

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Engine Safety, Control and Alarm System**with type designation(s)
SaCoS_one System

Issued to

MAN Diesel & Turbo SE
Augsburg, Germany

is found to comply with

Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards**Application :****System Certificate**This Certificate is valid until **2017-09-10**.Issued at **Høvik** on **2015-09-11**for **DNV GL**DNV GL local station: **Augsburg**Approval Engineer: **Didier Girardin**

Odd Magne Nesvåg
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

A. SaCoS_one LARGE

Product Description for SaCoS_one LARGE

SaCoS_one LARGE system is used in below applications:

- Common Rail Engines / Single & Multi Propulsion
- Common Rail Engines / Diesel Electric Plant, Auxiliary Genset
- Conventional Engines / Single & Multi Propulsion
- Conventional Engines / Diesel Electric Plant, Auxiliary Genset

Module	Drawing No	Main components			DNV TA certificate
		Function	Maker	Type	
Control Unit	11.41600-0020	Control Module terminal block terminal block	MAN WAGO WAGO	CM 280-6XX 281-6XX	A-13622 E-13275 E-13275
Injection Unit	11.14300-0148	Injection Module	MAN	IM	A-13895
Interface Cabinet	11.99100-3863	Gateway Module I/O system ethernet switch terminal block terminal block terminal block	MAN WAGO PHOENIX WAGO WAGO WAGO	GM 750-XXX 280-6XX 281-6XX 283-1XX	A-13894 A-14050 A-13936 E-13275 E-13275 E-13275
Auxiliary Cabinet	11.99100-4115	I/O system terminal block terminal block terminal block	WAGO WAGO WAGO WAGO	750-XXX 280-6XX 281-6XX 283-6XX	A-14093 E-13275 E-13275 E-13275
Local Operating Panel (LOP)	11.12500-1013	terminal block display	WAGO BEIJER	280-6XX EXTER T100	E-13275 A-14193
Remote Operating Panel (ROP)	11.99100-3714	I/O system terminal block display	WAGO WAGO BEIJER	750-XXX 280-6XX EXTER T100	A-14093 E-13275 A-14193
Extension Unit	11.41600-0498	I/O system terminal block	WAGO WAGO	750-XXX 281-6XX	A-14093 E-13275

SACOS_one LARGE System Software:

Module name	Module description	Software version
CR engines		
Control Module – CM	CM is used for control, alarm, safety functions	4.3.X
Gateway Module – GM	GM handles communication between SACOS_one and external systems.	4.3.X
Injection Module – IM	IM handles speed governing and loadsharing functions for Common rail engines	1.5.X
Display	Local and Remote Operating Panels are used for control and monitoring	3.0.X
PPN engines		
Control Module – CM	CM is used for control, alarm, safety functions	4.2.X
Gateway Module – GM	GM handles communication between SACOS_one and external systems.	4.2.X
Injection Module – IM	IM handles speed governing and loadsharing functions for Common rail engines	1.0.X
Display	Local and Remote Operating Panels are used for control and monitoring	3.0.X

X – Minor changes which not affect DNV requirements.

All software functional changes shall be reported to DNV GL for evaluation

Application/Limitation for SaCoS_one LARGE

1. Type Approval regards system design principle. Hardware is separately type approved as stated under Product Description.
2. At least two IM modules must be delivered for single common rail propulsion engines.
3. Sensors and actuators to be delivered with the engine are not covered by this certificate.
4. The system includes splash oil temperature monitoring functions. In connection with temperature monitoring of main bearings the system is suitable as substitution of an oil mist detector and the requirements of SOLAS and DNV classification rules related to prevention of crankcase explosive conditions.
5. Loadsharing functions for gensets are not covered by this Type Approval and are subject for testing in each case.
6. Dual Fuel Engines / Diesel Electric Plant, Auxiliary Genset

Approval conditions for SaCoS_one LARGE

The following documentation of the actual application is to be submitted for approval in each case:

- Reference to this Type Approval Certificate
- Software version number used in delivery
- System block diagram presenting the locations of all main components
- Power supply arrangement (may be part of the System block diagram)
- List of control and monitored points (alarms, safety actions, overrides, including signal type, range and threshold)
- Test program for certification
- Engine type name, power rating, number of cylinders, number of turbochargers or reference to relevant Type Approval Certificates
- Actuator/governor type

Product certificate

Each delivery of the application system is to be certified according to Pt.4 Ch.9 Sec.1. The certification test **is to be performed** at the manufacturer of the application system before the system is shipped to the yard. After the certification the clause for application software control will be put into force.

Clause for application software 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 GL for evaluation and approval.

Major changes in the software are to be approved before being installed in the computer.

A Certification of Application Functions may be required for the particular vessel.

Tests carried out for SaCoS_one Large

Function and failure tests at MAN Augsburg, dated 2010-06-10.

B. SaCoS_one GENSET

Product Description for SaCoS_one GENSET

SaCoS_one GENSET is used in conventional Engines for genset application for electrical propulsion and auxiliary use

SACOS_one GENSET consists of following units:

Control Module Small (CMS):

HW Type Approval: **TAA000000A**

Software Version for SaCoS_one GENSET: **1.4.X / 1.2.X**

Display Module (DM):

HW Type Approval: **TAA0000009**

Software Version for SaCoS_one GENSET: **1.4.X / 1.2.X**

1.2.X for non-propulsion application

X – Minor changes which not affect DNV requirements.

All software functional changes shall be reported immediately to DNV GL for evaluation

The engine electronic speed control is realized by Control Module Small. By standard, the conventional engines are equipped with and approved for an electro-hydraulic actuator of one of the following types:

Actuators for SaCoS_one GENSET: MAN MA 1.031-1 or MAN MA 2.031-1

Application/Limitation for SaCoS_one GENSET

1. Type Approval regards system design principle. Hardware is separately type approved as stated under Product Description.
2. Conventional Genset Engine applications are normally delivered with one DM as local operation panel including safety functions, and one CMS as control and alarm system, with possibility to perform remote control operation via additional DM units.
3. Sensors and actuators to be delivered with the engine are not covered by this certificate. Engine supplier is to ensure sensors and actuators complying with requirements in Pt.4 Ch.9 Sec.5 are delivered.
4. The system includes splash oil temperature monitoring functions. In connection with temperature monitoring of main bearings the system is suitable as substitution of an oil mist detector and the requirements of SOLAS and DNV classification rules related to crankcase explosive conditions monitoring.
5. Monitoring of both power supplies must be arranged, with corresponding alarm upon failure.
6. Loadsharing functions for gensets are not covered by this Type Approval and are subject for testing in each case.

Approval conditions for SaCoS_one GENSET

The following documentation of the actual application is to be submitted for approval in each case:

- Reference to this Type Approval Certificate
- Software version number used in delivery
- Reference to valid hardware type approval certificate numbers, if different than the ones listed under Product Description
- Software revision history document, if SW versions are different than the ones listed under Product Description
- System block diagram presenting the locations of all main components
- Power supply arrangement (may be part of the System block diagram)
- List of control and monitored points (alarms, safety actions, overrides, including signal type, range and threshold)

Job Id: **262.1-009704-4**
Certificate No: **TAA0000002**

Product certificate

As long as the units are covered by the Type Approval, a product certificate according to Pt.4 Ch.9 Sec.1 A 202 **will not be required**. Correct configuration and set up for each delivery to be tested during commissioning after installation.

Clause for application software 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 GL for evaluation and approval. Major changes in the software are to be approved before being installed in the computer. A Certification of Application Functions may be required for the particular vessel.

Tests carried out for SaCoS_one GENSET

Function and failure tests at Augsburg, dated 2010-07-08

Function and failure tests at Fredrikshavn, dated 2010-05-04

Function and failure tests in Korea, dated 2010-08-27 and 2010-10-11.

C. SaCoS_one PROPULSION

Product Description for SaCoS_one PROPULSION

SaCoS_one PROPULSION is used in conventional Engines for single/multi main engine application

SACOS_one PROPULSION consists of following units:

Control Module Small (CMS):

HW Type Approval: **TAA000000A**

Software Version for SaCoS_one PROPULSION: **1.5.X**

Display Module (DM):

HW Type Approval: **TAA0000009**

Software Version for SaCoS_one PROPULSION: **1.5.X**

Gateway Module (GM):

HW Type Approval: **A-13894**

Software Version for SaCoS_one PROPULSION: **1.5.X**

X – Minor changes which not affect DNV requirements.

All software functional changes shall be reported immediately to DNV GL for evaluation

The engine electronic speed control is realized by Control Module Small. By standard, the conventional engines are equipped with and approved for an electro-hydraulic actuator of one of the following types: Actuators for SaCoS_one PROPULSION: MAN MA1.031-1BB or MAN MA 2.030-1/BB (with mech. Backup governor)

Application/Limitation for SaCoS_one PROPULSION

1. Type Approval regards system design principle. Hardware is separately type approved as stated under Product Description.
2. Conventional Small Propulsion Engine applications are normally delivered with two DM units as local operation panels, and three separate CMS units, one for control & alarm functions, one as safety system and one additional for splash oil monitoring unit, with possibility to perform remote control operation via additional DM units.
3. Sensors and actuators to be delivered with the engine are not covered by this certificate. Engine supplier is to ensure sensors and actuators complying with requirements in Pt.4 Ch.9 Sec.5 are delivered.
4. The system includes splash oil temperature monitoring functions. In connection with temperature monitoring of main bearings the system is suitable as substitution of an oil mist detector and fulfills the requirements of SOLAS and DNV classification rules related to crankcase explosive conditions monitoring.
5. Monitoring of both power supplies must be arranged, with corresponding alarm upon failure.

Approval conditions for SaCoS_one PROPULSION

The following documentation of the actual application is to be submitted for approval in each case:

- Reference to this Type Approval Certificate
- Software version number used in delivery
- Reference to valid hardware type approval certificate numbers, if different than the ones listed under Product Description
- System block diagram presenting the locations of all main components
- Power supply arrangement (may be part of the System block diagram)
- List of control and monitored points (alarms, safety actions, overrides, including signal type, range and threshold)

- Functional description explaining exact scope of delivery (eg. gearbox control, pitch control, command transfer)
- Wiring diagrams
- Test program for certification

Product certificate

Each delivery of the application system is to be certified according to Pt.4 Ch.9 Sec.1. The certification test **is to be performed** at the manufacturer of the application system before the system is shipped to the yard. After the certification the clause for application software control will be put into force.

Clause for application software 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 GL for evaluation and approval. Major changes in the software are to be approved before being installed in the computer. A Certification of Application Functions may be required for the particular vessel.

Tests carried out for SaCoS_one PROPULSION

Function and failure tests at Augsburg, dated 2010-11-22.

Function and failure tests at Fredrikshavn, dated 2011-08-10.

D. Certificate retention survey for

- **SaCoS_one LARGE**
- **SaCoS_one GENSET**

The scope of the retention/renewal survey 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.

E. 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