Certificate no.:
TAM00001CT

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Gas Turbine Enclosure

with type designation(s)
SGT-400 Package

issued to
Siemens Energy Industrial Turbomachinery Ltd
Lincoln, **United Kingdom**

is found to comply with
DNV rules for classification – Ships

Application:

Approved for used as a gas turbine enclosure for gas turbine fuelled with fuel oil and natural gas.

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

Issued at **Høvik** on **2025-01-08**
This Certificate is valid until **2030-01-07**.
DNV local unit: **UK & Ireland CMC & VMC**

for **DNV**

Approval Engineer: **Terje Ingvar Arvidsen**

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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.

Product description

"SGT-400 package" consists of an enclosed gas turbine engine including gearbox. In addition, the enclosure contains auxiliary and safety systems.
Auxiliary systems are the ventilation system, lubricating oil system, fuel system, starting system and seal system.
Safety systems are gas detection system, fire detection system and fire extinguishing systems and an integrated control and safety system.

The gas turbine engine package is designed for operation on fuel oil or natural gas.

Application/Limitation

Approved for used as a gas turbine enclosure for gas turbine fuelled with fuel oil or natural gas.

The SGT-400 package can be used for propulsion or power generation. To fulfil requirements for redundancy a minimum of two independent power sources shall be installed on a vessel. This implies redundancy type 2 with time lag in re-establishment of function up to 10 minutes, (DNV-RU-SHIP Pt.4 Ch.1 Sec.1, table 1).

The gas turbine package shall be used for SGT-400 15MW or SGT-400 13MW. The limitation for the gas turbine core engine and performance and mass data for core engine (GG and PT) is given in the type approval certificate for the core engine, ref. DNV type approval certificate TAM00001AK.

Control and monitoring system is covered by a separate DNV Type Approval Certificate, TAA00003B2.

Application constraints	
Subject	**Value**
Max allowable list (degrees)	+/- 15
Max allowable trim (degrees)	+/- 1.7
Max allowable roll (degrees/s)	+/- 22.5
Max allowable pitch (degrees/s)	+/- 7.5
Max allowable shear force on PT output shaft (N)	500
Max allowable axial force on PT output shaft (N)	3100
Max allowable bending moment at PT output shaft (Nm)	135
Max allowable acceleration load, vertical (heave)	1g +/- 0.51g
Max allowable acceleration load, transverse (sway)	+/- 0.46g
Vertical 1g +/- 0.51g in combination with Longitudinal +/- 0.11g	
Vertical 1g +/- 0.51g in combination with Transverse +/- 0.46g	
Vertical 1g +/- 0.51g in combination with Transverse +/- (0.6 x 0.46g) = 0.28g and Longitudinal +/- (0.6 x 0.11g) = 0.07g	
Fuel type designation [1)]	
Max allowable salt content in inlet air (wppm) [2)]	

[1)] Gas Fuel in accordance with Siemens Energy specification 65_0027_02 'Specification for Gaseous Fuels' and Liquid Fuel in accordance with Siemens Energy Specification 65_0027_03 'Specification for Liquid Fuels

[2)] This is defined in Siemens Energy specification 65_0027_02 ' and paragraph 2. a) iv): 'the air filtration system shall not pass greater than 0.01 ppmm (parts per million by mass) salt when tested using a 30 knot aerosol holding 3.6 ppmm salt (as per NGTE test, now Defence and Evaluation Research Agency).

Documentation for approval for specific vessel:

Each package shall be delivered with the following documentation by the specified party:

1. For package (SE supply to ship owner / shipyard)

   - Gas Fuel System P&ID
   - Hazardous Area Diagram – SGT-400 Marine Propulsion Specific
   - Gas detection system C&E
   - High pressure gas fuel piping stress analysis
   - Turbine Package Piping & Instrumentation Diagram
   - Fire & Gas System Piping & Instrumentation Diagram
   - Tyco CO2 Fire Extinguishant Cabinet GA Drawing

- Tyco Commissioning, Operating and Maintenance Handbook - CO2 Extinguishant Skid
- Product certificate for gas control and monitoring system as per Type Approval Certificate TAA00003B2

2. On-board installation (Shipyard supply to approval authority)

- Hazardous area classification (including the hazardous areas generated by the enclosure)
- Fuel gas system P&ID (integrating with package and master gas valve assembly part of SE scope)
- Fuel gas system pipe routing sketch (including the vent pipes in SE scope)
- Ventilation system for gas fuel system spaces (integrating with the enclosure)
- Hydrocarbon gas detection and alarm system (fixed) arrangement plan (showing the detectors inside enclosure)
- Fuel gas safety system cause & effect diagram (integrating with the package)
- Fuel gas system operation manual as required by IGF Code Ch.18 (including gas turbine enclosure)
- Engine room arrangement plan (showing the gas turbine enclosure)
- Fire detection and alarm system (showing the detectors inside enclosure)

3. Supporting documentation (SE supply / Shipyard supply to the attending Surveyor onboard)

- Hydrostatic test report for fuel gas piping inside enclosure.
- Compliance documentation for fuel gas piping, valves, fittings and other components in accordance with DNV-RU-SHIP Pt.6 Ch.2 Sec.5 Table 3 and Table 4.
- Compliance documentation for auxiliary systems in accordance with DNV-RU-SHIP Pt.4 Ch.6 Sec.1 Table 4.
- List or schedule of Ex equipment in accordance with DNV-RU-SHIP Pt.4 Ch.8 sec.11 Table 1.
- Overall electrical single line diagram showing power system layout with identification of generator, transformers, switchboards/ distribution boards, frequency converters, major consumers as relevant.

Application/Special conditions:

- Gas turbine enclosure is considered as a secondary enclosure, and therefore, classified as Zone 1 hazardous area. SGT-400 gas turbine has a surface temperature below 480°C, all electrical equipment inside the enclosure is certified to Zone 1 standards, and there is no mechanical source of ignition. Secondary protection is provided by dilution ventilation by the airflow.
- Compliance with approved single line diagrams and table of Ex-installations shall be stated, or updated documents for the application shall be submitted.
- Component certification for subsystems is applicable as described in DNV-RU-SHIP Pt.4 Ch.8 Sec.1 Table 8.
- The electrical systems shall be inspected and tested by a DNV surveyor to confirm compliance with DNV-RU-SHIP Pt.4 Ch.8.
- The following design aspects are application dependent, and documentation must be submitted to DNV for each application:
    - Vibration analysis for complete drive train including propeller, if applicable.
    - Anti-icing system, if applicable
    - Specification of water wash system, if applicable

Ship specific arrangements:

- When gas turbine enclosure is installed inside a gas safe machinery space containing other gas consumers, an automatically operated master gas valve assembly shall be installed in the part of the fuel gas piping outside the machinery space. The gas safety actions will be the same as the master gas valve assembly supplied by SE.
- Secondary enclosure shall be arranged around the master gas valve (Off-skid Double-Block-and-Bleed assembly) not included in SE scope of supply.
- Ventilation inlet and outlet for gas turbine enclosure shall be located in open air.
- Remote release of CO_2 system to be located outside engine room contained the SGT-400 package.

Certification

- A DNV survey report confirming that the package has been manufactured in accordance with the type approval shall accompany each package and be available onboard the vessel where the package is fitted.
- Each delivery shall consider any specific requirement from the intended vessel's flag state.
- Valid certificates (MED or DNV TA) for the following components shall accompany each package and be available onboard the vessel where this package is fitted:
    a) All insulation on ship to be non-combustible SOLAS Reg II-2/5.3.1.1.
    b) Flame detector
    c) Smoke and heat detector

d) Gas detector

- CO_2 manifold and CO_2 agent cylinders are to be delivered with product certificates. CO_2 flexible hoses are to be delivered with valid type approval certificates.
- Pipes and fittings in fuel system shall be delivered with certification in accordance with DNV-RU-SHIP Pt.6 Ch.2 Sec.5 [1.7] Table 4.
- Valves in fuel system (with design temperature below 0°C or design pressure above 10 bar) shall be delivered with a Product Certificate.
- Electric motor starters used in gas supply systems and ventilation systems shall be certified in accordance with DNV-RU-SHIP Pt.4 Ch.8 (>100 kW/kVA).

Type Approval documentation

Marking of product
The product shall be marked with the manufacturer's name or trademark and type number identification.

Periodical assessment
Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

In case where the type approved product is manufactured at other companies, the periodical assessment shall verify that the type approval applicant has a quality control system for consistent production at their licensees/subcontractors. Furthermore periodical assessment shall be carried out randomly at these companies.