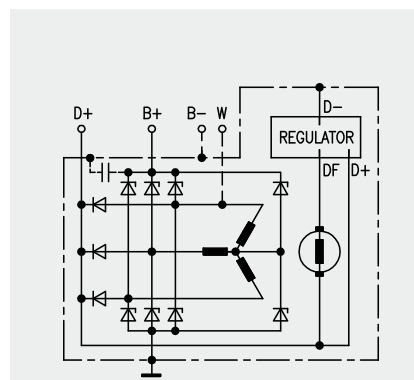
Test methods and conditions are based on standard ISO 8854.

Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 70A	1000	47	70
14V 80A	1100	40	80
14V 85A	1000	47	84
14V 95A	1100	42	94
14V 120A	1400	30	115

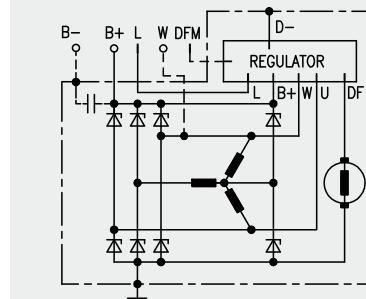
Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 40A	1000	23	40
28V 45A	1100	22	45
28V 50A	1200	22	50
28V 55A	1250	21	55
28V 60A	1400	18	60

Note: Alternator thermal stabilized at 3000 RPM, I = I_{max} at U_{B±} = 13V (27V), T_{amb} = 23°C ± 5°C. Performance curves at higher ambient temperatures available.

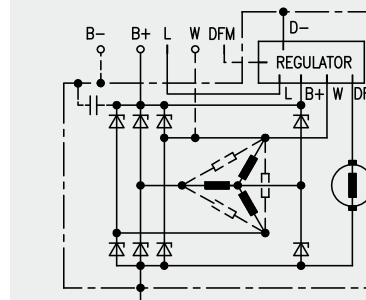
Connection diagrams



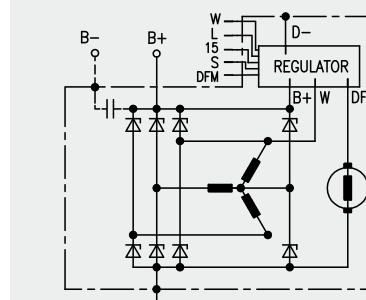
Mono-Function 14V, 28V



Multi-Function 14V (Type 1)



Multi-Function 14V (Type 2)



Multi-Function 28V

AAL COMPACT

Applications

- Agricultural and construction machinery (Mid-High range),
- Gen-sets,
- Commercial vehicles,
- Passengers cars,
- Special applications.

Features

- Compact design,
- Dust-proof,
- CW or CCW rotation fans,
- Multi-function regulator with additional functions,
- Pulleys and mounting brackets available according to customer's requirements
- High specific output power,
- Over-voltage protection,
- Higher protection against accidental contact,
- Lower noise level,
- Long life operation,
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=215^\circ\text{C}$ max,
- Multi-Function Regulator (14V, 28V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes and smaller diameter copper slip rings for higher brushes life,
- Two internal fans for CW or CCW rotation,
- Special roller type sealed bearings.

AAL compact



Main technical data

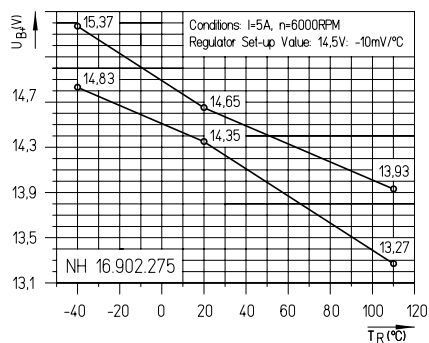
Type	AAL	
Rated Voltage (V)	14	28
Rated Current (A)	120 - 150	60 - 80
Stator Diameter (mm)	136	
Cooling	Air cooling / Two internal fans (CW or CCW)	
Weight ¹ (kg)	~ 6.7	
Max Permanent / Short time Rotational Speed (RPM)	13.000 / 15.000	
Voltage Regulator	Multi-Function (14V / 28V)	
Power diodes Type	Press-fit Zener (50A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals	(B+, L, W, B-, DFM), (B+, L, W, B-, DFM, 15, S) ³	
Drive end bearing / Rear bearing dimension	17x52X17 / 17x35x10	
Protection of the Slip rings and Brushes Compartment	IP 54	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

¹ without pulley

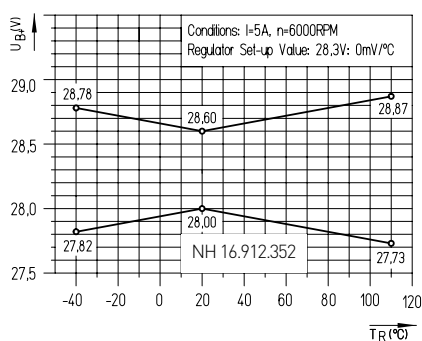
³ Multi-function 28V

Regulator characteristics (Voltage settings - typical)

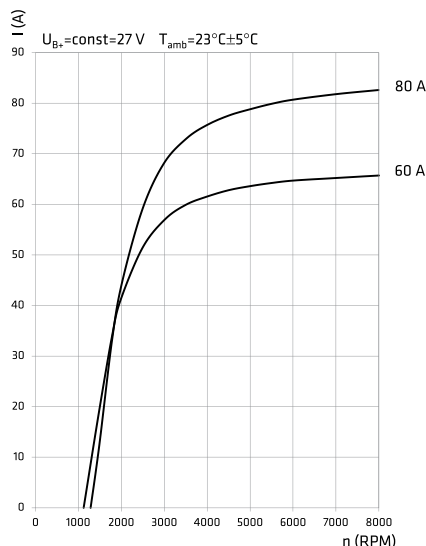
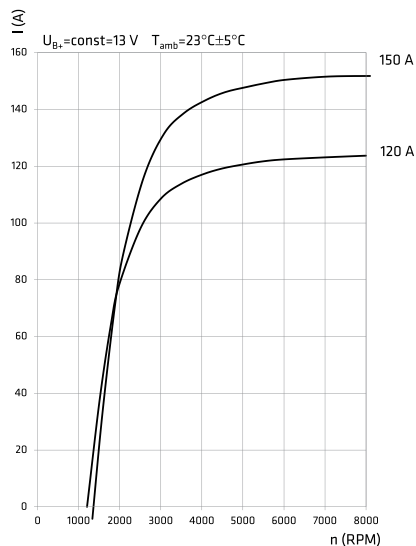
Multi-Function 14V



Multi-Function 28V



Performance curves



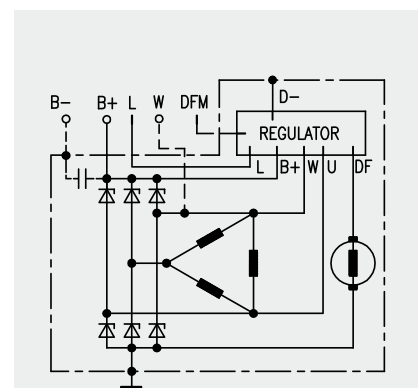
Test methods and conditions are based on standard ISO 8854.

Type	n_o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 120A	1250	70	120
14V 150A	1300	80	150

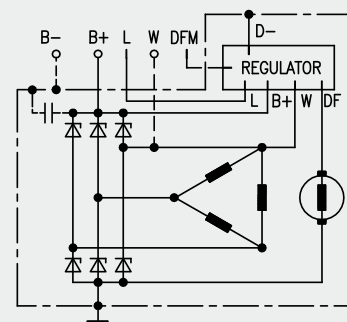
Type	n_o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 60A	1200	40	60
28V 80A	1300	35	80

Note: Alternator thermal stabilized at 3000 RPM, $I = I_{max}$ at $U_{B+} = 13V$ (27V), $T_{amb} = 23°C \pm 5°C$. Performance curves at higher ambient temperatures available.

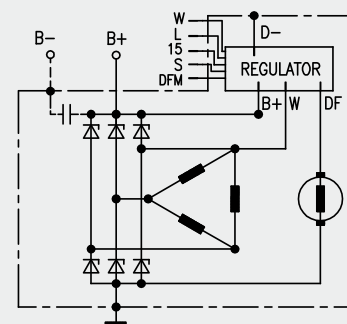
Connection diagrams



Multi-Function 14V (Type 1)



Multi-Function 14V (Type 2)



Multi-Function 28V

AAN

Applications

- Agricultural and construction machinery with higher electrical demand (Top-range):
 - High HP tractors,
 - Combines (Harvesters),
 - Wind-rovers, ...
- Commercial vehicles,
- Special applications.

Options

Insulated ground (return).
Marine versions available.

Features

- Heavy-duty design,
- Dust-proof,
- High specific output power,
- Multi-function regulator with additional functions (14V),
- Over-voltage protection,
- Long life bearings and brushes,
- Long life operation,
- Better protection of alternator sub-assemblies in harsh environment,
- Additional protection covers available for additional tube mounting for clean air intake,
- Max Efficiency > 65%
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=225^\circ\text{C}$ max mounted bellow rear bracket (2 diodes in parallel for high power 14V alternators),
- Mono-Function Regulator (28V):
 - Self-Excitation Supply (D+, diode trio),
 - Microelectronic,
- Multi-Function Regulator (14V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes of increased length and bronze (CuSn5) slip rings,
- External CW fan,
- Special roller type sealed bearings for high pulley loads.

AAN



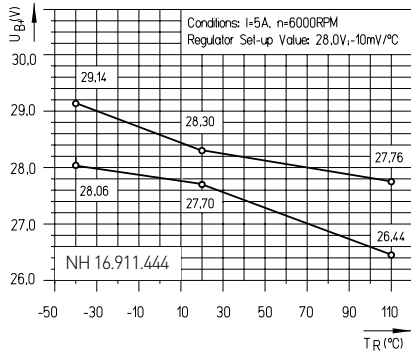
Main technical data

Type	AAN	
Rated Voltage (V)	14	28
Rated Current (A)	125 - 200	80 - 120
Stator Diameter (mm)	142	
Cooling	Air cooling / External fan CW	
Weight ¹ (kg)	~ 8.0	
Max Permanent / Short time Rotational Speed (RPM)	10.000 / 12.000	
Voltage Regulator	Mono-Function (28V) / Multi-Function (14V)	
Power diodes Type	Press-fit Zener (50A, 80A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals Mono/ Multi-function regulator	(B+, D+, W, B-) / (B+, L, W, B-, DFM)	
Drive end bearing / Rear bearing dimension	17x52x17, 17x62x20 / 17x32x14	
Protection of the Slip rings and Brushes Compartment	IP 54	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

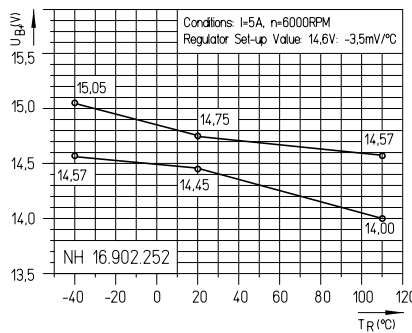
¹ without pulley

Regulator characteristics (Voltage settings - typical)

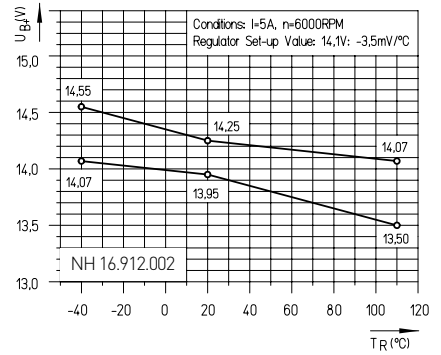
Mono-Function 28V



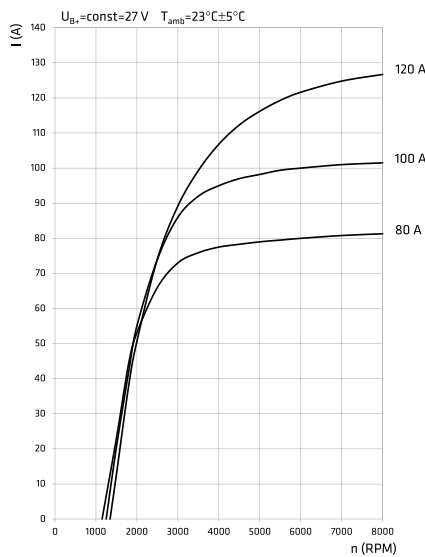
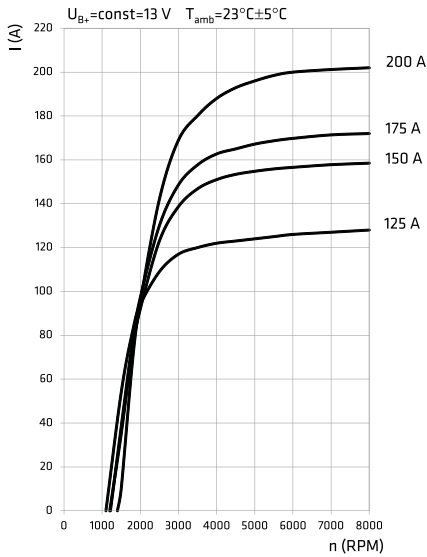
Multi-Function 14V



Multi-Function 14V ("One-wire")



Performance curves



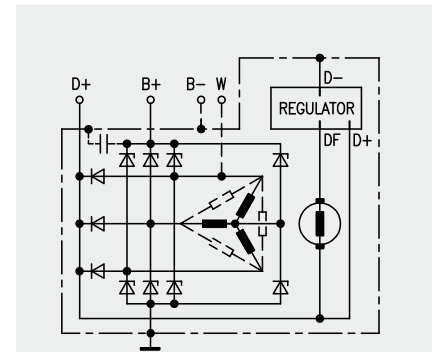
Test methods and conditions are based on standard ISO 8854.

Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 125A	1100	85	125
14V 150A	1200	75	155
14V 175A	1200	78	170
14V 200A	1400	70	200

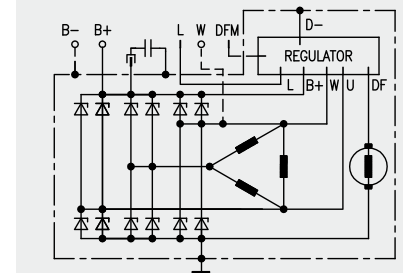
Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 80A	1150	44	80
28V 100A	1250	42	100
28V 120A	1350	38	120

Note: Alternator thermal stabilized at 3000 RPM, I = I_{max} at UB± = 13V (27V), Tamb = 23°C ± 5°C. Performance curves at higher ambient temperatures available.

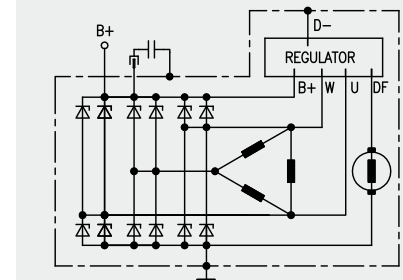
Connection diagrams



Mono-Function 28V



Multi-Function 14V



Multi-Function 14V ("One-wire")

AAN COMPACT

Applications

- Agricultural and construction machinery (Top-range),
- Heavy – duty applications,
- Passenger cars and commercial vehicles with higher electrical demand
- Special applications:
 - 48V alternators,
 - 110V~, 230V~ AC voltage alternators.

Options

Insulated ground (return).
Marine versions available.

Features

- Compact design,
- Dust-proof,
- Trash screens available,
- CW or CCW rotation fans,
- Multi-function regulator with additional functions (14V),
- Pulleys and mounting brackets available according to customer's requirements
- High specific output power,
- Over-voltage protection,
- Higher protection against accidental contact,
- Lower noise level,
- Long life operation,
- Max Efficiency > 65%
- EMC approved and certified.

Design

- 3-phase 6-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=225^\circ\text{C}$ max,
- Mono-Function Regulator (14V, 28V):
 - Self-Excitation Supply (D+, diode trio),
 - Microelectronic,
- Multi-Function Regulator (14V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes and smaller diameter copper slip rings for higher brushes life,
- Two internal fans for CW or CCW rotation,
- Special roller type sealed bearings for high pulley loads.

AAN COMPACT



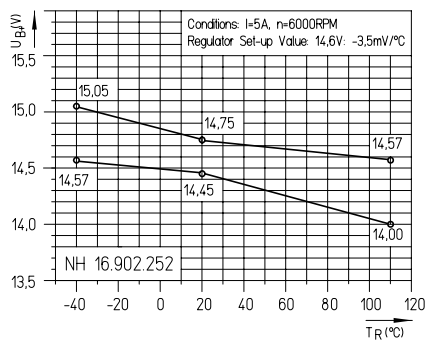
Main technical data

Type	AAN	
Rated Voltage (V)	14	28
Rated Current (A)	125 - 200	80 - 120
Stator Diameter (mm)	142	
Cooling	Air cooling / Two internal fans (CW or CCW)	
Weight ¹ (kg)	~ 7.3	
Max Permanent / Short time Rotational Speed (RPM)	13.000 / 15.000	
Voltage Regulator	Mono-Function (14V / 28V) / Multi-Function (14V)	
Power diodes Type	Press-fit Zener (65A, 80A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals Mono/ Multi-function regulator	(B+, D+, W, B-) / (B+, L, W, B-, DFM)	
Drive end bearing / Rear bearing dimension	17X52X17, 17x62X17 / 17x40x12	
Protection of the Slip rings and Brushes Compartment	IP 56	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

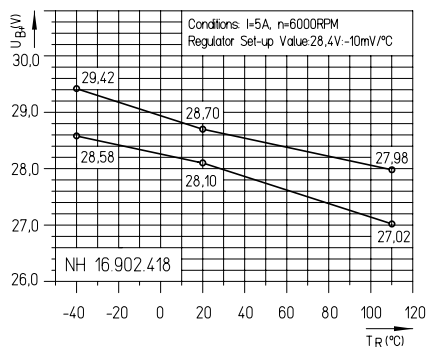
¹ without pulley

Regulator characteristics (Voltage settings - typical)

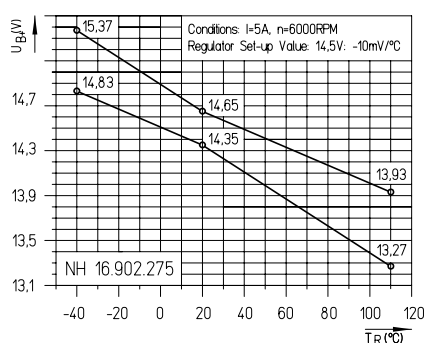
Mono-Function 14V



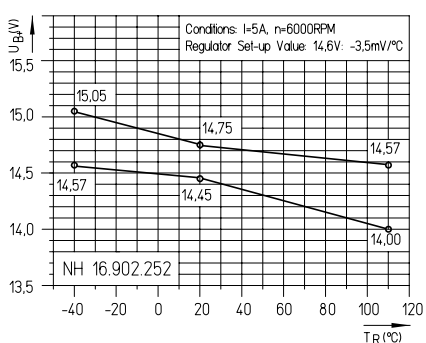
Mono-Function 28V



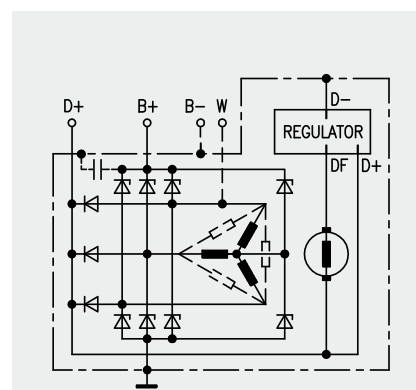
Multi-Function 14V



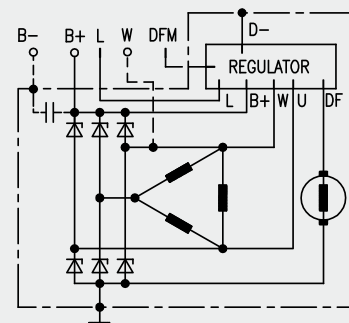
Multi-Function 14V ("One-wire")



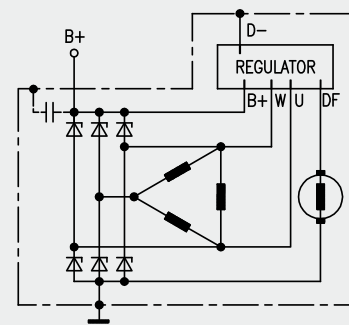
Connection diagrams



Mono-Function 14V, 28V

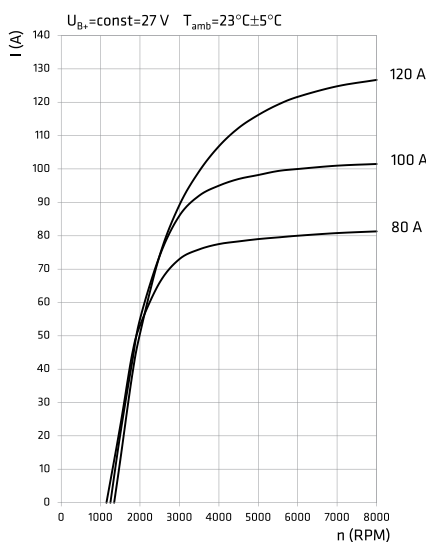
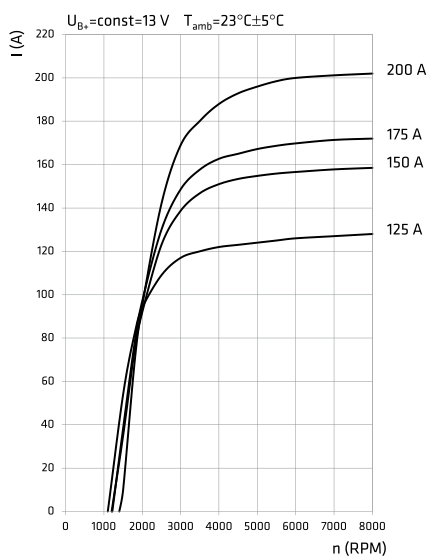


Multi-Function 14V



Multi-Function 14V ("One-wire")

Performance curves



Test methods and conditions are based on standard ISO 8854.

Type	n _o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 125A	1100	85	125
14V 150A	1200	75	155
14V 175A	1200	78	170
14V 200A	1400	70	200

Type	n _o (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 80A	1150	44	80
28V 100A	1250	42	100
28V 120A	1350	38	120

Note: Alternator thermal stabilized at 3000 RPM, I = Imax at UB+ = 13V (27V), Tamb = 23°C ± 5°C. Performance curves at higher ambient temperatures available.

AAT

Applications

AAT alternators were developed for heavy-duty and special applications with high electric load requirements, specially at idle speeds:

- Commercial vehicles as buses, trucks, ...,
- Buses where required additional power supply for A/C,
- Top class agricultural and construction machinery (combines, ...),
- Other heavy-duty and special applications, where required high output power.

Options

Insulated ground (return).

Marine versions available.

Features

- Heavy-duty design,
- Dust-proof,
- High specific output power and high output at idle,
- Over-voltage protection,
- Long life bearings and brushes,
- Long life operation,
- Better protection of alternator sub-assemblies in harsh environment,
- Trash screens available,
- Additional protection covers available for additional tube mounting for clean air intake,
- Max efficiency >70%,
- EMC approved and certified.

Design

- 3-phase 8-pole pairs synchronous generator with integrated rectifier and voltage regulator,
- Double insulated (G2) copper wire of temperature class over 200°C for stator and rotor windings,
- Bolt connections stator taps-rectifier ensure high reliability of connection,
- Rectifier with power press-fit type Zener diodes with operating temperature $T_j=225^\circ\text{C}$ max mounted bellow rear bracket (2 diodes in parallel per phase as standard),
- Mono-Function Regulator (14V, 28V):
 - Self-Excitation Supply (D+, diode trio),
 - Thick-Film Hybrid, Microelectronic,
- Multi-Function Regulator (14V):
 - Direct Excitation Supply (B+),
 - Microelectronic,
- Metal-graphite brushes of increased length and special bronze (CuSn5) slip rings,
- Big shaft diameter 22,2 or 30 mm,
- External Bi-directional fan or lower noise CW fan,
- Special roller type sealed bearings for high pulley loads and needle rear bearing.

AAT



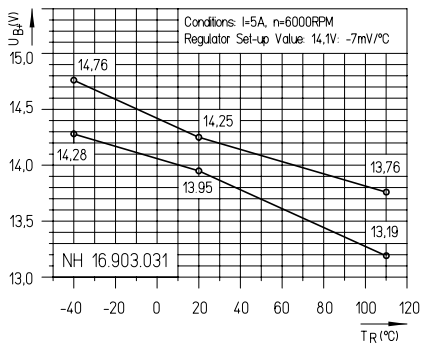
Main technical data

Type	AAT	
Rated Voltage (V)	14	28
Rated Current (A)	220 - 270	120 - 200
Stator Diameter (mm)	165,5	
Cooling	Air cooling / External fan Bi-directional or CW	
Weight ¹ (kg)	13 - 15	
Max Permanent / Short time Rotational Speed (RPM)	7.000 / 8.000	
Voltage Regulator	Mono-function (14V, 28V), Battery-less (28V), Multi-function (14V)	
Power diodes Type	Press-fit Zener (50A, 80A (14V) / 50A (28V))	
Over-voltage Protection	YES	
Zener Voltage (V)	19-25 (14V) / 34-40 (28V)	
Electrical terminals Mono/ Multi-function regulator	(B+, D+, W, B-) / (B+, L, W, B-, DFM)	
Drive end bearing / Rear bearing dimension	30x72x19, 30x72x27 / 20x28x13	
Protection of the Slip rings and Brushes Compartment	IP 56	
Operating (Storage) Temperatures	- 40°C to + 110°C (+ 130°C)	
EMC	Approved (Regulative ECE-R10 Rev.3: 2008-08)	

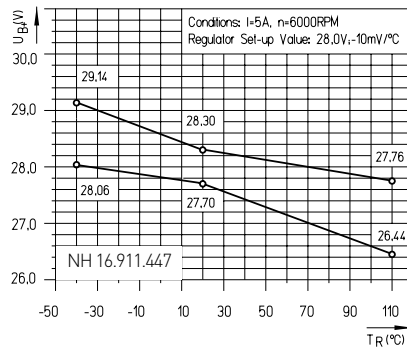
¹ without pulley

Regulator characteristics (Voltage settings - typical)

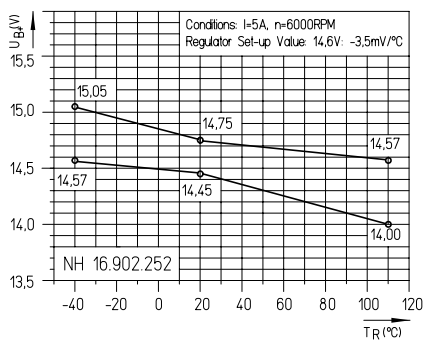
Mono-Function 14V



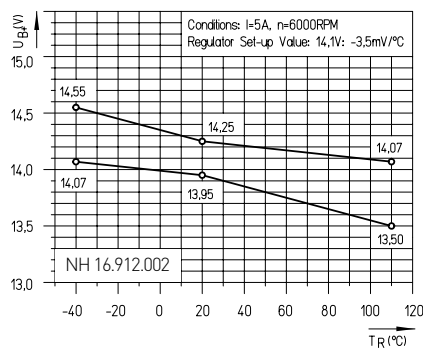
Mono-Function 28V



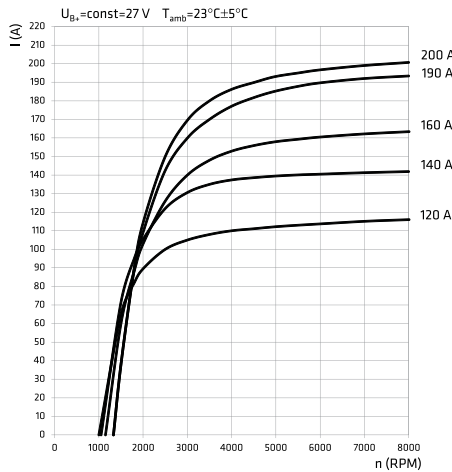
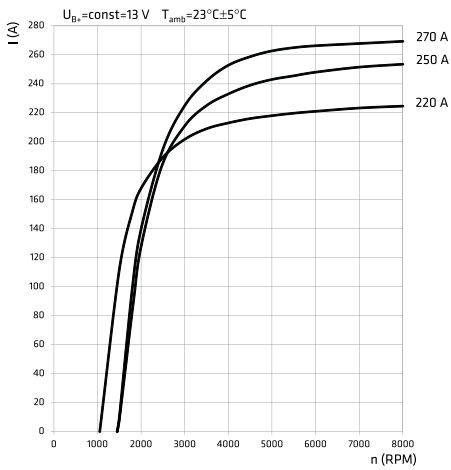
Multi-Function 14V



Multi-Function 14V ("One-wire")



Performance curves



Test methods and conditions are based on standard ISO 8854.

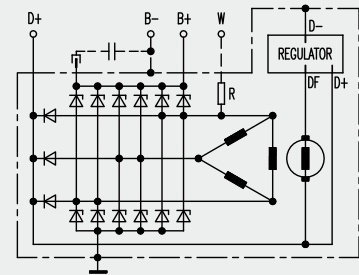
Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
14V 220A	1050	150	220
14V 250A	1450	90	248
14V 270A	1450	100	266

Type	n ₀ (RPM)	I (A) at 1800 RPM	I (A) at 6000 RPM
28V 120A	1000	82	115
28V 140A	1050	95	140
28V 160A	1150	88	160
28V 190A	1350	90	190
28V 200A*	1350	90	197

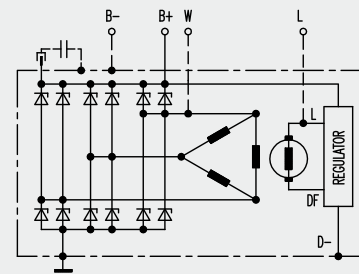
*Note: Bigger fan and brackets with cooling ribs

Note: Alternator thermal stabilized at 3000 RPM, I = I_{max} at U_B = 13V (27V), T_{amb} = 23°C ± 5°C. Performance curves at higher ambient temperatures available.

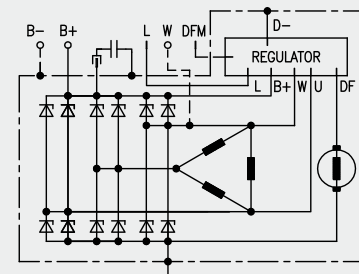
Connection diagrams



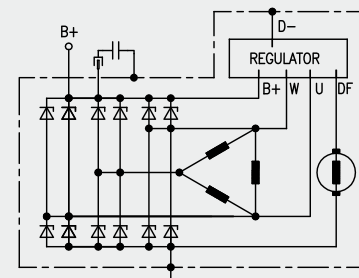
Mono-Function 14V, 28V



Battery-less operation



Multi-Function 14V



Multi-Function 14V ("One-wire")

PRODUCT REQUIREMENTS FORM

1 . Customer data

Company: _____
 Address: _____ Country: _____
 Responsible person: _____ Phone / Mobile: _____
 Fax: _____ E-mail: _____

2 . Engine data

Project Name: _____ Project No.: _____

Enquiry New project Modification

Brief description: _____

Planned quantity by year: Starting year _____ 1st _____ 2nd _____ 3rd _____ 4th _____

Application:

Automotive Commercial vehicles (trucks, buses, ...) Agriculture Construction Railway Marine

Other: _____

Engine data

Petrol No. of cylinders: _____ No. of valves: _____
 Diesel Displacement Ltr.: _____ Min. speed (idle): _____ RPM
 Rated output: _____ kW Nominal operating speeds: _____ RPM
 2/4 Stroke: _____ Max speed: _____ RPM
 Compression: _____

Alternator (actual used)

Supplier: _____ Type: _____ Rated voltage/current: _____ V _____ A

Drawing: YES NO _____

Other: _____

3 . Alternator design requirements**Electrical requirements**

Rated voltage: _____ V Rated Current: _____ A (1800 RPM) _____ A (6000 RPM)

Alternator performance curves (attached): YES NO

Rated electrical power: _____ kW Isolated ground (return) YES NO

Electrical terminals (types, dimension)

B+: _____ D+: _____ L: _____

W: _____ B-: _____ S: _____

15: _____ DFM: _____

Connector: YES NO Type _____

Other: _____

Regulator (set-up) voltage $U_{B+} =$ _____ V $T_k =$ _____ mV/°C Regulator characteristic (attached): YES NO

Regulator type: Mono-function Multi-function Multi-function - bus (BSS, LIN, ...)

Vehicle electrical system requirements: _____

Battery type: _____ Battery rated data: _____

Special electrical requirements: _____

Mechanical and fitting requirements

Direction of alternator rotation: clockwise counterclockwise both directions

Transmission ratio between engine / alternator: 1: _____

Type of driving belt/ pulley:

- One-groove, Belt width: _____ mm Angle: _____
- Two-groove, Belt width: _____ mm Dimension between grooves: _____ Angle: _____
- Poly V belt, No. of grooves: _____ Dimension between grooves: _____ Angle: _____
- Diameter of the pulley: _____ mm Belt line dimension (Pulley overhang): _____

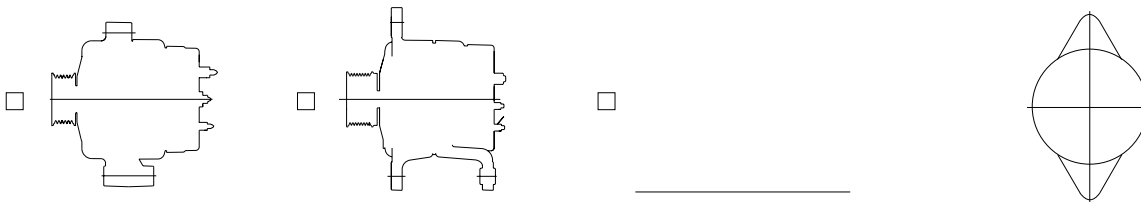
Overrunning pulley: YES NO Data: _____

Other: _____

Type of installation:

Side view:

Back side view: Please draw direction, position of cables and terminals



Max alternator brackets diameter: _____ mm Max alternator length: _____ mm Max alternator weight _____ kg

Mounting requirements: To specify on sketch above or enclose drawing or 3D model

Other design requirements: _____

Environmental requirements

Grade of protection according IP (DIN 40050): IP _____

- Environmental conditions:
- Salt spray High temperature Low temperature Humidity
 - Dust, mud Trash Water Other _____

Special requirements

Customer test specification: YES NO Part No.: _____

Safety standards: _____

Other standards: _____

Date: _____ Signature: _____

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