STAMFORD | AvK™

POWERING TOMORROW, TOGETHER

Application Guidance Notes: Technical Information from STAMFORD | AvK

AGN 006 – Codes, Standards and Directives

INTRODUCTION

STAMFORD | AvK (Cummins Generator Technologies) provide 'self-certification' under the ISO 9000 Quality Assurance System. The following is offered as an explanation of the policy and procedures adopted by STAMFORD | AvK, to provide traceable and QA System supported technical documentation, regarding the performance details of their range of alternators.

DEFINITION

Codes and Standards are not legally enforceable, but are considered methods of best practice. STAMFORD | AvK declare compliance with listed Codes and Standards. Relevant EU Directives are mandatory and direct member states are required to enact local law.

CODES AND STANDARDS

Standards Institutes came into existence because of the need for a structured and ordered manner of establishing the capability and suitability of a manufactured item to perform its intended task. To achieve this, Standards contain technical explanations regarding use of the various machine quantities, descriptions for test methods and procedures for identifying performance capabilities. They may also include instructions for data presentation in

recognised and orthodox terms for easy consideration of performance parameters, which is often accomplished by a coding system for grading comparable parameters.

Within the library of Codes and Standards that are relevant to alternators as manufactured by STAMFORD | AvK, are Sections and Parts that specifically describe design criteria and test methods for establishing machine quantities, and also identifying the allowable tolerances associated with each parameter's quantity. Examples of the most commonly encountered documents that describe performance capabilities for rotating electrical machines are:

IEC60034, IEC60085, IEEE115, ISO 8528, MIL-STD-705, NEMA-MG1.

The performance of alternators manufactured by STAMFORD | AvK complies with the 60034-1. In terms of the origin and use of this Standard, there is a traceability from IEC, through EN to BS, as follows:

- IEC 60034-1 is the Standard being managed at the global level
- EN 60034-1 is the version of the IEC standard adopted by the EU
- BS EN 60034-1 is the version of the standard adopted by UK

There are also standards that control the quality of materials used in the manufacture of alternators. There follows, a list of material standards that STAMFORD | AvK comply with:

- Lamination steel conforms to EN10106
- Rotor shaft material conforms to EN10083-2
- Copper wire conforms to EN60317-13, EN60264, EMA MW1000 and Fed Std. J-W-1177/14.

DIRECTIVES

Compliance to relevant EU Directives is compulsory. In complying with the member state response to the directives, in essence, they become country level regulations. Self-certification is a typical practice for showing compliance. Compliance is denoted by the CE Mark and is enforced by government agencies.

The CE Mark

The CE Mark signifies that the product carrying this mark complies with the relevant technical approval. In the case of an alternator, which is a complete machine in its own right, but is also a component part of equipment that forms a Generating Set, then relevant EU Directives must be complied with. These are: The EMC Directive, The Low Voltage Directive and the Restriction of Hazardous Substances (RoHS) Directive. High Voltage and Medium Voltage (>1000VAC) alternators do not carry the CE Mark.

The EU Directives clearly state that a Generating Set comprised of major components that are CE Marked, does not entitle the manufacturer of the Generating Set to claim compliance of the complete equipment. The manufacturer of the Generating Set must conduct appropriate testing by an Approved Test House and have in place an appropriate Technical Construction File.

In the case of a partly completed alternator, which requires further engineering as a component part of equipment that forms a Generating Set, then relevant EU Directives must be complied with. These are: The Machinery Directive and declaration as far as the machine build will allow, to The EMC Directive. Incomplete alternators do not carry the CE Mark.

The requirements included within The Machinery Directive 2006/42/EC have been duly considered by STAMFORD | AvK using a Cummins Corporate procedure, which provides instruction and direction to enable a cross functional team of people to undertake a product risk assessment in a controlled and documented manner. This Cummins Procedure has been applied to duly consider the requirements of The Low Voltage Directive 2014/35/EU and The EMC Directive 2014/30/EU, and the RoHS Directive 2011/65/EU.

A Declaration of Conformity or Declaration of Incorporation, as appropriate, accompanies the each alternator and is backed up by a Technical Construction File. Technical Construction Files are a requirement of the Machinery Directive and are a means of locating information to support compliance claims. The Technical Construction Files are only available to authorised market surveillance bodies. Each Technical Construction File is not a single document, rather a collection of copyright confidential product specific documentary files consisting of maturing information, reflecting product development, changes and auditing milestones.

The UKCA Mark

The UKCA Mark came into effect on 1st January 2021 as a result of “Brexit” and the separation of the UK from EU legislation. This will be mandatory on goods sold in the UK after 1st January 2023. The UKCA mark is similar to the CE Mark. The UKCA marking applies to most goods previously subject to the CE marking.

The technical requirements (‘essential requirements’) that must be met – and the conformity assessment processes and standards that can be used to demonstrate conformity – are largely the same as they were for the CE marking. The EU Directives applicable to CE marking are replaced with equivalent UK Statutory Instruments (UK S.I.) relevant to UKCA marking. Many of these still currently reference EU legislation, although over time, as UK and EU legislation diverge, these will become more region-specific. The relevant UK S.I. applicable to alternator are:

UK S.I. 2016/1101 The Electrical Equipment (Safety) Regulations
UK S.I. 2016/1091 The Electromagnetic Compatibility Regulations
UK S.I. 2012/3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations
UK S.I. 2008/1597 The Supply of Machinery (Safety) Regulations

Like CE Marking, the rules for UKCA marking are the same, i.e. High Voltage and Medium Voltage (>1000VAC) alternators do not carry the UKCA Mark.

The UK Statutory Instruments clearly state that a Generating Set comprised of major components that are UKCA Marked does not entitle the manufacturer of the Generating Set to claim compliance of the complete equipment. The manufacturer of the Generating Set must conduct appropriate testing by an Approved Test House and have in place an appropriate

Technical Construction File. In the case of a partly completed alternator, which requires further engineering as a component part of equipment that forms a Generating Set, then relevant UK S.I. must be complied with. These are:

The Supply of Machinery (Safety) Regulations and declaration as far as the machine build will allow, The Electromagnetic Compatibility Regulations and The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations. Just like CE Marking requirements, partly completed alternators do not carry the UKCA Mark.

The requirements included within The Supply of Machinery (Safety) Regulations have been duly considered by STAMFORD | AvK using a Cummins Corporate procedure, which provides instruction and direction to enable a cross functional team of people to undertake a product risk assessment in a controlled and documented manner. This Cummins Procedure has been applied to duly consider the requirements of UK S.I. 2016/1101 The Electrical Equipment (Safety) Regulations, UK S.I. 2016/1091 The Electromagnetic Compatibility Regulations and UK S.I. 2012/3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations.

A Declaration of Conformity or Declaration of Incorporation, as appropriate, covering both EU and UK requirements accompanies each alternator and is backed up by a Technical Construction File. Technical Construction Files are a requirement of the Machinery Directive and are a means of locating information to support compliance claims. The Technical Construction Files are only available to authorised market surveillance bodies. Each Technical Construction File is not a single document, rather a collection of copyright confidential product specific documentary files consisting of maturing information, reflecting product development, changes and auditing milestones.

Manufacturing Materials & Substances

There are legislative requirements placed on manufacturers with specified details regarding the incorporation of any component part, or using a manufacturing process that contains or involves the use of an identified substance, which has been identified as hazardous with serious consequences.

There are several systems for controlling chemicals in Europe, and these include:

- **REACH** Registration, Evaluation, Authorisation and restriction of Chemicals.
- **RoHS** Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2008.

The suppliers of parts to STAMFORD | AvK are contractually required to meet REACH and RoHS requirements, thereby introducing control at the source of material supply chain to ensure STAMFORD | AvK meet all aspects of compliance.

End of Life Disposal

At the end of their working life, the safe disposal of electrical power generation equipment is presently covered by;

- **WEEE :** Waste of Electrical and Electronic Equipment.....(Industrial)
- Green Passport for Ships.....(Marine)

Industrial

The STAMFORD | AvK product range is presently not included within the scope of equipment that is covered by the specified requirements of the WEEE Directive. The scope of the WEEE Directive, however, is due to be reviewed in 2019. When the revised and additional requirements of the WEEE Directive are made available for comment, or issued as a legislative requirement, STAMFORD | AvK will undertake a review of their product range and so, need for compliance.

Marine

The International Maritime Organisation (IMO) have issued guidelines to address the need to introduce greater protection for the workers and the environment at ship recycling facilities, and to give crew and passengers a safer and better environment.

Some of the Marine Classifying Societies have introduced rules that ensure that new build shipping is designed and manufactured with 'clean' materials and is of a 'clean design'. In order to ensure that 'clean materials' are incorporated within a new build ship, a document containing details of magnitudes of known Hazardous Substances must be created by the Ship Builder. The gathering of the relevant information is initiated by the request for the completion of a questionnaire type document, which has become known as the 'Green Passport Declaration'.

Requests for completion of a specific Green Passport document, which requires the identification of contained hazardous substance in terms of magnitude in percentage levels for each component part of a proposed alternator have been considered by STAMFORD | AvK.

It became apparent that the cost in terms of man hours and technical resource to complete the Green Passport Document for each type of marine alternator would be many thousands of pounds (£UK) and consequently will only be considered after a commercial agreement between STAMFORD | AvK and Customer is in place for the recovery of an agreed amount of the incurred costs.

STAMFORD | AvK continue to recommend that the route to be adopted should be based on the fact that STAMFORD | AvK have in place the REACH and RoSH controls for component parts incorporated within the Marine specification alternators. This is the safeguard the ship builder needs to ensure the requirements of the Green Passport have been fulfilled during shipboard equipment selection and controlled during installation.

SPECIFICATIONS

Technical Specifications are issued in order that the required performance and durability of manufactured items can be considered against the specified requirements. Often, initial quotations for a nominated alternator will be accompanied by technical data offered as supporting evidence for an alternator's suitability to meet the expectations for a specified and required duty.

Examples of Specifications are: the Rules and Regulations issued by Marine Classifying Societies; established equipment specifications for Telecommunication Companies; Military Specifications.

Compliance with a "Specification" invariably requires a series of contractually agreed tests, which if successful will initiate the issue of an approval certificate for compliance for part, or all of the specification.

It should always be remembered that the Specified testing criteria for a "generator at the manufacturer's works" will involve an electric motor driven alternator for which the test procedure stipulates that tests are to be conducted at a constant speed. Under such test conditions the alternator performance may well be fully compliant with the specified requirements. However, once this alternator is incorporated within a Generating Set, it is most unlikely that the prime mover will be able to maintain constant speed and so submittal of the performance data from the tests conducted at the "generator manufacturer's works" is no guarantee of specification-compliance for the Generating Set equipment package. In fact, there are several tests that are now frequently specified to be conducted on an 'isolated' alternator at the "generator manufacturer's works". But once this same alternator is incorporated within a Generating Set, its performance will be changed, requiring compliance for the complete Generating Set equipment package to be re-evaluated by yet more testing.

QUALITY MANAGEMENT SYSTEM

Compliance

Standards are documents that provide details of engineering excellence. The various national and international Standards Institutes continue to update their standards around new materials, new manufacturing techniques and revise the performance expectations; all based on modern expectations of the subject matter for which a standard has been written. Standards Institutes do not conduct tests, or implement audit processes for manufactured materials, components, equipment packages, or workmanship criterion. If a Company claims compliance to a Standard, then it does so by a process of self-certification, supported by a Quality Management System.

Authentication

STAMFORD | AvK has a Quality Management System that complies with ISO 9001:2015 requirements, and this is audited by an external body; Bureau Veritas Certification. It must be understood that the bodies that control and support National and International Engineering Standards do not issue compliance certificates. That is not the responsibility of such organisations; they are formed to offer technical guidance, and a common language for users of technical products, to qualify and explain performance abilities.

A certification document will only be provided by a Body that issues a Specification. Examples of such bodies are: CSA, UL and Marine Classifying Societies.

Validation

STAMFORD | AvK have a QA controlled process covering the design and testing of their product, which complies with the test methods described within the above mentioned examples of National and International Engineering Standards that identify the methods for determining synchronous machine quantities from tests.

The test results are processed under the STAMFORD | AvK Quality Assurance process to identify the performance capability of each alternator design, and appropriate technical quantities obtained from the exhaustive test data is converted into a 'Summary of Performance Capability', which becomes the published Technical Data Sheet issued for each specific design of alternator manufactured by STAMFORD | AvK.

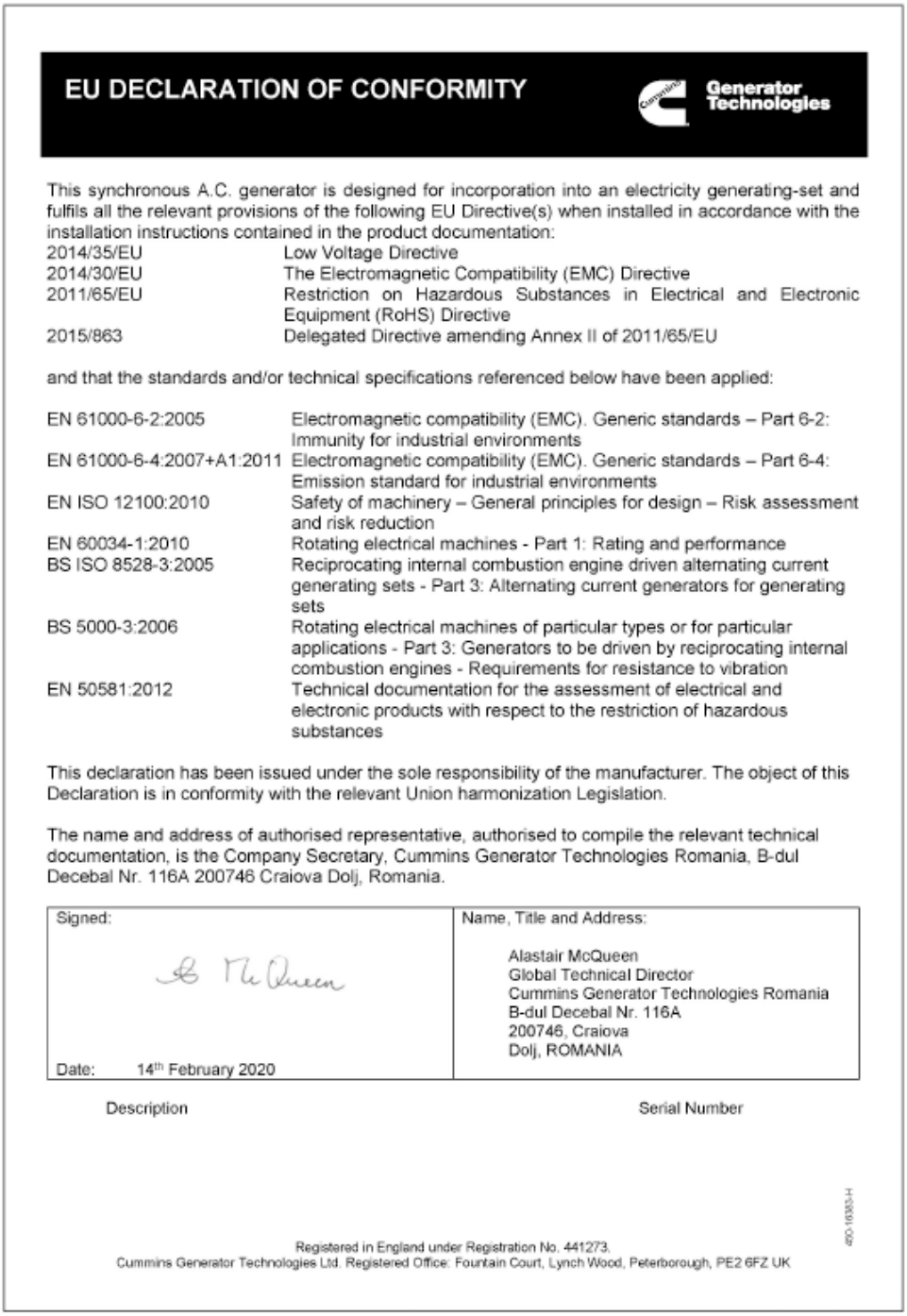
Certificate of Conformity

A Certificate of Conformity is attached to every dispatched complete alternator as part of the Quality Management System documentation to provide evidence that the dispatched alternator has been designed, manufactured and tested in compliance with the Codes, Standards and Directives that are applicable.

The EU Declaration of Conformity is supplied with the alternator, with a serial number coding that is specific to that machine. It bears the signature of the Global Technical and Quality Director for STAMFORD | AvK. Significantly, the declaration states that the alternator is designed for incorporation into an electricity generating set and fulfils all the provisions of the relevant EU Directives when installed in accordance with the installation instructions contained in the product documentation.

The EU Declaration of Conformity also lists the standards and technical specifications that have been applied.

An example EU Declaration of Conformity appears on the next page.



EU DECLARATION OF CONFORMITY

Generator Technologies

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:

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

and that the standards and/or technical specifications referenced below have been applied:

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

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.

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.

Signed:	Name, Title and Address:
A McQueen Date: 14th February 2020	Alastair McQueen Global Technical Director Cummins Generator Technologies Romania B-dul Decebal Nr. 116A 200746, Craiova Dolj, ROMANIA

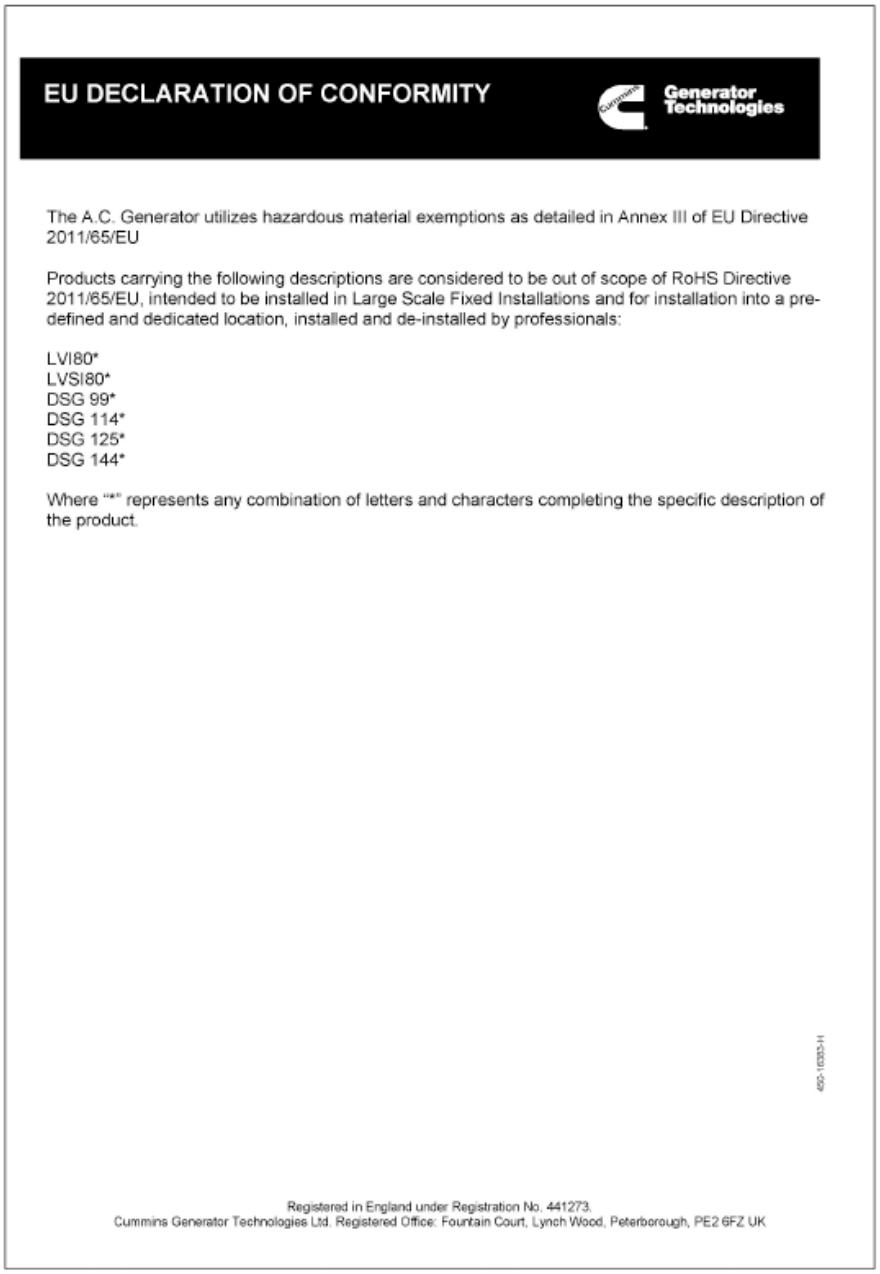
Description

Serial Number

450-16393-H

Registered in England under Registration No. 441273.
Cummins Generator Technologies Ltd. Registered Office: Fountain Court, Lynch Wood, Peterborough, PE2 6FZ UK

FIGURE 3. DECLARATION OF CONFORMITY - SHEET 1



EU DECLARATION OF CONFORMITY

Generator Technologies

The A.C. Generator utilizes hazardous material exemptions as detailed in Annex III of EU Directive 2011/65/EU

Products carrying the following descriptions are considered to be out of scope of RoHS Directive 2011/65/EU, intended to be installed in Large Scale Fixed Installations and for installation into a pre-defined and dedicated location, installed and de-installed by professionals:

LVI80*
LVSI80*
DSG 99*
DSG 114*
DSG 125*
DSG 144*

Where "*" represents any combination of letters and characters completing the specific description of the product.

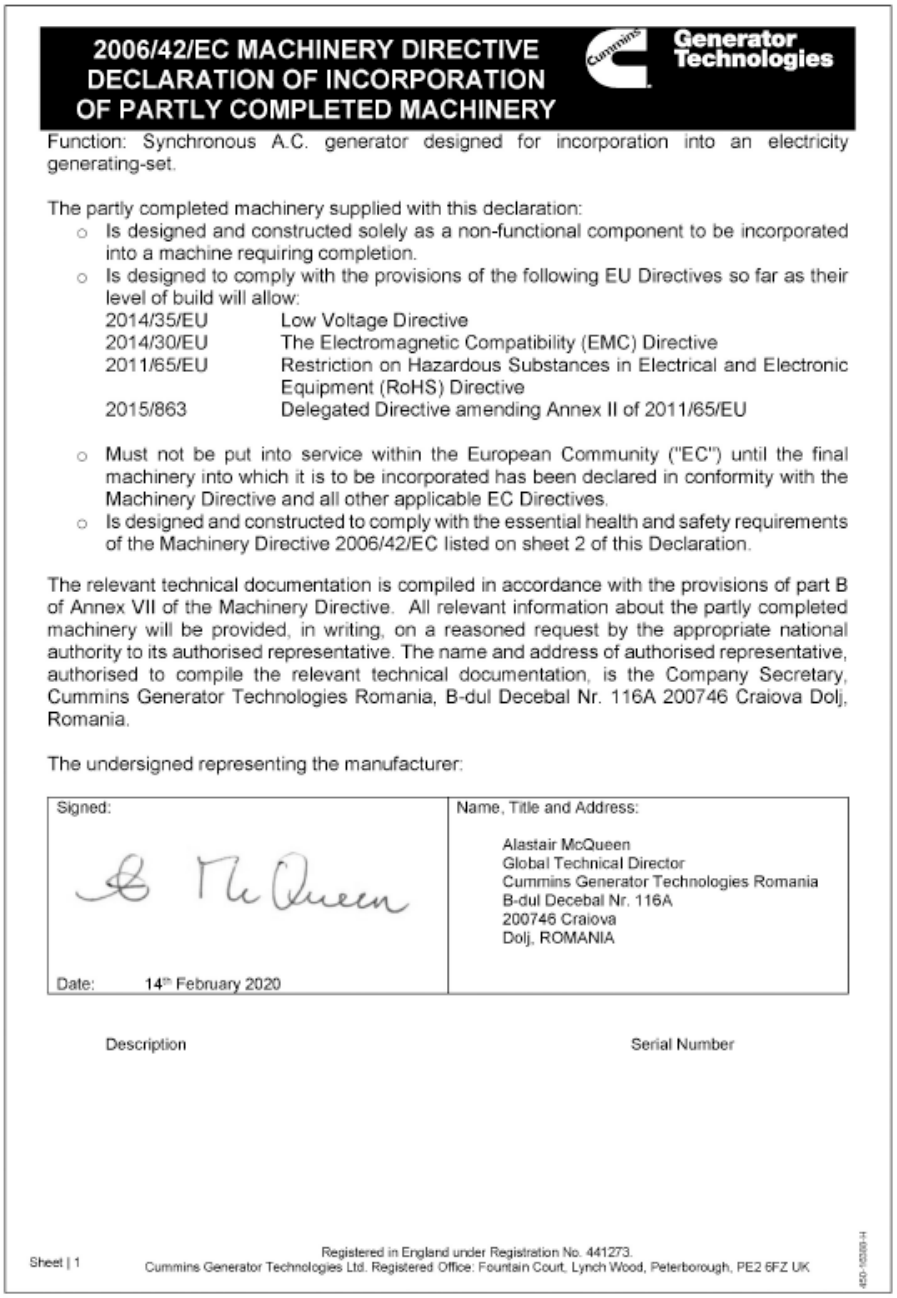
Registered in England under Registration No. 441273.
Cummins Generator Technologies Ltd. Registered Office: Fountain Court, Lynch Wood, Peterborough, PE2 6FZ UK

FIGURE 4. DECLARATION OF CONFORMITY - SHEET 2

Declaration of Incorporation.

To comply with EU Directives regarding CE Marking, every partly completed alternator is dispatched with a Declaration of Incorporation as part of the Quality Management System documentation, to provide evidence that the dispatched alternator has been designed, manufactured and tested in compliance with the statutory requirements of the relevant EU Directives for ac generators (alternators); primarily 2006/42/EC Machinery Directive.

The Declaration of Incorporation is supplied with the alternator, with a serial number coding that is specific to that machine. It bears the signature of the Global Technical and Quality Director for STAMFORD | AvK. Significantly, the declaration states that the alternator is designed for incorporation into an electricity generating-set and fulfils all the provisions of the relevant EU Directives when installed in accordance with the installation instructions contained in the product documentation.



2006/42/EC MACHINERY DIRECTIVE
DECLARATION OF INCORPORATION
OF PARTLY COMPLETED MACHINERY

Generator Technologies

Function: Synchronous A.C. generator designed for incorporation into an electricity generating-set.

The partly completed machinery supplied with this declaration:

- Is designed and constructed solely as a non-functional component to be incorporated into a machine requiring completion.
- Is designed to comply with the provisions of the following EU Directives so far as their level of build will allow:

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

- Must not be put into service within the European Community ("EC") until the final machinery into which it is to be incorporated has been declared in conformity with the Machinery Directive and all other applicable EC Directives.
- Is designed and constructed to comply with the essential health and safety requirements of the Machinery Directive 2006/42/EC listed on sheet 2 of this Declaration.

The relevant technical documentation is compiled in accordance with the provisions of part B of Annex VII of the Machinery Directive. All relevant information about the partly completed machinery will be provided, in writing, on a reasoned request by the appropriate national authority to its authorised representative. 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.

The undersigned representing the manufacturer:

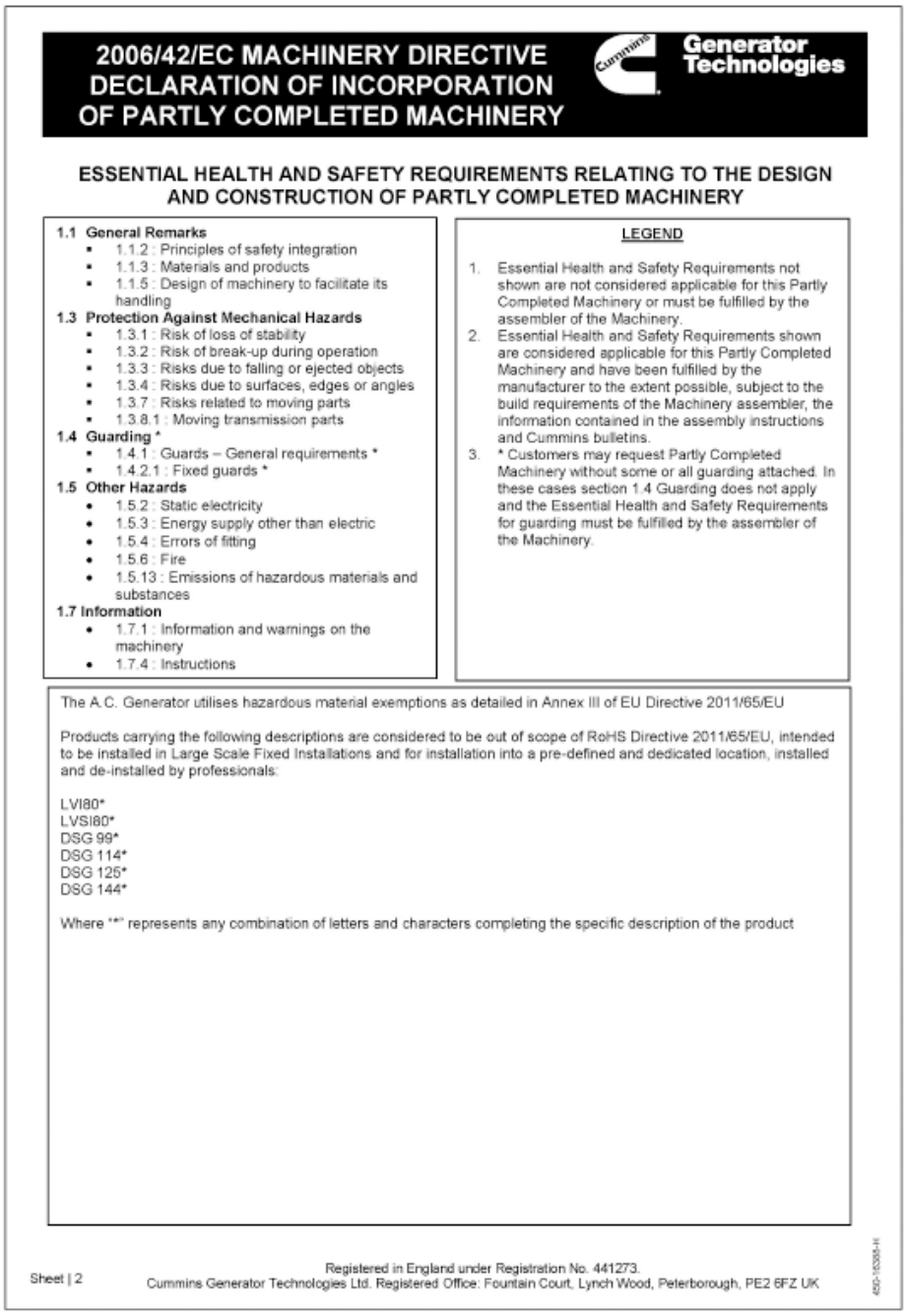
Signed:	Name, Title and Address:
A McQueen Date: 14th February 2020	Alastair McQueen Global Technical Director Cummins Generator Technologies Romania B-dul Decebal Nr. 116A 200746 Craiova Dolj, ROMANIA

Description Serial Number

Sheet | 1

Registered in England under Registration No. 441273.
Cummins Generator Technologies Ltd. Registered Office: Fountain Court, Lynch Wood, Peterborough, PE2 6FZ UK

FIGURE 5. DECLARATION OF INCORPORATION - SHEET 1



2006/42/EC MACHINERY DIRECTIVE
DECLARATION OF INCORPORATION
OF PARTLY COMPLETED MACHINERY

Generator Technologies

ESSENTIAL HEALTH AND SAFETY REQUIREMENTS RELATING TO THE DESIGN AND CONSTRUCTION OF PARTLY COMPLETED MACHINERY

1.1 General Remarks
- 1.1.2 : Principles of safety integration
- 1.1.3 : Materials and products
- 1.1.5 : Design of machinery to facilitate its handling

1.3 Protection Against Mechanical Hazards
- 1.3.1 : Risk of loss of stability
- 1.3.2 : Risk of break-up during operation
- 1.3.3 : Risks due to falling or ejected objects
- 1.3.4 : Risks due to surfaces, edges or angles
- 1.3.7 : Risks related to moving parts
- 1.3.8.1 : Moving transmission parts

1.4 Guarding *
- 1.4.1 : Guards – General requirements *
- 1.4.2.1 : Fixed guards *

1.5 Other Hazards
- 1.5.2 : Static electricity
- 1.5.3 : Energy supply other than electric
- 1.5.4 : Errors of fitting
- 1.5.6 : Fire
- 1.5.13 : Emissions of hazardous materials and substances

1.7 Information
- 1.7.1 : Information and warnings on the machinery
- 1.7.4 : Instructions

LEGEND

1. Essential Health and Safety Requirements not shown are not considered applicable for this Partly Completed Machinery or must be fulfilled by the assembler of the Machinery.
2. Essential Health and Safety Requirements shown are considered applicable for this Partly Completed Machinery and have been fulfilled by the manufacturer to the extent possible, subject to the build requirements of the Machinery assembler, the information contained in the assembly instructions and Cummins bulletins.
3. * Customers may request Partly Completed Machinery without some or all guarding attached. In these cases section 1.4 Guarding does not apply and the Essential Health and Safety Requirements for guarding must be fulfilled by the assembler of the Machinery.

The A.C. Generator utilises hazardous material exemptions as detailed in Annex III of EU Directive 2011/65/EU

Products carrying the following descriptions are considered to be out of scope of RoHS Directive 2011/65/EU, intended to be installed in Large Scale Fixed Installations and for installation into a pre-defined and dedicated location, installed and de-installed by professionals:

LVI80*
LVSI80*
DSG 99*
DSG 114*
DSG 125*
DSG 144*

Where "*" represents any combination of letters and characters completing the specific description of the product

Sheet | 2

Registered in England under Registration No. 441273.
Cummins Generator Technologies Ltd. Registered Office: Fountain Court, Lynch Wood, Peterborough, PE2 6FZ UK

450-15305-H

FIGURE 6. DECLARATION OF INCORPORATION - SHEET 2

Testing

Standard Production Test.

For all products from S0/S1 up to P7/ S7 STAMFORD | AvK have a paperless system for the production testing of component parts and final test of the complete alternator. The STAMFORD | AvK Quality Management System is based on each component test station having a pre-programmed test procedure, which operates on a *Go / No Go* control basis, with this system not issuing a test certificate.

If a customer order includes a request for ‘Factory Test Certificate’, this will be created at final point of documentation control for the alternator, prior to dispatch.

For all S9, P80 and AvK products STAMFORD | AvK provide a certificate detailing the results of the production tests.

STAMFORD | AvK test procedures comply with IEC 60034-1. The standard production test conforms to the test requirements identified in IEC 60034-1 Chapter 9.

Through compliance with the above Standard, STAMFORD | AvK also comply with BS 5000 Part 3. STAMFORD | AvK believe the requirements of any other national standards are probably covered by STAMFORD | AvK compliance with European and International Engineering Standards.

For further guidance on the testing of alternators manufactured by STAMFORD | AvK, refer to AGN007.