DNV·GL

Certificate No:
TAA00001JB
File No:
864.70
Job Id:
262.1-026365-1

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Electronic fuel injection system

with type designation(s)
ADEM III (Advanced Diesel Engine Management)

Issued to
Caterpillar Inc.
Lafayette, IN, USA

is found to comply with
Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards

Application :

Location classes can be found on page 2.

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.

This Certificate is valid until **2020-06-28**.

Issued at **Hamburg** on **2018-06-29**
DNV GL local station: **New York** for **DNV GL**

Approval Engineer: **Didier Girardin**

Joannis Papanuskas
Head of Section

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Product description

ADEM III (Advanced Diesel Engine Management) is Fuel Injection Control and Speed Governing System for the engine series **C9, C12, C18, 3500*, C280.**

*) 00 – for specific engine "00" are replaced by digits indicating number of cylinders.

The ADEM-III consists of the following hardware and software modules:

System HARDWARE location classes					
Hardware name	**Temperature**	**Humidity**	**Vibration**	**EMC**	**Enclosure**
ADEM III - Electronic Control Module (ECM)	D	B	B	A	C

System sensors location classes					
Hardware name	**Temperature**	**Humidity**	**Vibration**	**EMC**	**Enclosure**
Throtlle Sensor	D	B	B	A	C
Intake Air sensor	D	B	B	A	C
Exhaust temperature sensor	D	B	B	A	C
Aftercooler temperature sensor	D	B	B	A	C
Coolant temperature sensors	D	B	B	A	C
Fuel temperature sensor	D	B	B	A	C
Lubrication oil temperature	D	B	B	A	C
Atmospheric pressure sensor	D	B	B	A	C
Turbo inlet pressure sensor	D	B	B	A	C
Turbo outlet pressure sensor	D	B	B	A	C
Crankcase pressure sensor	D	B	B	A	C
Oil pressure sensor	D	B	B	A	C
Speed sensor	D	B	B	A	C
Timming sensor	D	B	B	A	C

ADEM III SOFTWARE	
Engines series	**Software version**
C9	**X**_C9_**Y**_ADEM III
C12	**X**_C12_**Y**_ADEM III
C18	**X**_C18_**Y**_ADEM III
3500	**X**_35**ZZ**_**Y**_ADEM III-16
C280	**X**_C280_**Y**_ADEM III-16
X – engine model designation (i.e. MAR – marine engines) **Y** – engine model specific parameters (number of cylinder, etc.) **Z** – number of cylinders (engine type) for 3500 series	

ADEM III (ECM) module place of manufacture

1. The Morey Corporation
   100 Morey Drive
   Woodbridge, IL 60517
   United States of America

Place of system manufacture

1. Caterpillar Inc.
   Lafayette, IN
   United States of America
2. Caterpillar Inc.
   Griffin, GA
   United States of America

Application/Limitation

1. This certificate is valid only for systems made and delivered by Caterpillar Inc. from production centers listed under place of system manufacture for engine series listed under product description and provided they hold a valid DNV Type Approval Certificate.
2. This Type Approval covers **only** Fuel Injection Control and Speed Governing functions of ADEM III. Other functions shall be approved and certified on case-by-case basis, like required by DNV Rules for Ships, HS, LC and NSC Pt.4 Ch.9 and DNV Offshore Standard DNV-OS-D202.
3. The system intended for single engine propulsion plant must be equipped with "back up" Engine Control Module (ECM) – dual configuration.
4. Approval of sensors are only valid in connection with this application.
5. Specifications for routine test and maintenance of sensor according to class rules to be provided by manufacturer.
6. Sufficient mechanical protection and correct installation of sensors to be verified for each installation.
7. List of control & monitored points (including alarms, shutdowns, set points, etc.) shall be according to the engine's intended function (propulsion, auxiliary genset, emergency genset, etc.) and shall comply with the vessel's main class requirements in DNV Rules for Ships, HS, LC and NSC Pt.4 Ch.3 Sec.1 Table E1, E2, E3 and, if Ship Rules and E0 notation apply, Pt.6 Ch.3 Sec.3 Tables A1 and A5. If the vessel has electric propulsion the requirements in Pt.4 Ch.8 Sec.12 shall also be taken into consideration.
8. ADEM III Fuel Injection Control and Speed Governing System shall be prepared for dual power supply.
9. In case of differences between listed below documentation required for approval and documents submitted for approval will be found, the system documentation needs to be case-by-case approved and system certification may be required. Approval fee or certification fee will be applied.Documentation required for approval in this case can be extended to what is listed in DNV Rules for Ships, HS, LC and NSC Pt.4 Ch.9 Sec.1 Table C2.
10. If, during approval or onboard survey, differences will be found between actual delivery setup (difference in alarms and safety actions, firmware versions, sensors setup, monitoring functions, etc.) and setup required by this Type Approval certificate for specific vessel notations and main class, then the system needs to be case-by-case approved and system certification may be required. Approval fee or certification fee will be appliedDocumentation required for approval in this case can be extended to what is listed in DNV Rules for Ships, HS, LC and NSC Pt.4 Ch.9 Sec.1 Table C2.

Approval conditions

The following documentation of the actual application is to be submitted for approval in each case:
- Reference to this Type Approval Certificate
- Information about engine type and intended use (propulsion, auxiliary, emergency, etc.)
- Software version used in specific delivery
- System block diagram (showing overall system layout and ECM)
- Confirmation that List of control & monitored points is like stated in Application/Limitation point 7
- Confirmation that power supply arrangement is like stated in Application/Limitation point 8

The Type Approval covers hardware and software listed under Product description.

Product certificate

As long as the units are covered by this Type Approval, a product certificate according to Pt.4 Ch.9 Sec.1 will **not be** required for system applications made and delivered according to the requirements listed under Application / Limitation (including approval documentation submittal requirements). Correct configuration and set up for each delivery to be tested during commissioning after installation.

Clause for application function control

All changes in software are to be recorded as long as the system is in use on board. The records of all changes are to be forwarded to DNV for evaluation and approval. Major changes in the software are to be approved before being installed in the computer. Certification of Application Functions may be required for specific vessel delivery.

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the type are complied with, and that no alterations are made to the product design or choice of systems, software versions, components and/or materials.

The main elements of the assessment are:

- Ensure that type approved documentation is available
- Inspection of factory samples, selected at random from the production line (where practicable)
- Review of production and inspection routines, including test records from product sample tests and control routines
- Ensuring that systems, software versions, components and/or materials used comply with type approved documents and/or referenced system, software, component and material specifications
- Review of possible changes in design of systems, software versions, components, materials and/or performance, and make sure that such changes do not affect the type approval given
- Ensuring traceability between manufacturer's product type marking and the type approval certificate

Periodical assessment is to be performed at least every second year and at renewal of this certificate.

END OF CERTIFICATE