



RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER

No. 315-05-1196c

dated 25.02.2019

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2019, ND No.2-020101-114-E

Item(s) of supervision:

valve-type generator sets

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Appendix(-ces):

text of amendments to Part XI "Electrical Equipment"

Director General

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Text of CL:

We hereby inform that based on the results of the scientific research Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships shall be amended as specified in the Appendix to the Circular Letter.

It is necessary to do the following:

1. Bring the content of the Circular Letter to the notice of the RS surveyors, interested organizations and persons in the area of the RS Branch Offices' activity.
 2. Apply the provisions of the Circular Letter.
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List of amended and introduced paras/chapters/sections (to specify in the List of Circular Letters (form 8.3.36)):

Part XI: Section 23

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RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS
ND No. 2-020101-114-E

Part XI. ELECTRICAL EQUIPMENT

A new **Section 23** shall be introduced reading as follows:

"23 SPECIAL REQUIREMENTS FOR VALVE-TYPE GENERATOR SETS

23.1 GENERAL

23.1.1 Unless otherwise specified in this Section, drive movers of valve-type generator sets shall comply with the requirements of Part IX "Machinery", generators and semiconductor converters - with the requirements of this Part and control system - with Part XV "Automation".

The manufacturer shall take into consideration the nature of physical processes in the equipment being part of valve-type generator sets and shall ensure its compatibility and system integration.

23.1.2 Alternating and direct current valve-type generator sets may be used as the main electrical power source. As an emergency electrical power source, the valve-type generator sets may be used only in the ship electric power system with electrical power distribution for direct current.

23.1.3 In addition to the list given in 1.4.2, prior to survey of electrical equipment during the manufacture, the calculations shall be submitted to the Register for consideration to confirm the absence of mechanical resonance across the operating speed variation range of the valve-type generator set from the minimum to the maximum values, or else the near resonance frequencies shall be excluded from the rotational speed control law.

23.2 DEFINITIONS AND EXPLANATIONS

23.2.1 The following definitions and explanations have been adopted in this Section.

Valve-type generator means an equipment system consisting of rotating electric engine, semiconductor converter and control system intended for generation of electrical power as part of the ship electric power system.

Alternating current valve-type generator means the valve-type generator consisting of a rotating electric engine, semiconductor converter (or inverter) and control system intended for generation of alternating electrical power.

Direct current valve-type generator means the valve-type generator consisting of a rotating electric engine, semiconductor converter (or inverter) and control system intended for generation of direct current electrical power.

Valve-type generator set means a unit consisting of the valve-type generator and prime (drive) heat mover.

Voltage regulator of semiconductor converter means a device being a part of the semiconductor converter of the alternating or direct current valve-type generator set intended for voltage control.

Voltage frequency regulator of semiconductor converter means a device being a part of the semiconductor converter of the alternating current valve-type generator set intended for output voltage frequency control.

23.3 DRIVE (PRIME) MOVERS

23.3.1 Internal combustion engine, steam turbine, gas-turbine engine or other source of mechanical energy, accepted for application on board the ships by these Rules, may be used as a prime mover in the valve-type generator set.

23.4 GENERATORS

23.4.1 Synchronous generator with electromagnetic excitation, synchronous generator with permanent magnets, asynchronous generator, direct current commutator-type generator or other type of electric machines, accepted for application on board the ships by these Rules, may be used as an electrical generator in the valve-type generator set.

23.4.2 A generator being a part of the valve-type generator set shall be calculated for the estimated level of higher harmonic components induced by operation for the semiconductor converter. When calculating the rated power of the generator of the valve-type generator set, the sufficient output reserve shall be provided to prevent the generator temperature rise, compared with sinusoidal load.

23.4.3 As regards the valve-type generator set based on the synchronous generators with permanent magnets not capable of field suppression the measures shall be provided for rapid deceleration of the generator shaft in case of inner short circuits in the generator or semiconductor converter, or other additional measures for field suppression or emergency localization shall be provided.

23.5 SEMICONDUCTOR CONVERTERS

23.5.1 Semiconductor rectifiers, inverters, frequency converters, d.c. converters may be used as a semiconductor converter in the valve-type generator set.

23.5.2 Where necessary, the valve-type generator set shall contain the required devices (noise limiters) limiting the distortion level of the generating voltage curve to ensure compliance with the requirements of 2.2.1.3.

23.5.3 When a mains-controlled semiconductor converter is used in the alternating current valve-type generator set, the measures shall be provided for ensuring its reactive power necessary for commutation of the rectifiers, for example, by means of installation of a synchronous compensator.

23.5.4 Direct current valve-type generator set intended for operation as a part of the ship electric power system with electrical power distribution for direct current shall also comply with the requirements of Section 22.

23.6 COOLING AND LUBRICATING SYSTEMS

23.6.1 For calculating the cooling and lubricating systems of drive movers and generators of the valve-type generator set, decrease of cooling medium and lubricant feed from the appurtenant machinery at the reduction of rotation speed as compared with the rated one shall be considered.

23.7 VOLTAGE REGULATION

23.7.1 The valve-type generator set shall contain a generator voltage regulator and/or semiconductor converter voltage regulator.

23.7.2 On changing of the prime mover rotation speed in accordance with the accepted algorithms, the generator voltage regulator and/or semiconductor converter voltage regulator shall ensure the regulation performance of the output voltage of the valve-type generator set complying the requirements of 10.6 and 10.7.

23.8 SPEED REGULATION

23.8.1 Drive mover of the valve-type generator set shall be fitted with speed limiter. The requirements for the speed limiter of the prime mover shall be specified by the manufacturer of the valve-type generator set based on the accepted algorithms of speed regulation.

23.8 VOLTAGE FREQUENCY REGULATION

23.9.1 Semiconductor frequency converter being a part of the alternating current valve-type generator set shall be fitted with a frequency regulator that shall ensure regulation performance of the output frequency of the valve-type generator set in compliance with the requirements of 2.11.3, Part IX "Machinery".

23.10 PROTECTIVE DEVICES

23.10.1 For valve-type generator set, at least the following protective devices shall be provided.

For generator:

from overloads;

from short circuits;

from inner short circuits for generators with the power output of 1000 kVA.

For semiconductor converter:

from minimum input voltage;

from maximum input voltage;

from maximum voltage in direct current link (if present);

from power modules overheating;

from overloads;

from inner short circuits;

from an output short circuit.

23.10.2 Valve-type generator sets shall withstand short circuits at the switchboard busbars undamaged. At the short circuit in the ship power mains the valve-type generator (synchronous condenser) shall ensure the short circuit current value sufficient for the activation of protective devices, or else other technical measures ensuring the activation of such devices shall be provided.

23.11 OVERLOAD

23.11.1 All power elements of a valve-type generator set, including generators and semiconductor converters, shall have the overload capacity complying with the requirements of 10.5.

23.12 SYNCHRONIZATION

23.12.1 Alternating and direct current valve-type generator sets shall be capable of synchronizing and continuously operating in parallel with other generator sets, including those of valve type.

23.12.2 Synchronization of a valve-type generator set shall be ensured by the impact on the voltage regulator of the generator and/or semiconductor converter, and in case of an alternating current valve-type generator set – also by the impact on the voltage frequency regulator of the semiconductor converter.

23.13 POWER DISTRIBUTION WHEN OPERATING IN PARALLEL

23.13.1 When a valve-type generator set operates in parallel with another generator set, including that of a valve type, distribution of active power not in proportion with the rated power output of prime movers is permitted, provided the required ship power mains voltage is ensured, at gradual or abrupt load change and/or variation in the rotational speed of the prime mover.

23.13.2 When a valve-type generator set operates in parallel with another generator set, including that of a valve type, distribution of reactive power not in proportion with the rated power output of prime movers is permitted, provided the required ship power mains voltage is ensured, at gradual or abrupt load change and/or variation in the rotational speed of the prime mover.

23.14 CONNECTION DIAGRAMS AND OPERATION MODES

23.14.1 Bypass circuit connection.

23.14.1.1 Alternating current valve-type generator set with electromagnetic excitation may have a bypass circuit allowing to connect the generator to the switchboard directly, not via a semiconductor converter. In case of bypass circuit connection, the generator set shall operate at a constant rotational speed across the load variation range and comply with the requirements of this Part for power sources operating at a constant speed.

23.14.1.2 Maintaining the constant ship power mains voltage frequency while operating via a bypass circuit is ensured by means of a prime mover speed regulator, maintaining voltage – by means of a generator voltage regulator.

23.14.1.3 Transfer from bypass circuit to semiconductor converter operation (and vice versa) shall be performed while maintaining the connection of the generator set to the switchboard. Disconnection is permitted, provided no overload of other power sources operating at the switchboard busbars is caused.

23.14.2 Motor operation mode.

23.14.2.1 Valve-type generator may operate in the motor mode, if such operation mode is provided for the semiconductor converter, generator and other elements.

23.14.2.2 Motor operation mode is possible for shaft generators either autonomously or together with the main engine for the propeller if fed from other ship power sources.

23.14.2.3 A generator may be used in motor operation mode for the starting of the prime mover of the valve-type generator set using power generated by other mains power sources and then switching into the generator mode. When starting, the parameters of power supply in the ship mains shall comply with the requirements of 2.1.3. In this case, a compressed starting air system or another main starting method shall be invariably provided for the valve-type generator set.

23.15 MEASUREMENT INSTRUMENTS

23.15.1 For each alternating current valve-type generator the following measurement instruments shall be installed at the switchboard:

- .1 an ammeter with a selector switch for generator current measurement in each phase;
- .2 an ammeter with a selector switch for converter output current measurement in each phase;
- .3 a voltmeter with a selector switch for measurement of generator line voltages;
- .4 a voltmeter with a selector switch for measurement of line voltages at the converter output;
- .5 a frequency indicator at the generator output;
- .6 a frequency indicator at the converter output;
- .7 a wattmeter at the generator output;
- .8 a wattmeter at the converter output;
- .9 a tach-generator.

23.15.2 For each direct current valve-type generator (with an alternating current generator and a semiconductor rectifier) the following measurement instruments shall be installed at the switchboard:

- .1 an ammeter with a selector switch for generator current measurement in each phase;
- .2 an ammeter with a selector switch for converter output current measurement in each phase;
- .3 a voltmeter with a selector switch for measurement of generator line voltages;
- .4 a voltmeter for measurement of direct current voltages at the converter output;
- .5 a frequency indicator at the generator output;
- .6 a wattmeter at the generator output;
- .7 a wattmeter at the converter output;
- .8 a tach-generator."