DNV·GL

Certificate No:
TAA00000KD

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Electrical Measuring and Protection Relay

with type designation(s)
PPU-3 , GPU-3 - Generator Controllers and Protection, PPM-3 - Power Management System

Issued to
DEIF A/S
SKIVE, Denmark

is found to comply with
DNV GL rules for classification – Ships, offshore units, and high speed and light craft

Application :

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

Location classes:

Temperature	**B**
Humidity	**B**
Vibration	**A**
EMC	**A/B****
Enclosure	**B***

*** for display and operation panels only, for the main modules required protection according to the Rules to be provided upon installation on board**

****EMC Class B for Displays DU-2, AOP1, AOP2**

This Certificate is valid until **2018-11-13**.

Issued at **Høvik** on **2016-11-14**

for **DNV GL**

DNV GL local station: **Aalborg**

Approval Engineer: **Bartosz Kabak**

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.

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Product description

The unit is based on a compact all-in-one design which includes an LCD HMI panel that can be mounted directly on top of the base unit or in the front of e.g. a switchboard door. Two additional such displays can be installed within 200m distance of the main display unit. Additional operator panels (AOP) with 16 LEDs and 8 pushbuttons can be installed, one locally within 0.5m (AOP-1) and five within 200m (AOP-2). The units are designed for the following applications:

Generator Protection Unit (GPU-3)
combines the following functions:

- Generator and busbar protection
- Engine control and protection
- Synchronisation
- AC metering

Paralleling and Protection Unit (PPU-3)
has the following additional functions (Regulation modes):

- Loadsharing (via analogue or CANbus link)
- Fixed Power
- Fixed Frequency
- Frequency droop

Protection and Power Management system (PPM-3)
may include control and monitoring of:

- Multiple gen-sets
- Shaft generators and shore connection
- Busbars and bustie breakers
- Emergency generators

A PPM-3 system includes the following basic functions:

- All breakers can be synchronised by choice
- Load-dependent start/stop operation
- Priority selection of gen-sets
- Redundant communication between the controllers
- Plant divided into sections for individual functionality
- Load transfer
- Heavy consumer management
- Multi-master system for the following applications:
    - Diesel generator operation
    - Shaft generator operation
    - Shore connection operation
    - Split busbar(s) operation
    - Emergency/harbour generator operation

There are several additional functions available as options. Reference is made to the manufacturer's documentation.

The following alarm and protection functions as defined by ANSI are available:

ANSI no.	Function / description	PPM-3	PPU-3, GPU-3
27	Undervoltage	X	X
27	Positive sequence (mains voltage low)		X
27Q	Reactive power dependent undervoltage		X
27T	Time dependent undervoltage		X
32	Overload/Reverse Power	X	X
40	Loss of excitation/Overexcitation	X	X
40	Power dependent reactive power import/export		X
46	Negative sequence current high		X
47	Negative sequence voltage high		X

50/51	Overcurrent	X	X
50	Zero sequence current high		X
51	Inverse timer overcurrent		X
51V	Voltage-dependent overcurrent	X	X
59	Overvoltage	X	X
59	Zero sequence voltage high		X
60	Current/Voltage unbalance	X	X
67	Directional overcurrent		X
78	Vector jump		X
81	Over/Underfrequency	X	X
81R	df/dt (ROCOF)		X

The same software is installed in all units. Project specific functions are achieved by setting limits for alarms and parameters.

The software are identified by the following versions:

	PPM-3	PPU-3, GPU-3
Appl. SW	3.0x.x	3.1x.x
M4 board SW	2.0x.x	2.0x.x

Further details about the system may be found at DEIF's homepage on the Internet:
http://www.deif.com

Approval conditions

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

When the type approved software is revised (affecting all future deliveries) DNV GL is to be informed by forwarding updated software version documentation. If the changes are judged to affect functionality for which rule requirements apply a new functional type test may be required and the certificate may have to be renewed to identify the new software version.

Case-by-case:
For each delivery where the product is included (typically a switchboard) the following information related to the application system is to be submitted for approval:

- Reference to this Type Approval Certificate
- System block diagram
- Power supply arrangement (may be part of the System block diagram)
- List of hardware and software modules as identified in this Type Approval Certificate
- Functional description including functions provided through AOP(s) if applicable
- List of implemented alarm and protection functions (ref. the ANSI list above) with proposed limits and time delays
- Test program for the certification test (non-standard PPM-3) or commissioning tests (PPU-3/GPU-3/standard PPM-3)

Product certificate
For a PPU-3, GPU-3 or a standard PPM-3 system (DNV GL approved) delivery: as long as the delivered system is covered by this Type Approval, a product certificate according to Pt.4 Ch.9 Sec.1 [1.2.3] is not required. Correct configuration and set up for the delivery to be tested during commissioning after installation onboard.

For non-standard PPM-3 systems: each system to be certified according to Pt.4 Ch.9 Sec.1. The certification test is to be performed before the system is installed onboard at the company defined as responsible for the system, typically at the switchboard manufacturer. The product certificate must identify this Type Approval Certificate and the parameter settings for the specific project. After the certification the clause for application software control will be in force:

<u>Clause for application software control</u>
All changes in software and parameter settings 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 controller(s).

Application/Limitation

Rule requirements for separate prime mover safety functions are to be observed. In case the optional M4 board is fitted to perform these functions the safety stop circuit is to be independent of the normal stop circuit, e.g. separate stop coils are to be arranged.

For high speed vessels category B (ref. Pt.4 Ch.8 Sec.2 [6.1]) the PPM-3 system must be configured so as to ensure that the power management functions are active for each busbar section when the bustie breaker is open. Also, the communication network between DGUs for one busbar section must not be affected by a defective communication network for the other busbar section.

Type Approval documentation

Tests carried out

Applicable tests according to Standard for Certification No. 2.4, April 2006.
Functional Type Tests on a representative system (4 diesel generators, one shaft generator, one emergency generator/bus, one bustie breaker, one shore connection) at DEIF's test bench during 2007.05.19-20.
Functional Type Tests for two of four standard PPM-3 systems, 2xDG-BTB-SG/SC and 4xDG-BTB at DEIF's test bench on 2010-10-07

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