

STAMFORD

N200 N300 Alternators

Owner Manual

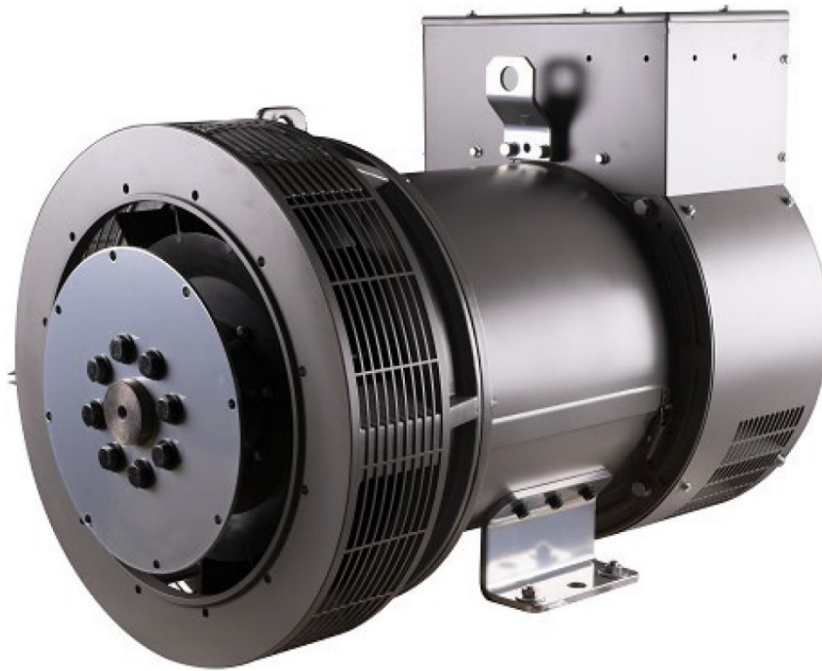


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1 Foreword

1.1 The Manual

This manual contains guidance and instructions for the installation and operation of the alternator. This manual does not include instructions for servicing and maintaining the alternator. Contact Cummins Generator Technologies (CGT) Customer Service for details.

Before operating the alternator, read this manual and make sure that all personnel who work on the equipment have access to the manual and all additional documentation supplied with it. Misuse and failure to follow the instructions, and the use of non-approved parts, may invalidate the product warranty and lead to potential accidents.

This manual is an essential part of the alternator. Make sure that the manual is available to all users throughout the life of the alternator.

The manual is written for skilled electrical and mechanical technicians and engineers, who have prior knowledge and experience of generating equipment of this type. If in doubt, please seek expert advice or contact your local CGT subsidiary.

NOTICE

Information in this manual was correct when published. It may be superseded due to our policy of continuous improvement. Please visit www.stamford-avk.com for latest documentation.


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2 Safety Precautions

2.1 Safety Information and Notices used in this Manual

Danger, Warning and Caution panels are used in this manual to describe the sources of hazards, their consequences and how to avoid injury. Notice panels emphasize important or critical instructions.

 DANGER
<i>Danger indicates a hazardous situation which, if not avoided, WILL result in death or serious injury.</i>

 WARNING
<i>Warning indicates a hazardous situation which, if not avoided, COULD result in death or serious injury.</i>

 CAUTION
<i>Caution indicates a hazardous situation which, if not avoided, COULD result in minor or moderate injury.</i>

NOTICE
Notice refers to a method or practice which can result in product damage, or to draw attention to additional information or explanations.

2.2 General Guidance

NOTICE
These safety precautions are for general guidance and supplement your own safety procedures and all applicable laws and standards.

2.3 Skill Requirements of Personnel

Service and maintenance procedures must only be carried out by experienced and qualified personnel, who are familiar with the procedures and the equipment.

2.4 Risk Assessment

A risk assessment has been performed on this product by CGT, however a separate risk assessment must be performed by the user/operating company to establish all personnel-related risks. All affected users must be trained on the identified risks. Access to the Power Plant/Generator Set during operation must be restricted to persons who have been trained on these risks.

2.5 Personal Protective Equipment (PPE)

All persons operating, servicing, maintaining or working in or with a power plant or a generator set must wear appropriate Personal Protective Equipment (PPE)

Recommended PPE includes:

- Ear and Eye Protection
- Head and face protection
- Safety footwear
- Overalls that protect the lower arms and legs

Ensure that all persons are fully aware of the emergency procedures in case of accidents.

2.6 Noise

WARNING

Noise

Noise from a running alternator can cause serious injury by permanent hearing damage. To prevent injury, wear appropriate personal protection equipment (PPE).

Maximum A-weighted noise emissions may reach 97 dB(A). Contact the supplier for application-specific details.

2.7 Electrical Equipment

DANGER

Live Electrical Conductors

Live electrical conductors can cause serious injury or death by electric shock and burns. To prevent injury and before removing covers over electrical conductors, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

All electrical equipment can be dangerous if not operated correctly. Always install, service and maintain the alternator in accordance with this manual. Work that requires access to electrical conductors must comply with all applicable local and national electrical safety procedures for the voltages involved and any site specific rules. Always use genuine branded replacement parts.

2.8 Lock Out/Tag Out

WARNING

Reconnected Energy Source

Accidental reconnection of energy sources during service and maintenance work can cause serious injury or death by electric shock, burns, crushing, severing or trapping. To prevent injury and before starting service and maintenance work, use appropriate lock out/tag out safety procedures to keep the generator set isolated from energy sources. Do not defeat or bypass the lock out/tag out safety procedures.

2.9 Lifting

DANGER

Falling Mechanical Parts

Falling mechanical parts can cause serious injury or death by impact, crushing, severing or trapping.

To prevent injury and before lifting:

- ***Check the capacity, condition and attachment of lifting equipment (crane, hoists and jacks, including attachments to anchor, fix or support the equipment).***
- ***Check the capacity, condition and attachment of accessories for lifting (hooks, slings, shackles and eye bolts for attaching loads to lifting equipment).***
- ***Check the capacity, condition and attachment of lifting fixtures on the load.***
- ***Check the mass, integrity and stability (e.g. unbalanced or shifting center of gravity) of the load.***

WARNING

Falling Mechanical Parts

Falling mechanical parts can cause serious injury or death by impact, crushing, severing or trapping.

To prevent injury and before lifting the alternator:

- ***Do not lift the complete generator set by the alternator lifting fixtures.***
- ***Keep the alternator horizontal when lifting.***
- ***Fit drive end and non-drive end transit fittings to single bearing alternators to keep the main rotor in the frame.***

Do not remove the lifting label attached to one of the lifting points.

2.10 Alternator Operating Areas

WARNING

Ejected Debris

Debris ejected during catastrophic failure can cause serious injury or death by impact, severing or stabbing.

To prevent injury:

- ***Keep away from the air inlet and air outlet when the alternator is running.***
- ***Do not put operator controls near the air inlet and air outlet.***
- ***Do not cause overheating by running the alternator outside rating plate parameters.***
- ***Do not overload the alternator.***
- ***Do not run an alternator with excessive vibration.***
- ***Do not synchronize parallel alternators outside the specified parameters.***

Always wear suitable PPE when working in the hatched areas shown in the diagram or directly in-line with any air inlet/outlet.

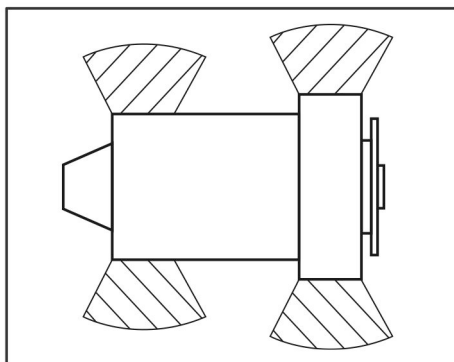


FIGURE 1. HATCHED AREAS

Make sure this consideration is captured in your risk assessment.

2.11 Hazard Warning Labels

⚠ WARNING
<p>Safety Cover Removed <i>A hazard exposed when a safety cover is removed can cause serious injury or death.</i> To prevent injury:</p> <ul style="list-style-type: none"> • <i>Fit the safety labels at the locations shown on the back of the label sheet supplied.</i> • <i>Observe the safety labels.</i> • <i>Refer to the service manual before removing covers.</i>

The generator set manufacturer is responsible for fitting the self-adhesive hazard warning labels supplied with the alternator.

Replace labels that are missing, damaged or painted over.



FIGURE 2. HAZARD WARNING LABELS


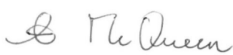
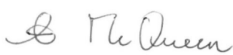
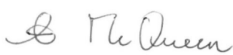
3 Safety Directives and Standards

STAMFORD® Alternators meet applicable European safety directives, and national and international standards relevant to alternators. The alternator must be operated within the limits specified in the relevant standards and within the parameters on the alternator rating plate.

Marine alternators meet the requirements of all the major marine classification societies.

This manual includes declaration template examples. Alternators are supplied with a declaration certificate that displays the product description and unique serial number.

3.1 Low Voltage Directive: Declaration of Conformity

EU DECLARATION OF CONFORMITY																										
<p>This synchronous A.C. generator is designed for incorporation into an electricity generating-set and fulfils all the relevant provisions of the following EU Directive(s) when installed in accordance with the installation instructions contained in the product documentation:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">2014/35/EU</td> <td>Low Voltage Directive</td> </tr> <tr> <td>2014/30/EU</td> <td>The Electromagnetic Compatibility (EMC) Directive</td> </tr> <tr> <td>2011/65/EU</td> <td>Restriction on Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive</td> </tr> <tr> <td>2015/863</td> <td>Delegated Directive amending Annex II of 2011/65/EU</td> </tr> </table> <p>and that the standards and/or technical specifications referenced below have been applied:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">EN 61000-6-2:2005</td> <td>Electromagnetic compatibility (EMC). Generic standards – Part 6-2: Immunity for industrial environments</td> </tr> <tr> <td>EN 61000-6-4:2007+A1:2011</td> <td>Electromagnetic compatibility (EMC). Generic standards – Part 6-4: Emission standard for industrial environments</td> </tr> <tr> <td>EN ISO 12100:2010</td> <td>Safety of machinery – General principles for design – Risk assessment and risk reduction</td> </tr> <tr> <td>EN 60034-1:2010</td> <td>Rotating electrical machines - Part 1: Rating and performance</td> </tr> <tr> <td>BS ISO 8528-3:2005</td> <td>Reciprocating internal combustion engine driven alternating current generating sets - Part 3: Alternating current generators for generating sets</td> </tr> <tr> <td>BS 5000-3:2006</td> <td>Rotating electrical machines of particular types or for particular applications - Part 3: Generators to be driven by reciprocating internal combustion engines - Requirements for resistance to vibration</td> </tr> <tr> <td>EN 50581:2012</td> <td>Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances</td> </tr> </table> <p>This declaration has been issued under the sole responsibility of the manufacturer. The object of this Declaration is in conformity with the relevant Union harmonization Legislation.</p> <p>The name and address of authorised representative, authorised to compile the relevant technical documentation, is the Company Secretary, Cummins Generator Technologies Romania, B-dul Decebal Nr. 116A 200746 Craiova Dolj, Romania.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Signed:  Date: 14th February 2020 </td> <td style="width: 50%; padding: 5px;"> Name, Title and Address: Alastair McQueen Global Technical Director Cummins Generator Technologies Romania B-dul Decebal Nr. 116A 200746, Craiova Dolj, ROMANIA </td> </tr> </table>			2014/35/EU	Low Voltage Directive	2014/30/EU	The Electromagnetic Compatibility (EMC) Directive	2011/65/EU	Restriction on Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive	2015/863	Delegated Directive amending Annex II of 2011/65/EU	EN 61000-6-2:2005	Electromagnetic compatibility (EMC). Generic standards – Part 6-2: Immunity for industrial environments	EN 61000-6-4:2007+A1:2011	Electromagnetic compatibility (EMC). Generic standards – Part 6-4: Emission standard for industrial environments	EN ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction	EN 60034-1:2010	Rotating electrical machines - Part 1: Rating and performance	BS ISO 8528-3:2005	Reciprocating internal combustion engine driven alternating current generating sets - Part 3: Alternating current generators for generating sets	BS 5000-3:2006	Rotating electrical machines of particular types or for particular applications - Part 3: Generators to be driven by reciprocating internal combustion engines - Requirements for resistance to vibration	EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	Signed:  Date: 14 th February 2020	Name, Title and Address: Alastair McQueen Global Technical Director Cummins Generator Technologies Romania B-dul Decebal Nr. 116A 200746, Craiova Dolj, ROMANIA
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Description	Serial Number																									
Registered in England under Registration No. 441273. Cummins Generator Technologies Ltd. Registered Office: Fountain Court, Lynch Wood, Peterborough, PE2 6FZ UK																										

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FIGURE 3. DECLARATION OF CONFORMITY - SHEET 1

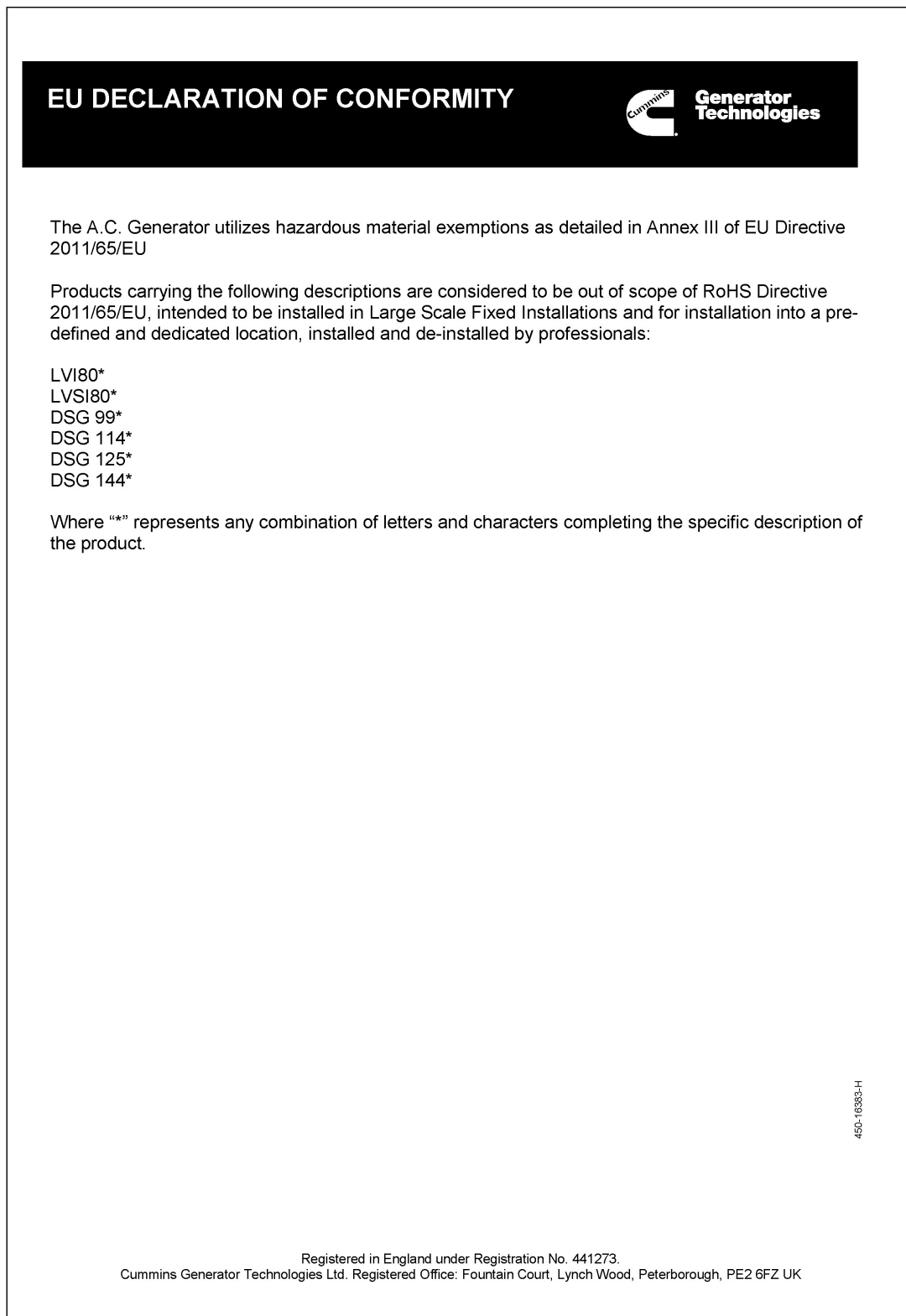


FIGURE 4. DECLARATION OF CONFORMITY - SHEET 2

3.2 Additional Information for EMC Compliance

STAMFORD® alternators are designed to meet EMC emissions and immunity standards for industrial environments. Additional equipment may be required when the alternator is installed in residential, commercial and light industrial environments.

The installation 'earth/ground' arrangements require the connection of the alternator frame to the site protective earth conductor using a minimum lead length.

Installation, maintenance and servicing must be carried out by adequately trained personnel fully aware of the requirements of the relevant EC directives.

NOTICE

CGT is not liable for EMC compliance if unauthorized parts, not of STAMFORD® brand, are used for maintenance and servicing.

4 Introduction

4.1 General Description

The STAMFORD® N200 and N300 range of alternators is of brushless rotating field design, available from 380 V up to 480 V, 50 Hz (1500 RPM) or 60 Hz (1800 RPM) and built to meet international standards IEC60034.

The STAMFORD® N200 & N300 range are self-excited as standard with excitation power derived from the main output windings, using a digital AVR.

4.2 Alternator Name

TABLE 1. N200, N300 ALTERNATOR NAMING FORMAT

N	125	G	4
Series N	kVA 125, 200, 250, 300.....	Product Type G = Generator	Poles 4 = 4 poles

4.3 Serial Number Location

A unique serial number is stamped into the drive end ring of the frame. Also, it can be found on the nameplate.

4.4 Rating Plate

The fixed rating plate label states the intended operating parameters of the alternator.

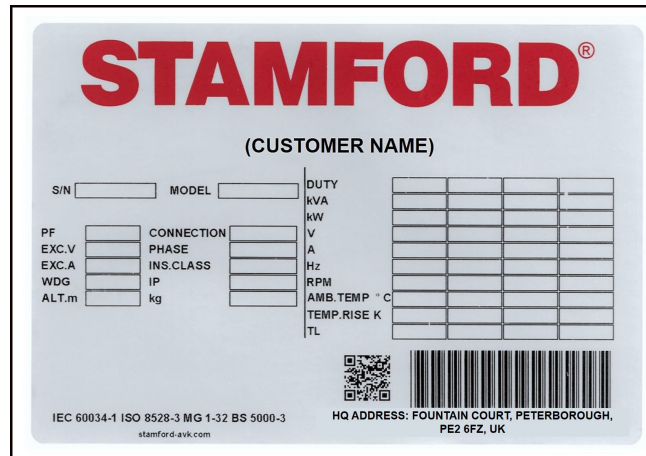


FIGURE 5. GLOBAL STAMFORD AC ALTERNATOR RATING PLATE

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5 Application of the Alternator

It is the customer's responsibility to make sure that the selected alternator is suitable for the final application.

5.1 Environment

The alternators are protected to IP23 as standard. IP23 is not adequate protection for use outdoors without additional measures.

TABLE 2. ENVIRONMENTAL SPECIFICATION

Ambient Temperature	-15 °C to 40 °C (5 °F to 104 °F)
Relative Humidity	< 70%
Altitude	< 1000 m (3280 ft)

The alternator has been designed for the environment shown in the table. The alternator can operate outside these conditions if it is rated accordingly; the nameplate gives details. If the operating environment is changed after purchase, refer to the factory for a revised alternator rating.

5.2 Air Flow

Make sure that the air inlets and outlets are not obstructed when the alternator is running.

5.3 Airborne Contaminants

Contaminants such as salt, oil, exhaust fumes, chemicals, dust and sand will reduce the effectiveness of the insulation and the life of the windings. Consider using an enclosure to protect the alternator.

5.4 Humid Conditions

The water carrying capacity of air depends on temperature. If the air temperature falls below its saturation point, dew may form on the windings, reducing the electrical resistance of the insulation. In humid conditions, additional protection may be required even if the alternator is fitted inside an enclosure.

5.5 Anti-Condensation Heaters (If Fitted)

⚠ DANGER

Live Electrical Conductors

Live electrical conductors can cause serious injury or death by electric shock and burns.

To prevent injury and before removing covers over electrical conductors, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

Power to the anti-condensation heater is supplied from a separate source. Anti-condensation heaters raise the air temperature around the windings to deter condensation forming in humid conditions when the alternator is not operating. Best practice is to energize the heaters automatically when the alternator is off.

5.6 Enclosures

Fit an enclosure to protect the alternator from adverse environmental conditions. Make sure that air entering the alternator is of adequate flowrate, free from moisture and contaminants, and below the maximum ambient temperature on the rating plate.

Make sure there is sufficient access around the alternator for safe maintenance.

6 Installation into the Generator Set

6.1 Alternator Dimensions - N200

Refer to the rating plate to identify the alternator model.

NOTICE

Data sheets are available from www.stamford-avk.com

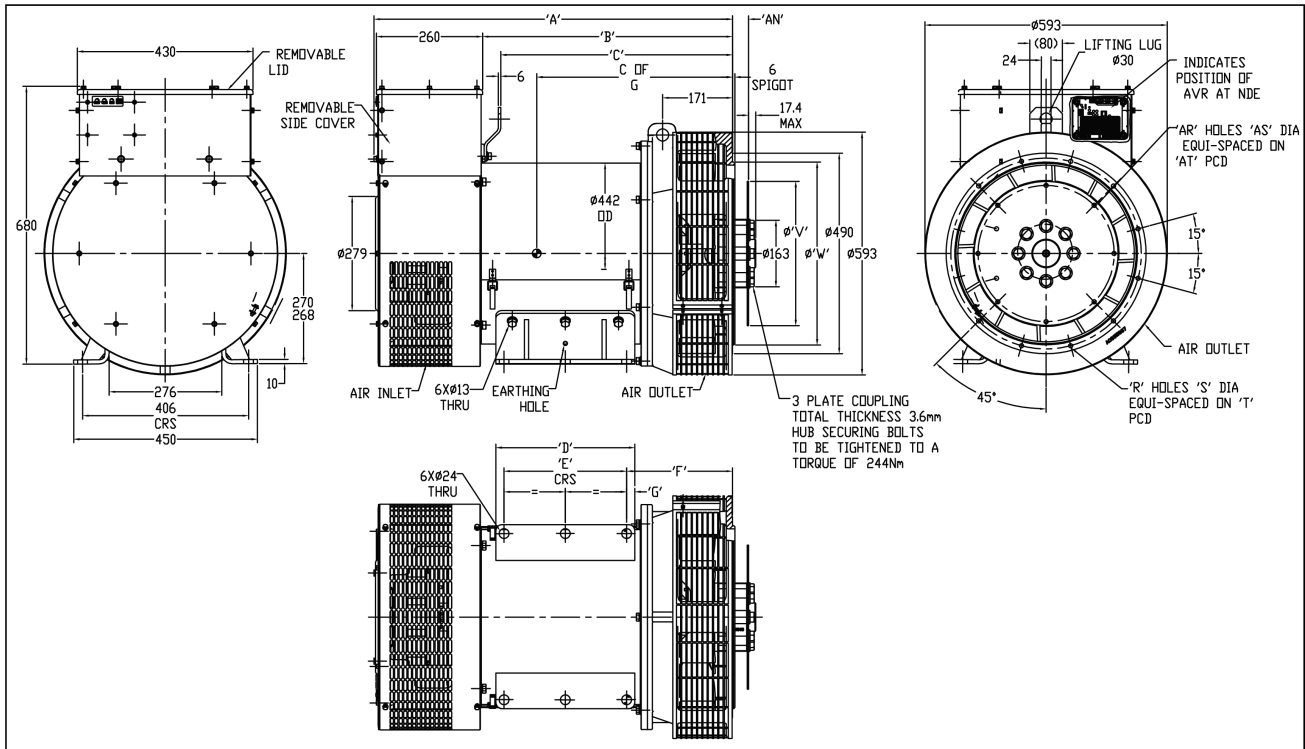


FIGURE 6. N200 GENERAL ASSEMBLY DRAWING

TABLE 3. N200 ALTERNATOR DIMENSIONS

Model	Dimensions								Weight
	A	B	C	D	E	F	G	C of G	kg
N125G4	723	457	412	185	75	293.5	55	339	390
N150G4	773	507	462	235	150	281	42.5	363	440
N180G4	838	572	527	300	203	288	48.5	399	490
N200G4	878	612	567	340	300	259	20	418	530

TABLE 4. ADAPTOR DIMENSIONS

SAE No.	Dimensions			
	R	S	T	W
2	12	11	466.7	447.6

3	12	11	428.6	409.5
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TABLE 5. COUPLING DISCS DIMENSIONS

SAE No.	Dimensions				
	AR	AS	ST	V	AN
10	8	11	295.3	314.2	53.8
11.5	8	11	333.3	352.3	39.6

6.2 Alternator Dimensions - N300

Refer to the rating plate to identify the alternator model.

NOTICE

Data sheets are available from www.stamford-avk.com

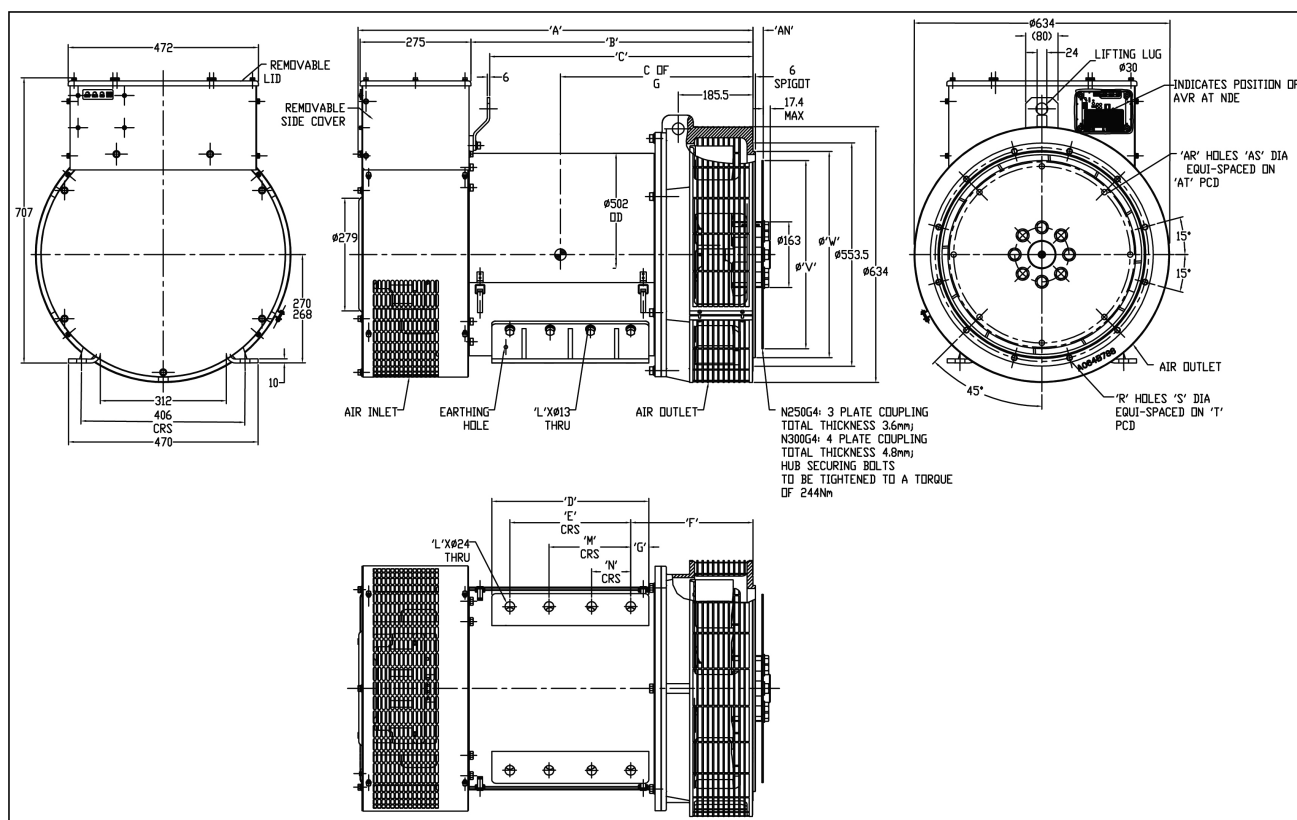


FIGURE 7. N300 GENERAL ASSEMBLY DRAWING

TABLE 6. N300 ALTERNATOR DIMENSIONS

Model	DIMENSION											Wt kg
	A	B	C	D	E	F	G	L	M	N	C of G	
N250 G4	895	615	569	310	203	312	53.5	6	155	-	432	650

N300 G4	980	700	654	390	300	303.5	45	8	203	97	478	740
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TABLE 7. ADAPTOR DIMENSIONS

SAE No.	Dimensions			
	R	S	T	W
1	12	12.7	530.2	511.1
2	12	11	466.7	447.6

TABLE 8. COUPLING DISCS DIMENSIONS

SAE No.	Dimensions				
	AR	AS	ST	V	AN
11.5	8	11	333.3	352.3	39.6
14	8	13.5	438.2	466.6	25.4

6.3 Lifting the Alternator

WARNING

Falling Mechanical Parts

Falling mechanical parts can cause serious injury or death by impact, crushing, severing or trapping.

To prevent injury and before lifting the alternator:

- ***Do not lift the complete generator set by the alternator lifting fixtures.***
- ***Keep the alternator horizontal when lifting.***
- ***Fit drive end and non-drive end transit fittings to single bearing alternators to keep the main rotor in the frame.***

Before coupling, remove the drive end transit arrangement. After coupling, remove the non-drive end transit bar. Lift the alternator by hooks or shackles attached to the lifting points (lugs or eyes) provided. A label attached to a lifting point shows the correct lifting arrangement. Use chains of sufficient length, and a spreader bar if necessary, to make sure that the chains are vertical when lifting. Make sure that the capacity of the lifting equipment is sufficient for the alternator mass shown on the label.

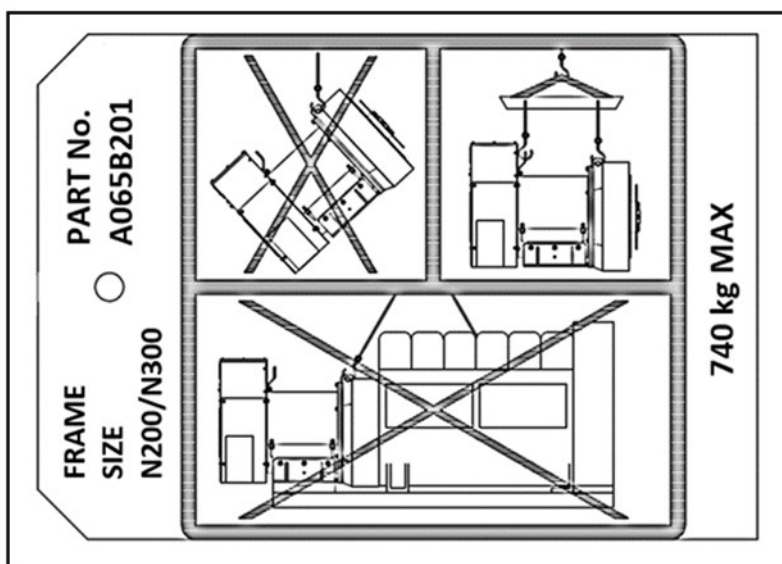


FIGURE 8. LIFTING LABEL

6.4 Storage

If the alternator will not be used immediately, it must be stored in a clean, dry, vibration-free environment. We recommend the use of anti-condensation heaters, when available.

If the alternator can be rotated, turn the rotor a minimum of 6 revolutions every month during storage.

6.4.1 Storage Instruction

When an alternator is stationary, in storage or otherwise, it may be subjected to environmental factors, such as vibration, humidity, temperature and airborne contaminant particles, that could degrade the bearing arrangements.

Contact CGT Customer Service for advice in advance if the alternator will be stationary for long periods.

6.4.2 After Storage

After a period of storage, carry out pre-running checks to determine the condition of the windings. If the windings are damp or the insulation resistance is low, the windings must be dried.

Before putting the alternator into service, refer to the following table.

TABLE 9. BEARING STORAGE AND AFTER STORAGE

	Not Rotated during Storage	Rotated during Storage
Sealed Bearing	<p>Stored < 12 months, put the alternator into service.</p> <p>Stored > 12 months, replace the bearing then put the alternator into service.</p>	<p>Stored < 24 months, put the alternator into service.</p> <p>If stored > 24 months, replace the bearing then put the alternator into service.</p>

6.5 Generator Set Coupling

⚠ WARNING

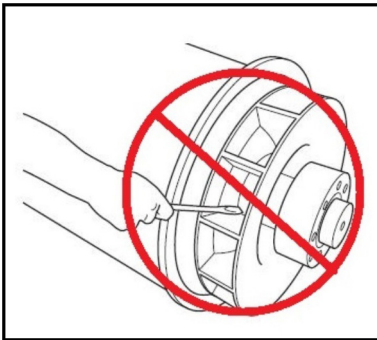
Moving Mechanical Parts

Moving mechanical parts during generator set coupling can cause serious injury by crushing, severing or trapping.

To prevent injury, keep arms, hands and fingers away from mating surfaces when coupling the generator set.

NOTICE

Do not attempt to rotate the alternator rotor by levering against the vanes of the cooling fan. The fan is not designed to withstand such forces and will be damaged.



To prevent rust during transit and storage, the alternator frame spigot, rotor coupling plates and shaft extension have been treated with a rust preventative coating. Remove this before coupling the generator set.

Efficient operation and long component life depend on minimizing mechanical stresses on the alternator. When coupled in a generator set, misalignment and vibration interactions with the prime mover engine can cause mechanical stress.

6.6 Pre-Running Checks

Before starting the generator set, test the insulation resistance of windings and check that all connections are tight and in the correct location. Make sure the alternator air path is clear of obstructions. Replace all covers.

6.7 Insulation Resistance Test

⚠ WARNING

Live Electrical Conductors

Live electrical conductors at the winding terminals after an insulation resistance test can cause serious injury or death by electric shock or burns.

To prevent injury, discharge the windings by shorting to earth through an earthing rod for at least 5 minutes.

⚠ DANGER

Live electrical conductors. To prevent injury, before removing covers over electrical conductors or rotating parts, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

NOTICE

Disconnect the AVR before carrying out these tests. The alternator must not be put into service until the minimum insulation resistance is achieved.

The resistance test must be carried out by a qualified person using the test voltage below for 1 minute.

TABLE 10. INSULATION RESISTANCE TEST VALUES

Alternator Voltage (kV)	Test Voltage (V)	Minimum Insulation Resistance (MΩ) at 20 °C	
		In Service Alternator	New Alternator
Main Stator	500	5	10
Exciter Stator	500	5	10
Exciter Rotor, Rectifier & Main Rotor Combined	500	5	10

You must dry out the alternator windings if the measured insulation resistance is less than the minimum value.

6.8 Direction of Rotation

The fan is designed for clockwise rotation, as viewed from the drive end of the alternator (unless otherwise specified when ordered). If the alternator must run counter-clockwise, please seek advice from CGT Customer Service.

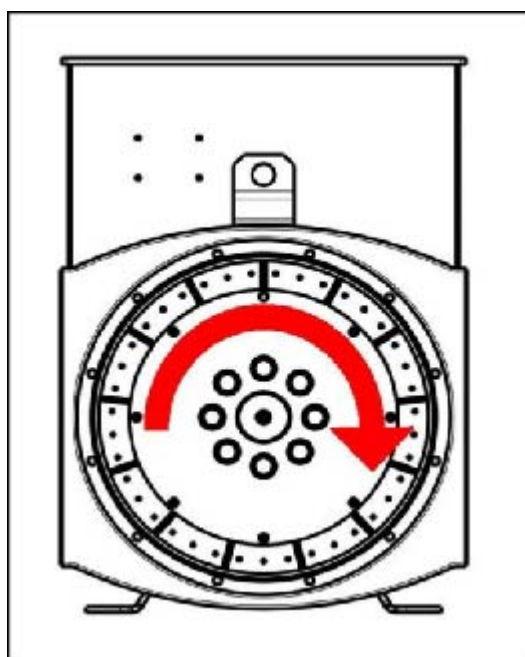


FIGURE 9. DIRECTION OF ROTATION

6.9 Phase Rotation

Main stator output is connected for a phase sequence of U V W when the alternator runs clockwise, as viewed from the drive end. If the phase rotation must be reversed, the customer must re-connect the output cables in the terminal box. Contact CGT Customer Service for a circuit diagram of 'reverse phase connections'.

6.10 Voltage and Frequency

Check that the voltage and frequency shown on the alternator rating plate meet the requirements of the generator set application. Refer to detailed instructions in the AVR manual for adjustments.

6.11 AVR Settings

The Digital AVR is factory set for initial running tests. Check that the AVR settings are compatible with your required output. Refer to detailed instructions in the AVR manual for on and off-load adjustments.

Potentiometers for adjustment

- VOLTS, to adjust generator output voltage, clockwise increases output voltage.
- STABILITY, to prevent voltage hunting, clockwise increase the damping effect.
- DROOP, to set the generator droop to 5% at 0pf, clockwise increases the droop.
- O/EXC, (factory sealed) to set over excitation trip cut off level, clockwise increases the cut off level.

Details of AVR, please refer to AVR datasheet.

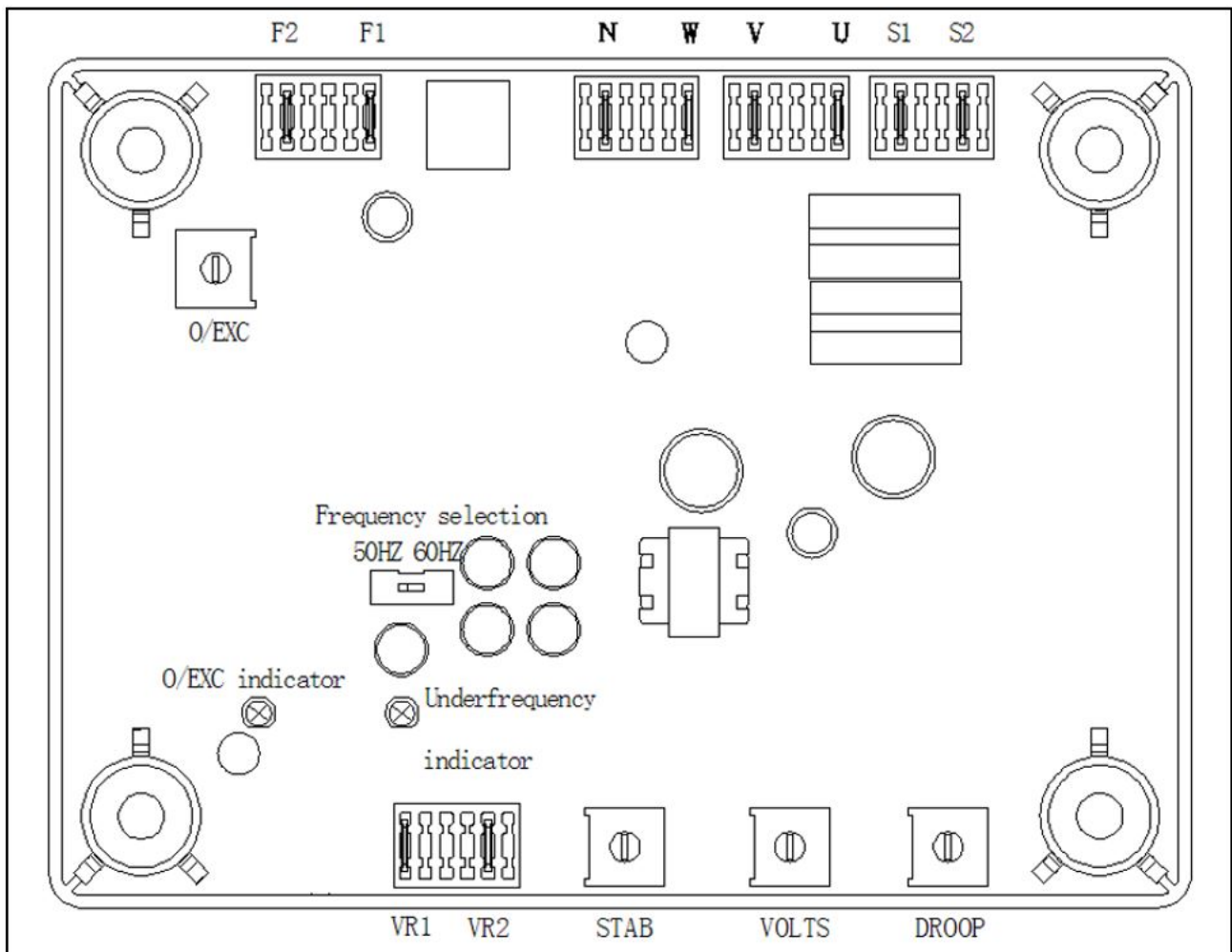


FIGURE 10. DM730 INTERFACE AND OUTLINES

6.12 Electrical Connections

WARNING

Incorrect Electrical Installation and System Protection

Incorrect electrical installation and system protection can cause serious injury or death by electric shock and burns.

To prevent injury, installers must be qualified and are responsible for meeting appropriate inspectorate and local electricity authority requirements and site safety rules.

NOTICE

The terminal box is designed to support the fitted busbars or terminals, transformers, load cables and auxiliary terminal box. Additional mass could cause excessive vibration and lead to failure of the terminal box enclosure and mounting. Refer to CGT before fixing any additional mass to the terminal box. Panels must be removed to be drilled or cut, to prevent swarf entering the terminal box or alternator.

The installer must check that the alternator frame is bonded to the generator set bedplate and to the site earth. If anti-vibration mounts are fitted between the alternator frame and its bedplate, a suitably-rated earth conductor must bridge across the anti-vibration mount.

Refer to wiring diagrams for electrical connection of the load cables.

As standard, the alternator neutral is not bonded to the alternator frame. If required, neutral may be connected to the earth terminal within the terminal box, by a conductor of at least one half of the sectional area of a phase lead.

Load cables must be supported appropriately to avoid a tight radius at the point of entry into the terminal box, clamped at the terminal box gland, and allow at least ± 25 mm movement by the generator set on its anti-vibration mountings, without causing excessive stress to the cables and alternator load terminals.

Wire Diagram and Connection diagram as below,

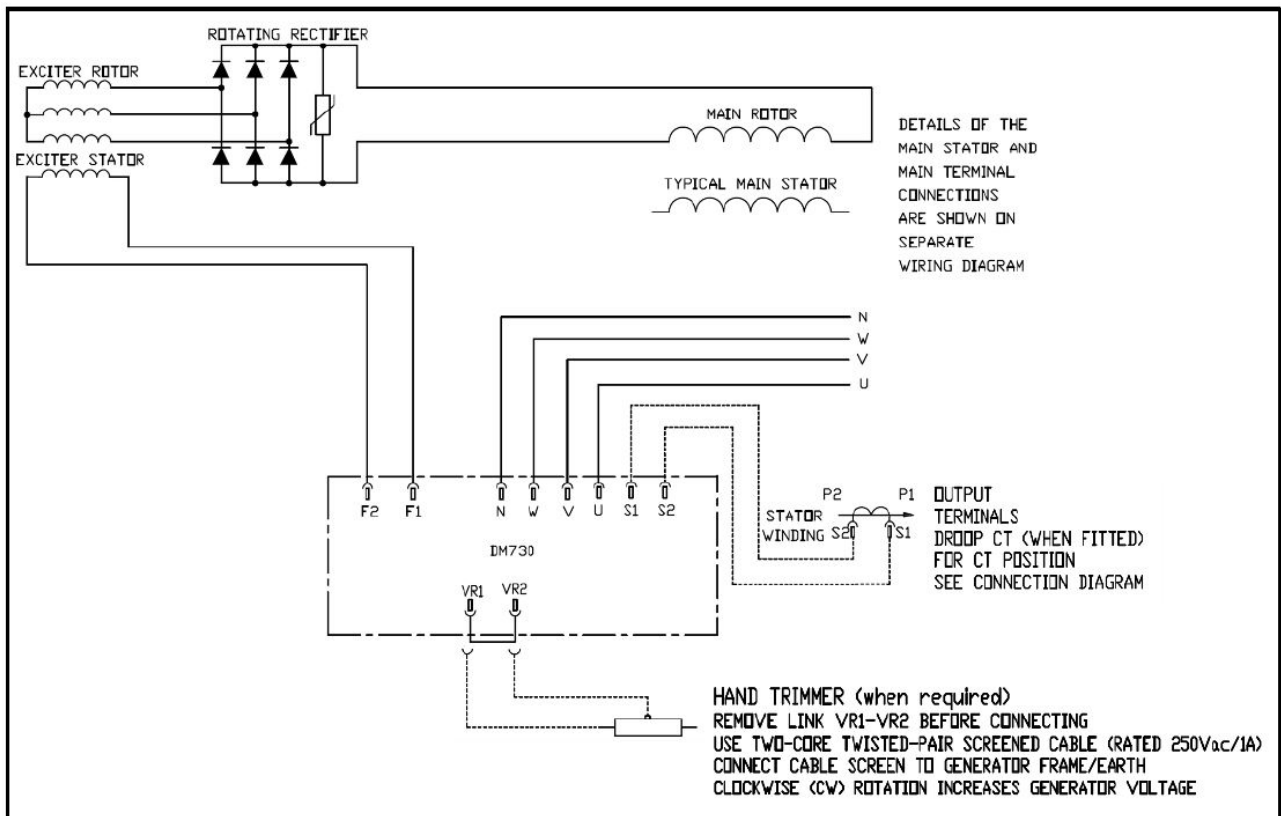


FIGURE 11. BASE WIRING DIAGRAM A064Y421

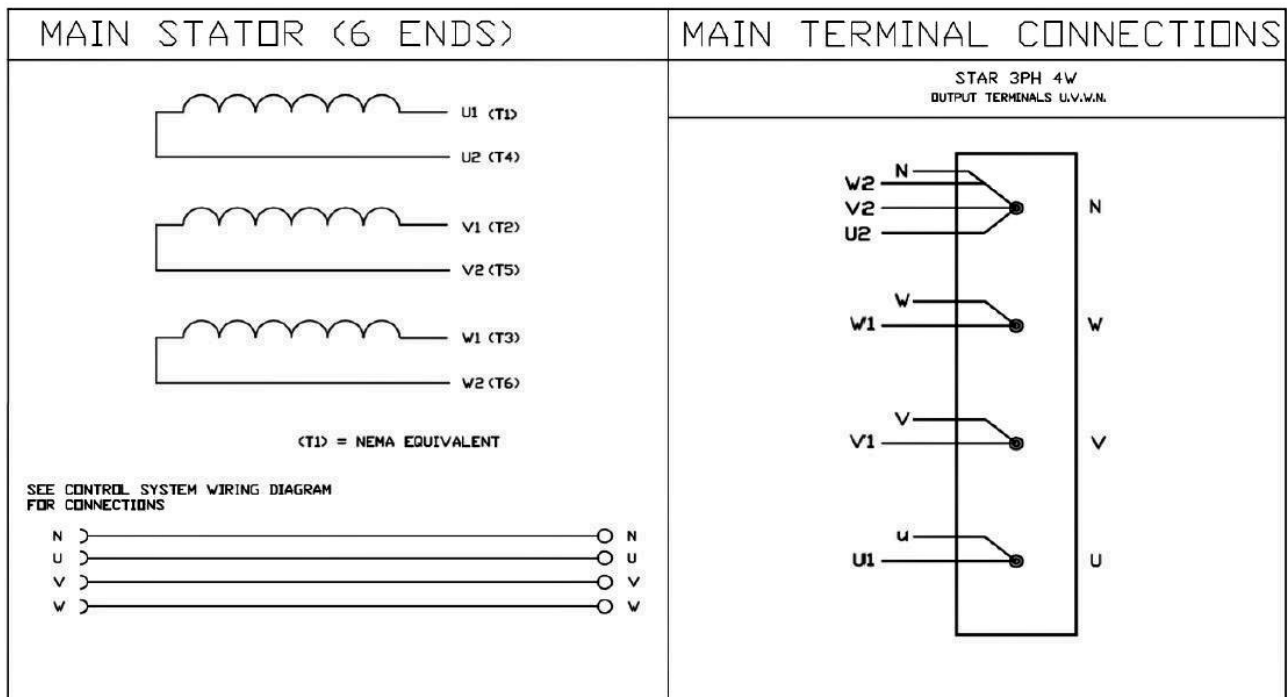


FIGURE 12. CONNECTION DIAGRAM A064Y458

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7 Service and Maintenance

7.1 Bearings

7.1.1 Introduction

DANGER

Rotating Mechanical Parts

Rotating mechanical parts can cause serious injury or death by crushing, severing or trapping.

To prevent injury and before removing covers over rotating parts, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

NOTICE

Store parts and tools in static and dust-free conditions, to prevent damage or contamination.

A bearing is damaged by the axial force needed to remove it from the rotor shaft. Do not reuse a bearing.

A bearing is damaged if the insertion force is applied through the bearing balls. Do not press fit the outer race by force on the inner race, or vice versa.

Do not try to turn the rotor by levering against the cooling fan vanes. The fan will be damaged.

The alternator rotor is supported by a bearing at the non-drive end (NDE) and by coupling to the prime mover at the drive end (DE).

- The bearing condition must be included as part of your routine maintenance to ensure smooth operation without noise and prevent failure. The bearing must be replaced every 18 months or within 10,000 operating hours, whichever occurs first. Bearing life is determined by the site environment and application, like vibration, temperature, load, etc.

7.2 Controls

7.2.1 Introduction

An operating alternator is a harsh environment for control components. Heat and vibration can cause electrical connections to loosen and cables to fail. Routine inspection and test can identify an issue before it becomes a failure that incurs unplanned downtime.

7.2.2 Safety

DANGER

Live Electrical Conductors

Live electrical conductors can cause serious injury or death by electric shock and burns.

To prevent injury and before removing covers over electrical conductors, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

⚠ WARNING**Hot Surfaces**

Skin contact with hot surfaces can cause serious injury by burns.

To prevent injury, wear appropriate personal protection equipment (PPE).

7.3 Rectifier System

7.3.1 Introduction

The rectifier converts alternating current (AC) induced in the exciter rotor windings into direct current (DC) to magnetize the main rotor poles. The rectifier comprises two Intergrated modules, each with three diodes. In addition to connecting to the main rotor, the DC output of the rectifier also connects to a varistor. The varistor protects the rectifier from voltage spikes and surge voltages that may be present on the rotor under various loading conditions of the alternator.

The exciter rotor windings are connected to 3 diode anodes to form the positive plate and to 3 diode cathodes to form the negative plate to give full wave rectification from AC to DC. The rectifier is mounted on, and rotates with, the exciter rotor at the non-drive end (NDE).

7.3.2 Safety

⚠ DANGER**Live Electrical Conductors**

Live electrical conductors can cause serious injury or death by electric shock and burns.

To prevent injury and before removing covers over electrical conductors, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

⚠ DANGER**Rotating Mechanical Parts**

Rotating mechanical parts can cause serious injury or death by crushing, severing or trapping.

To prevent injury and before removing covers over rotating parts, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

7.3.3 Test and Replace Varistor

1. Inspect the varistor, (if fitted).
2. Record varistor as faulty if there are signs of overheating (discoloration, blisters, melting) or disintegration.
3. Disconnect one varistor lead. Store fastener and washers.
4. Measure the resistance across the varistor. Good varistors have a resistance greater than 100 MΩ.
5. Record the varistor as faulty if the resistance is short circuit or open circuit in either direction. (Some multimeters will read O.L. at high resistance levels. Please be aware of the limits of your tools.)
6. If the varistor is faulty, replace it and replace all diodes.
7. Reconnect and check that all leads are secure, washers fitted and fasteners tight.

7.3.4 Test and Replace Diodes

NOTICE

Do not tighten above the stated torque, Components will be damaged.

1. Disconnect the leads of the diodes. Store fastener and washers.
2. Measure the voltage drop across the diode in the forward direction, using the diode test function of a multimeter.
3. Measure the resistance across the diode in the reverse direction, using the 1000 VDC test voltage of an insulation tester.
4. Diode is faulty if the voltage drop in the forward direction is outside the range 0.3 to 0.9 VDC, or the resistance is below 20 MΩ in the reverse direction.
5. Repeat the tests for the remaining diodes.
6. If any diode is faulty, replace the whole rectifier kit (diodes and varistor same type, same manufacturer):
 - a. Remove the NDE bracket to gain access to the diodes and varistor when replacing the whole rectifier kit.
 - b. Install the new rectifier kit.
 - c. Apply 10 Nm torque to give good mechanical, electrical and thermal contact of the modules.
 - d. Replace the varistor and apply 2.3 Nm torque.
 - e. Connect the Ex-Rotor leads to the diodes and apply 2.3 Nm torque.
7. Refit the NDE bracket and check that all leads are secure, washers fitted and fasteners tight.

7.4 Windings

7.4.1 Introduction

NOTICE

Disconnect all control wiring and customer load leads from alternator winding connections before conducting these tests.

NOTICE

The Automatic Voltage Regulator (AVR) contains electronic components which would be damaged by high voltage applied during insulation resistance tests. The AVR must be disconnected before doing any insulation resistance test. Temperature sensors must be grounded to earth before doing any insulation resistance test.

Damp or dirty windings have a lower electrical resistance and could be damaged by insulation resistance tests at high voltage. If in doubt, test the resistance at low voltage (500 V) first.

Alternator performance depends on good electrical insulation of the windings. Electrical, mechanical and thermal stresses, and chemical and environmental contamination, cause the insulation to degrade. Various diagnostic tests indicate the condition of insulation by charging or discharging a test voltage on isolated windings, measuring current flow, and calculating the electrical resistance by Ohm's law.

When a DC test voltage is first applied, three currents can flow:

- **Capacitive Current:** To charge the winding to the test voltage (decays to zero in seconds),

- **Polarizing Current:** To align the insulation molecules to the applied electric field (decays to near-zero in ten minutes), and
- **Leakage Current:** Discharge to earth where the insulation resistance is lowered by moisture and contamination (increases to a constant in seconds).

For an insulation resistance test, a single measurement is made one minute after a DC test voltage is applied, when capacitive current has ended. For the polarization index test, a second measurement is made after ten minutes. An acceptable result is where the second insulation resistance measurement is at least double the first, because the polarization current has decayed. In poor insulation, where leakage current dominates, the two values are similar. A dedicated Insulation Tester takes accurate, reliable measurements and may automate some tests.

7.4.2 High Voltage Test

NOTICE

Windings have been tested at high voltage during manufacture. Repeated high voltage tests may degrade the insulation and reduce operating life. If a further test is required at installation for customer acceptance, it must be done at a reduced voltage, $V = 0.8 \times (2 \times \text{Rated Voltage} + 1000)$. Once in service, any further tests for maintenance purposes must be done after passing visual checks and insulation resistance tests, and at a reduced voltage, $V = (1.5 \times \text{Rated Voltage})$.

8 Parts Identification

8.1 N200 and N300 Alternators

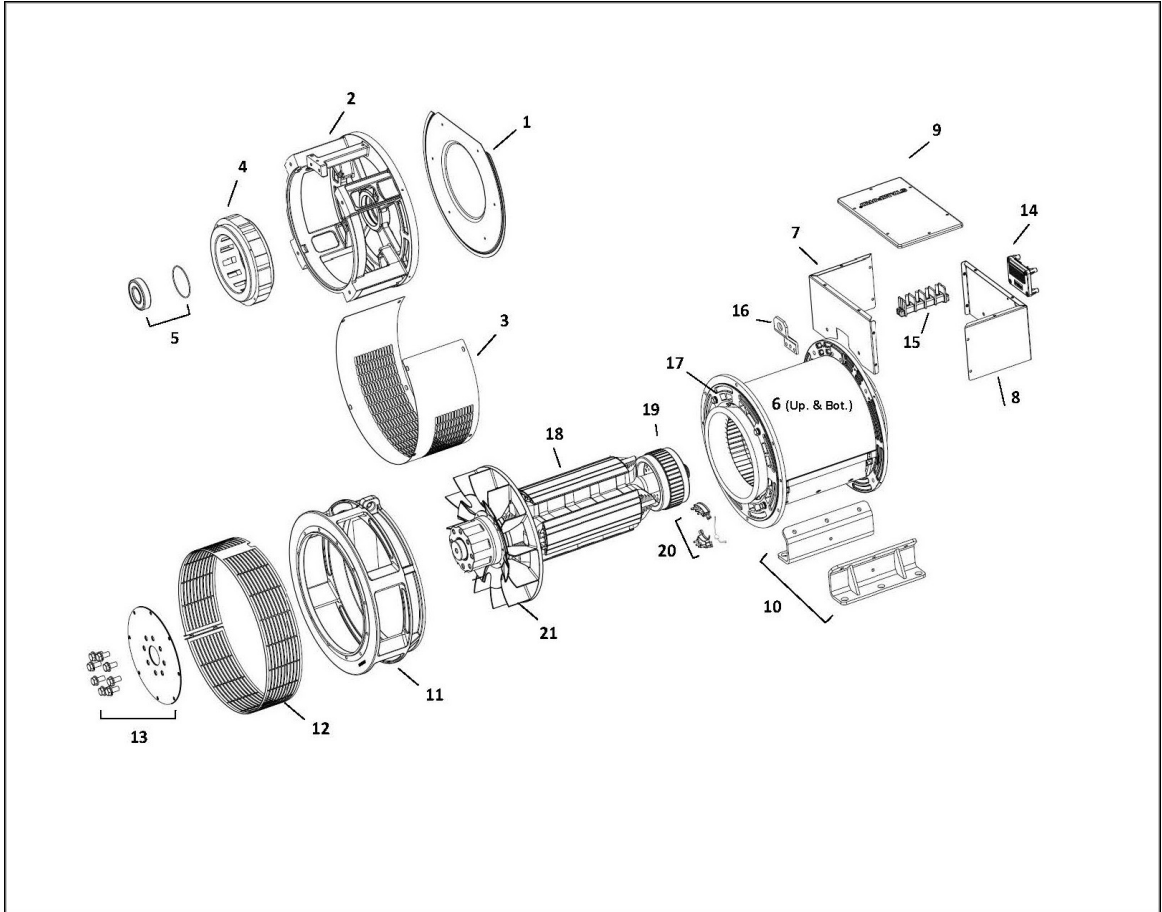


FIGURE 13. SINGLE BEARING ALTERNATOR EXPLODED VIEW

8.2 N200 and N300 Parts and Fasteners

TABLE 11. COMPONENTS, FASTENERS AND TORQUE VALUES

Ref	Component	N200 Series			N300 Series		
		Fastener	Qty	Torque Nm	Fastener	Qty	Torque Nm
1	NDE Cover	M6 x 16	5	10	M8 x 20	5	26
2	NDE Bracket	M12 x 45	4	95	M10 x 40	8	50
3	NDE Air Inlet Cover	M6 x 16	8	10	M6 x 16	8	10
4	Exciter Stator	M6 x 55/65	4	10	M6 x 75	4	10

5	Bearing Kit	-	-	-	-	-	-
6	Frame Covers	Latches	-	-	-	-	-
7	Terminal Box DE and Left Panel	M6 x 16 M8 x 20	2/2	10/26	M6 x 16 M8 x 20	2/2	10/26
8	Terminal Box NDE and Right Panel (AVR)	M6 x 16 M8 x 20	2/2	10/26	M6 x 16 M8 x 20	2/2	10/26
9	Terminal Box Lid	M6 x 16	6	10	M6 x 16	6	10
10	Feet (Pair)	M12 x 35	6	95	M12 x 45	8	95
11	Adaptor	M10 x 45	6	50	M12 x 45	6	95
12	DE Air Outlet Cover	M5 x 25	2	5	M5 x 25	2	5
13	Coupling Kit	M16 x 35/50	8	244	M16 x 35	8	244
14	AVR	M5 x 55	4	5	M5 x 55	4	5
15	Terminal Board	M8 x 25	2	26	M8 x 25	2	26
16	NDE Lifting Lug	M10 x 50	2	50	M10 x 55	2	50
17	Main Stator	-	-	-	-	-	-
18	Main Rotor	-	-	-	-	-	-
19	Exciter Rotor	-	-	-	-	-	-
20	Rectifier Kit	M6 x 60/70	4	10	M6 x 80	4	10
20a	Varistor to Rectifier	M6 Nut	2	2.3	M6 Nut	2	2.3
20b	Ex-Rotor Leads to Diodes	M5 Nut	6	2.3	M5 Nut	6	2.3
21	Fan	M6 x 45	8	10	M6 x 45	8	10

9 Technical Data

NOTICE

Compare measurements with the technical data sheet and the test certificate supplied with the alternator.

9.1 N200 and N300 Winding Resistances

Alternator	Resistance of windings at 20°C (Measured values should be within 10%)			
	Main Stator (Ohms)	Exciter Stator (Ohms)	Exciter Rotor, L-L (Ohms)	Main Rotor (Ohms)
	W312 Line to Line			
N125G4	0.0488	15.7	0.188	0.9266
N150G4	0.0382	15.7	0.188	1.0533
N180G4	0.0289	17.4	0.2	1.2251
N200G4	0.0266	17.4	0.2	1.3223
N250G4	0.0169	17.4	0.2	1.8305
N300G4	0.0136	16.7	0.21	2.0977

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10 Service Parts

Servicing and repairing your alternator with Genuine STAMFORD® parts is critical to ensure maximum life and reliability of your product. For further parts information and details of your nearest outlet visit www.stamford-avk.com/parts.

10.1 Parts Orders

When ordering parts the machine serial number or machine identity number and type should be quoted, together with the part description. The machine serial number can be found on the name plate or frame.

10.2 Customer Service

For details of your nearest service outlet visit www.stamford-avk.com.

10.3 Recommended Service Parts

In critical applications a set of these service spares should be held with the alternator.

TABLE 12. N200_N300 SERVICE PARTS

Part	Number
DM730 voltage regulator	A064T106
Non-drive end Bearing	45-0868
Rectifier Kit (includes varistor)	A065G023

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11 End of Life Disposal

Companies specializing in reclaiming material from scrap products can reclaim most of the iron, steel and copper from the alternator. For more details, please contact Customer Service.

11.1 Recyclable material

Mechanically separate the base materials, iron, copper and steel, removing paint, polyester resin, and insulation tape and/or plastics residues from all components. Dispose of this 'waste material'

The iron, steel and copper can now be recycled.

11.2 Items requiring specialist treatment

Remove electrical cable, electronic accessories and plastic materials from the alternator. These components need special treatment to remove the waste from the reclaimable material.

Forward the reclaimed materials for recycling.

11.3 Waste material

Dispose of waste material from both of the above processes via a specialist disposal company.

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