RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER **No. 315-07-1365c** dated 25.03.2020

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2020, ND No. 2-020101-124-E

Item(s) of supervision:

dynamic positioning systems

Entry-into-force date: **from the date of publication** Valid till:**-** Validity period extended till: **-**

Cancels / amends / adds Circular Letter No. **-** dated **-**

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Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Part I "Classification" and Part XV "Automation"

Director General Konstantin G. Palnikov

Text of CL:

We hereby inform that referring to IMO circular MSC.1/Circ.1580 "Guidelines for Vessels and Units with Dynamic Positioning (DP) Systems" the Rules for the Classification and Construction of Sea-going Ships shall be amended as specified in the Appendices 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 during review of the design documentation on ships, during survey of ships under construction and in service, during review and approval of the technical documentation on equipment/products installed on board the ships contracted for construction or conversion on or after 01.05.2020.

List of the amended and/or introduced paras/chapters/sections:

Part I: paras 3.2.8.1.5 — 3.2.8.1.9, 3.2.8.2.11 — 3.2.8.2.17, 3.3.8.11, 3.3.8.14 — 3.3.8.16, 3.4.8.2 — 3.4.8.6 and 3.5.3

Part XV: Section 8

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Appendix 1 to Circular Letter
No. 315-07-1365c dated 25.03.2020

Information on amendments introduced by the Circular Letter
(for inclusion in the Revision History to the RS Publication)

Nos.	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
1	Part I, para 3.2.8.1.5	Requirements for plan approval documentation on dynamic positioning systems have been specified	315-07-1365c of 25.03.2020	01.05.2020
2	Part I, paras 3.2.8.1.6 — 3.2.8.1.9	New paras 3.2.8.1.6 and 3.2.8.1.7 containing requirements for plan approval documentation on dynamic positioning systems have been introduced. Existing paras 3.2.8.1.6 and 3.2.8.1.7 have been renumbered 3.2.8.1.8 and 3.2.8.1.9 accordingly	315-07-1365c of 25.03.2020	01.05.2020
3	Part I, paras 3.2.8.2.11 — 3.2.8.2.17	New paras containing requirements for plan approval documentation on dynamic positioning systems have been introduced	315-07-1365c of 25.03.2020	01.05.2020
4	Part I, para 3.3.8.11	Requirements for technical design documentation on dynamic positioning systems have been specified	315-07-1365c of 25.03.2020	01.05.2020
5	Part I, paras 3.3.8.14 — 3.3.8.16	New paras containing requirements for technical design documentation on dynamic positioning systems have been introduced	315-07-1365c of 25.03.2020	01.05.2020
6	Part I, paras 3.4.8.2 — 3.4.8.6	New paras containing requirements for detailed design documentation for a ship under construction regarding dynamic positioning systems have been introduced	315-07-1365c of 25.03.2020	01.05.2020
7	Part I, para 3.5.3	New para containing requirements for programmes of mooring and sea trials of ships with distinguishing marks **DYNPOS-2** or **DYNPOS-3** in the class notation has been introduced	315-07-1365c of 25.03.2020	01.05.2020
8	Part XV, Section 8	Section has been completely amended considering IMO circular MSC.1/Circ.1580	315-07-1365c of 25.03.2020	01.05.2020

Appendix 2 to Circular Letter
No. 315-07-1365c dated 25.03.2020

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2020,

ND No. 2-020201-124-E

PART I. CLASSIFICATION

3 TECHNICAL DOCUMENTATION

1 **Para 3.2.8.1.5** is replaced by the following text:

"**.5** technical background containing the design intent of a dynamic positioning system with indication of the equipment redundancy level for ships with distinguishing marks **DYNPOS-2** or **DYNPOS-3** in the class notation, with substantiation of the worst-case failure design intent when, after occurrence of the worst-case failure, the ship will be able to keep position and/or heading in the specified environmental conditions (**);".

2 **New paras 3.2.8.1.6 and 3.2.8.1.7** are introduced reading as follows:

"**.6** general arrangement plan of the dynamic positioning system equipment including thrusters, switchboards and panels of dynamic positioning system with indication of main and back-up (if any) control stations, position reference systems and external force sensors (*);

.7 drawings of cable runs (power and control cables) with indication of their penetrations through watertight and fire-resisting bulkheads of ships with distinguishing mark **DYNPOS-3** in the class notation (*);".

3 **Existing paras 3.2.8.1.6** and **3.2.8.1.7** have been renumbered **3.2.8.1.8** and **3.2.8.1.9**, accordingly.

4 **New paras 3.2.8.2.11 — 3.2.8.2.17** are introduced reading as follows:

"**.11** technical background with description of operating conditions, operating principle, operating modes, with substantiation of dynamic positioning system redundancy level according to a distinguishing mark to be added to the class notation (**);

.12 failure modes and effects analysis (FMEA, refer to 8.2.1 of Part XV "Automation") of dynamic positioning system taking into account the design intent as specified in 3.2.8.1.5 (**);

.13 list of critical components of dynamic positioning system (**);

.14 blackout recovery procedure for dynamic positioning system (**);

.15 capability plots demonstrating ship's position keeping capacity at least for fully effective dynamic positioning system and post worst-case failure condition for particular environmental conditions (**);

.16 functional diagrams of computer-based dynamic positioning control system with indication of inputs and outputs with feedbacks and power supplies (*);

.17 drawings of panels of main and back-up (for **DYNPOS-3**) control stations of dynamic positioning system with indication of location of controls, thruster emergency stops, alarm devices, indicators and internal communications (*).".

5 **Para 3.3.8.11** is replaced by the following text:

"**.11** technical background containing the design intent of a dynamic positioning system with indication of the equipment redundancy level for ships with distinguishing marks **DYNPOS-2** or **DYNPOS-3** in the class notation, with substantiation of the worst-case failure design intent when, after occurrence of the worst-case failure, the ship will be able to keep position and/or heading in the specified environmental conditions (**);".

6 **New paras 3.3.8.14 — 3.3.8.16** are introduced reading as follows:

"**.14** general arrangement plan of the dynamic positioning system equipment including thrusters, switchboards and panels of dynamic positioning system with indication of main and back-up (if any) control stations, position reference systems and external force sensors (*);

.15 drawings of cable runs (power and control cables) with indication of their penetrations through watertight and fire-resisting bulkheads of ships with distinguishing mark **DYNPOS-3** in the class notation (*);

.16 drawings of panels of main and back-up (for **DYNPOS-3**) control stations of dynamic positioning system with indication of location of controls, thruster emergency stops, alarm devices, indicators and internal communications (*).".

7 **New paras 3.4.8.2 — 3.4.8.6** are introduced reading as follows:

"**.2** failure modes and effects analysis (FMEA, refer to 8.2.1 of Part XV "Automation") of dynamic positioning system taking into account the design intent as specified in 3.3.8.11 (**);

.3 list of critical components of dynamic positioning system (**);

.4 capability plots demonstrating ship's position keeping capacity at least for fully effective dynamic positioning system and post worst-case failure condition for particular environmental conditions (**);

.5 functional diagrams of computer-based dynamic positioning control system with indication of inputs and outputs with feedbacks and power supplies (*);

.6 blackout recovery procedure for dynamic positioning system (**).".

8 **New para 3.5.3** is introduced reading as follows:

"**3.5.3** Programmes of mooring and sea trials of ships with distinguishing marks **DYNPOS-2** or **DYNPOS-3** in the class notation shall contain complete tests of the dynamic positing system including the tests to verify FMEA provisions.".

PART XV. AUTOMATION

8 DYNAMIC POSITIONING SYSTEMS

9 **Section 8** is replaced by the following text:

"**8 DYNAMIC POSITIONING SYSTEMS**

8.1 APPLICATION AND MARKS IN CLASS NOTATION

8.1.1 The requirements of this Section apply to the following:

electric and electronic equipment of the dynamic positioning systems;

automated control systems for thruster units;

ship systems affecting dynamic positioning system operation as specified in 8.14.1.

8.1.2 Observance of the requirements of this Section and applicable requirements of other sections of this Part is mandatory for ships, which are assigned in compliance with 2.2.9, Part I "Classification", one of the following marks: **DYNPOS-1**, **DYNPOS-2** or **DYNPOS-3**, added to the class notation.

8.2 DEFINITIONS AND EXPLANATIONS

8.2.1 Dynamic positioning control system (DP control system) means a computer-based programmable system intended for automatic and remote automated control of the auxiliary thrusters, propulsion plants, steering gear, if part of the dynamic positioning

system, in order to dynamically keep position and/or heading of the ship with prescribed accuracy under the action of disturbing environmental forces, and consisting of the following:

computer-based system with associated software and interfaces for generation of control signals in automatic mode or with the use of a single control device (joystick);

operator panel system with controls and data displays;

position reference systems;

external force sensors;

power cabling;

information and control cabling.

Dynamic positioning operation (DP operation) means using the dynamic positioning system to control at least two degrees of freedom in the horizontal plane automatically.

Dynamic positioning system (DP system) means the complete installation intended for control of power supply system of the ship, auxiliary thrusters, propulsion plants, steering gear, if part of the dynamic positioning system, in order to dynamically keep position and/or heading of the ship with prescribed accuracy under the action of disturbing environmental forces.

The dynamic positioning system shall comprise, but not be limited to, the following main systems:

power supply system;

thruster system;

dynamic positioning control system.

Failure modes and effects analysis (FMEA) of dynamic positioning system of ships with distinguishing marks **DYNPOS-2** or **DYNPOS-3** in the class notation means a systematic analysis of all potential failures and effects with respect to ship systems and sub-systems, individual machinery items and devices involved in ship dynamic positioning operations carried out to a level of detail that is required to demonstrate that no single failure will cause a loss of position and/or heading as per the worst-case failure design intent.

Hidden failure means a failure that is not immediately evident to dynamic positioning system operator or maintenance personnel and has the potential for failure of equipment to perform a dynamic positioning control system on-demand function (back-up devices, systems and sub-systems of the dynamic positioning system, protective devices for diesel-generator plants, protective devices in main switchboard and switchboards, back-up power supplies, other equipment of the dynamic positioning system).

Independent joystick system means a system for automated control of thruster system using one control providing remote automated positioning control and automatic heading control. The system shall be independent of the main or back-up dynamic positioning control system and shall have its own UPS.

Joystick system means a system for remote automated control of thruster system using one control and providing remote automated positioning and remote automated or automatic heading control.

Loss of position and/or heading of the ship means that the ship's position and/or heading is outside the limits set for carrying out the dynamic positioning activity in progress.

Main dynamic positioning control station (main DP control station) means an operator workstation designated for dynamic positioning operations, which is equipped with control panels, ensures a good view of the ship's exterior limits, and where dynamic positioning control system panels and displays are installed, as well as relevant devices for automatic and joint automated control and devices for separate remote control of thrusters, propulsion plants, steering gear, if part of the dynamic positioning system, emergency stop devices for propulsion plant and thrusters, independent joystick system, devices for switching between control systems, necessary information sources, such as indicators and displays, position reference systems, alarm panels, communication systems.

Power supply system means the system necessary to supply the dynamic positioning system with power under all operating conditions including emergency ones and comprising:

prime movers of generators with necessary piping and auxiliary systems including fuel, cooling, lubrication oil, hydraulic, pneumatic and pre-heating systems;

generators;

switchboards;

cabling;

independent power supplies, including uninterruptible power supplies;

power management systems.

Redundancy of dynamic positioning system means duplication or multiple redundancy of its components, at which an installation consisting of an power supply system and thruster units with their individual control systems is functioning under control of a computer-based system in such a way that failure of particular control systems, particular thruster units or components of the power supply system does not affect the performance of the task to ensure the ship position keeping and/or heading holding.

Ship dynamic position and/or heading keeping means maintaining a desired position and/or heading within the required accuracy and under specified environmental conditions.

Single failure in dynamic positioning system means a failure in active components and/or passive elements of a dynamic positioning system, as defined in 8.5.5 and 8.5.6.

Thruster system means the system intended for providing adequate thrust in longitudinal and lateral directions at each instant of time as well as yawning moment which can compensate for the environmental factors affecting the ship.

The system shall comprise the following items:

thrusters with drives and auxiliary equipment including hydraulic piping and tanks (if any);

main propulsion plant of the ship with supporting systems and steering gear if under the dynamic positioning system control;

means for individual manual control of each propulsion unit, steering gear and thruster; and

associated cabling connecting all system's machinery and systems to the dynamic positioning control system.

Worst-case failure (WCF) means the identified single fault in the dynamic positioning system resulting in maximum detrimental effect on the dynamic positioning system capability to maintain a desired position and/or heading of ship as determined through the FMEA.

Worst-case failure design intent (WCFDI) means the specified minimum dynamic positioning system capabilities to be maintained following the worst-case failure. The worst-case failure design intent is used as the basis of the design. This usually relates to the number of thrusters and generators that can simultaneously fail.

8.3 SCOPE OF SURVEYS

8.3.1 The following equipment of the DP system is subject to survey during manufacture and on board:

electric machines and electric machine converters of ship’s power supply system;

electric drives of propulsion units, steering gear and thrusters;

power static semi-conductor converters and transformers;

switchboards;

switchgear and control gear and protective devices;

uninterruptable power supply arrangements;

power and control, including information, cabling;

control and monitoring consoles of dynamic positioning control system;

computers and computer-based systems with software;

ship's position reference systems;

external force sensors.

8.4 TECHNICAL DOCUMENTATION REVIEW

8.4.1 Prior to commencement of survey of DP system equipment and in addition to the information specified in 1.4 hereof, the following documentation shall be submitted to the Register for review:

Table 8.1.4

List of documentation for products

Equipment/ system	Name of documentation	Description	Distinguishing mark in class notation
Dynamic positioning control system	Technical description**	Technical description shall contain information as follows: description of the DP control system operating modes; description of interaction with ship systems including control system for ship's power supply system (response times, positioning accuracy, operating conditions, etc.); list of redundant equipment in compliance with the requirements covered by class notation; functional diagram of the system; list of system components (control stations, position reference systems, etc.); description of self-check system and alarm and monitoring system within dynamic positioning control system, list of the alarm and monitoring system signals; user interface description;	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
		description of software solutions responsible for function of continuous analysis which provides verification that the ship will remain in position and/or heading will be maintained if the worst-case failure occurs under current environmental conditions as well as simulation of the DP system behaviour following the worst-case failure based on the manual input of environmental condition data; DP capability plots demonstrating position keeping capacity at least for fully effective DP system and following a single worst-case failure in DP system, as determined through the FMEA	**DYNPOS-2** **DYNPOS-3**
	Software description**	This document shall contain as follows: list of software modules specifying their purposes; protection measures against unauthorized modification of software; protection measures against modifications of settings; record keeping and procedure of software updating; methods and programme for software testing	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Schematic and functional diagrams*	DP control system diagrams with indication of inputs and outputs, feedbacks and power supplies	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Failure modes and effects analysis (FMEA)**	The document shall specify analysis of possible failures and their effects to confirm compliance with the requirements in the ship class notation	**DYNPOS-2** **DYNPOS-3**
	Procedure for DP system recovery**	Blackout recovery procedure for dynamic positioning system	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Factory testing programme*		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**

Equipment/ system	Name of documentation	Description	Distinguishing mark in class notation
	Programme of mooring and sea trials*	The document shall include testing procedures to verify the system functioning in all operating conditions as well as to check all FMEA provisions (for systems **DYNPOS-2, DYNPOS-3**)	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Operation manual**	Operation manual, equipment installation instruction and maintenance instruction may be combined to form one document	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Equipment installation instruction**		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Equipment maintenance instruction**		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
Independent joystick system	Technical description**	Technical description shall contain information as follows: description of the system operating modes; system performance (reaction times, positioning accuracy, operating conditions, etc.); functional diagram of the system*; list of the system components; user interface description	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Software description**	This document shall contain as follows: list of software modules specifying their purposes; protection measures against unauthorized modification of software; protection measures against modification of settings; record keeping and procedure of software updating; methods and programme for software testing	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Schematic diagrams*		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Factory testing programme*		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Programme of mooring and sea trials*	The document shall include testing programme to verify the system functioning in all operating modes as well as to check FMEA findings (for systems **DYNPOS-2, DYNPOS-3**)	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Operation manual**	Operation manual, equipment installation instruction and maintenance instruction may be combined to form one document	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Equipment installation instruction**		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Equipment maintenance instruction**		**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
Position reference systems	Programme of mooring and sea trials*	The document shall include testing programme to verify the system functioning in all operating modes	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Operation manual**	user interface description; description of the system operating modes;	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**

Equipment/ system	Name of documentation	Description	Distinguishing mark in class notation
	Technical description**	Technical description shall contain information as follows: list of equipment; equipment characteristics; operating conditions; connection diagrams*	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
External force sensors (heading, motions, wind speed, wind direction)	Technical description**	Technical description shall contain information as follows: list of equipment; equipment characteristics; operating conditions; connection diagrams*; user interface description	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
	Sea and mooring trials programme*	The document shall include testing programme to verify the system functioning in all operating modes	**DYNPOS-1** **DYNPOS-2** **DYNPOS-3**
Power management system	Failure modes and effects analysis (FMEA)**	The documents shall specify analysis of possible failures and their effects to confirm compliance with the requirements in the ship class notation	**DYNPOS-2** **DYNPOS-3**
	Blackout recovery procedure for ship's power supply system**	Procedure shall describe recovery process for ship's power supply system in relation to the mode of ship dynamic position and/or heading keeping	
*The document shall be approved. **The document shall be agreed.			

8.4.2 When the DP system components are manufactured by various manufacturers, each of them shall submit a set of technical documentation for the manufactured equipment compliant to the applicable requirements of 1.4 and 8.4.1.

8.5 DESIGN OF THE DP SYSTEMS, CLASSES

8.5.1 The design of the dynamic positioning control systems shall conform to the general requirements set forth in Section 2.

8.5.2 Where the propulsion plant and rudder system of a self-propelled ship form part of the DP system, the requirements of this Chapter shall be fully applied thereto, in addition to the requirements placed upon the propulsion machinery and rudder system.

8.5.3 The DP systems shall be subdivided into classes based on their design capability to maintain position and/or heading of the ship if the worst-case failure occurs, as specified below.

8.5.4 Class 1 DP system, which corresponds by its characteristics to mark **DYNPOS-1** in the class notation, is a system with minimum redundancy as indicated in 8.5.8. In this case, the loss of position and/or heading of the ship may occur in the event of a single failure.

8.5.5 Class 2 DP system, which corresponds by its characteristics to mark **DYNPOS-2** in the class notation, shall have such redundancy that a loss of position and/or heading shall not occur in the event of a single failure under specified/considered environmental conditions according to the design in any active component or system (generator, thruster, propulsion unit and steering gear, if part of the DP system, main switchboard section or switchboard, control cabling, remotely controlled valve, etc.) or one passive component of the system (cable, piping, heat exchanger, manually controlled valve, etc.), failure of which may immediately cause deterioration of the DP system capability to maintain ship's position and/or heading.

Common passive components may be used in the systems, which will not immediately affect heading or position keeping capabilities upon failure (e.g. components in ventilation and seawater systems not directly cooling DP system running machinery). Common passive components of the system shall not be usually considered to fail owing to adequate protection from mechanical damage and component properties confirmed by results of technical supervision of the Register.

8.5.6 Class 3 DP system, which corresponds by its characteristics to mark **DYNPOS-3** in the class notation, shall have such redundancy that a loss of position and/or heading shall not occur in the event of a single failure or an accident under specified/considered environmental conditions according to the design in the system components in the following cases:

failure in any component, as indicated in 8.5.5, as well as any passive component in the DP system;

failure in all active and passive components located in any one watertight compartment, from flooding or fire;

failure in all active and passive components located in any one fire subdivision, from fire or flooding.

8.5.7 For Class 2 and 3 DP systems, the controls of operator panels of the dynamic positioning control system shall be designed so that no single inadvertent act of the operator of the dynamic positioning control system can lead to a loss of position and/or change in heading.

8.5.8 Class 1 DP system shall be designed with redundancy of the position reference system.

Duplication of computer-based DP control system is not mandatory; however, it is necessary to provide independent joystick system with automatic ship heading keeping function as specified in 8.9.4.

8.5.9 Class 2 DP system shall be designed with redundancy of the following components:

power supply system;

thrusters with their local control systems;

computer-based systems with the operator panels and controls of DP control system;

position reference systems and external force sensors.

8.5.10 Class 3 DP system shall be designed with redundancy of components as provided for Class 2, but in addition, all the redundant components shall be separated by "A-60" class fire-resisting bulkheads and in case of equipment below the main bulkhead deck they shall be also separated by watertight bulkheads.

8.5.11 The redundant components ensuring single failure tolerance shall function continuously or be switched on automatically. In this case, the redundant equipment performance shall be sufficient for carrying out the DP activity in progress with account of the ship purpose and required accuracy until such activity can be safely completed.

For Class 2 and 3 DP systems, the provision shall be made regarding possible tracking of hidden failures that, as determined through the FMEA, can lead to loss of duplication of equipment or systems included in DP system operation upon request of the control system algorithm. In this case, various software and hardware may be used (tracking continuity of data communication links, tracking of equipment "status", available unacknowledged failure signals, etc.). To achieve the purposes above, start of the periodical equipment testing programmes is allowed as well as monitoring of certain systems.

8.6 POWER SUPPLY SYSTEM

8.6.1 The power system necessary to supply the thruster system shall have a sufficient capacity and shall respond in time to power demand changes caused by operating modes needed at the moment.

Sudden load changes in ship's power supply system resulting from any single failures in DP system shall not cause loss of ship's electric power.

8.6.2 For Class 1 DP systems, the power system need not be redundant.

8.6.3 For Class 2 DP systems, the power system shall be divisible into two or more independent systems, so that after failure of one of them the remaining power supply systems can supply power to the connected thruster units with supporting systems to ensure maintaining of position and/or heading of the ship. While in use, the power system may be run as a common electric power supply system.

8.6.4 For Class 3 DP systems, the power system shall have characteristics mentioned in 8.6.3, but in addition, it shall be physically divided by "A-60" class division (bulkhead) into two or more independent systems. Where the power supply systems are located onboard below the operational waterline, they shall be also divided by watertight bulkheads. During operation, such systems shall function separately.

8.6.5 For Class 2 and 3 DP systems at least one power management system shall be provided. Such system shall have structure ensuring performance in case of any single failure, as indicated in 8.5.5 and 8.5.6.

8.6.6 The programmable electronic systems (computer-based or microprocessor (PLC) systems) shall be supplied in such a way as to minimize voltage bumps, harmonic interference and to provide protection against erroneous connection (connection with a wrong polarity).

8.7 THRUSTER SYSTEM

8.7.1 Each electric drive of the thrusters shall be power supplied by a separate supply circuit without the use of common feeders or common protective devices.

8.7.2 Each electric drive of thrusters shall be provided with its own control system supplied by a separate circuit without the use of common feeders or common protective devices. Such control system shall provide, if necessary, remote automated control of the respective thruster, which shall be independent of the dynamic positioning control system.

8.7.3 Failures in the thruster system, including failed control commands for propeller pitch, azimuth and/or propeller speed, shall not cause change in heading or increase in thrust magnitude.

8.7.4 To eliminate electromagnetic interaction between command signals, feedback signals of the local control systems of thruster units and electronic (computer-based) dynamic positioning control system, the mentioned control systems shall meet the requirements set forth in 2.2, Part XI "Electrical Equipment".

8.7.5 The thruster system with thrusters control systems and support auxiliary arrangements and equipment of Class 2 and 3 DP systems shall be supplied with power in compliance with 8.6.3 and 8.6.4. If a failure of one of the power supply systems with thruster units connected to it occurs, the thruster units remaining in operation shall provide sufficient resultant thrust in the longitudinal and lateral directions as well as yawning moment for maintaining position and/or heading of the ship under the environmental forces action stipulated in the design.

8.7.6 Each thruster unit shall have an emergency stop system accessible for actuation both from the thruster unit local control station and the DP control station. Emergency stop systems of thruster units used in Class 2 and 3 DP systems shall have control loop monitoring. In Class 3 DP systems the engineering solutions shall be provided for such monitoring in the event of failure or accident according to 8.5.6.

8.8 CONTROL STATIONS

8.8.1 The main dynamic positioning control station shall be generally located on the navigation bridge where the operator has a good view of the ship's exterior limits. DP system operator's workstation shall be equipped with the panels of the dynamic positioning control system with relevant devices for automatic and automated control, including devices for remote automated control system for thrusters, propulsion plants and rudders, if part of the DP system, emergency stops for propulsion plants and thrusters, independent joystick system, devices for switching between control systems, necessary information sources, such as indicators, controls for position reference systems, alarm panels, communication systems.

8.8.2 The display switching system and controls shall be designed with due regard to the national ergonomic standards. The thruster and propulsion unit control mode shall be selectable by simple actions of the operator and the mode selected shall be clearly distinguishable among the following control modes provided:

automatic control of thruster system;

remote automated control of all units within thruster system with the use of a single control device;

remote automated control of each unit being part of the thruster system;

manual control of ship's propulsion plant, thrusters and rudders from the local control stations.

8.8.3 The alarm and monitoring system of the DP system shall meet the general requirements set forth in 2.4.

8.8.4 The alarm and monitoring system of the DP system, in addition to audible and visual signals relating to the DP system machinery and devices, shall contain textual and graphic information on failures.

8.8.5 The control system shall provide for quick transfer from the automatic to remote automated control of the thrusters, propulsion plants and rudders, if involved in DP system operations, using both individual controls (according to the number of thruster units) and a single common joystick. Transfer from the remote automated to automatic control shall be effected with similar quickness.

8.9 COMPUTER-BASED DYNAMIC POSITIONING CONTROL SYSTEMS

8.9.1 The redundancy requirements shall not be applicable to computer-based systems in Class 1 dynamic positioning control systems.

8.9.2 Computer-based systems in Class 2 dynamic positioning control systems shall be duplicated and independent of one another.

The dynamic positioning control systems shall be designed with a logic that would render fault development and transfer from one system to another impossible. The redundant system components shall interact in such a manner that if one of these components fails, it is isolated (disconnected) while the other component is activated. The control station shall represent sufficient visual and audible information on transfer to the back-up system or component. Malfunctions of common facilities, such as plant interfaces, arrangements for switching between systems, data transfer, data buses and software, including self-checking routines shall not be capable of causing the failure of both systems.

8.9.3 Computer-based systems in Class 3 dynamic positioning control systems shall be duplicated as indicated in 8.9.2, and furthermore, provision shall be made for an independent back-up dynamic positioning control system arranged in a special space separated by "A-60" class bulkhead from the main control station. During normal dynamic positioning control, the back-up system shall be in "hot back-up" state in "on" condition and shall be automatically updated by data input from the position reference system and external force sensors, thruster system feedback sensors, etc. Change-over of control to the back-up system shall be possible at all times and shall be effected manually from the back-up control station.

8.9.4 Independent joystick system with automatic ship heading keeping function shall be provided for DP systems irrespective of their Class.

8.9.5 In computer-based systems of Class 2 and 3 DP systems the software function of continuous analysis shall be implemented to verify that heading will be maintained and/or the ship will remain in position if the worst-case failure occurs. The analysis shall verify that, following the worst-case failure, the remaining in operation thrusters, propulsion plants and rudders, if involved in DP system operations, can generate the same resultant thrust and yawning moment as required prior to the accident under current environmental conditions.

8.9.6 The control systems with the software function of failure consequence analysis according to 8.9.5 shall actuate warning alarm where the analysis outcome establishes DP system's inability to maintain position and/or heading of the ship after the worst-case failure under current environmental conditions.

8.9.7 For DP system operations, which will take a long time to safely terminate, the failure consequence analysis shall be capable of simulating the DP system behaviour after the worst-case failure based on manual inputs of weather trend.

8.9.8 If the ship's equipment and/or systems (e.g. processing facilities for sea cable or pipe laying, etc.) are capable of generating disturbances with direct impact on DP performance, required data inputs shall be submitted automatically to the DP control system from such equipment/systems. Additionally, provisions shall be made for such data inputs into the DP control system manually.

8.9.9 Redundant computer-based systems shall be arranged with automatic transfer of control after a failure in one of the computer-based systems. The automatic transfer of control from one computer-based system to another shall be smooth, without significant disturbing effects on the thruster system. The alarm and monitoring system shall give the signal if the system, which take over control, is for whatever reason unable to provide automatic control during the transfer of systems.

8.9.10 A dedicated uninterruptible power source (UPS) shall be provided for each DP control system, including independent joystick system. The UPS battery capacity shall be sufficient for servicing the computer-based DP control system and external force sensors connected to it as well as position reference system for 30 minutes following a main supply failure. For Class 2 and 3 DP systems, UPS shall be connected to independent power supply systems as indicated in 8.6.3 and 8.6.4. UPS for Class 3 back-up dynamic positioning control system shall be arranged considering 8.9.3. During change-over from the main supply to the battery supply, the alarm and monitoring system signal shall be given. The alarm and monitoring system signal shall also be given when the accumulator battery is discharged.

8.9.11 Application programs and database of dynamic positioning control system programmable devices shall be protected against destruction or data loss due to faults in the equipment power supply system.

8.10 POSITION REFERENCE SYSTEMS

8.10.1 Position reference systems shall be based on the operating requirements with due regard to the acceptable performance characteristics. The systems shall be simultaneously and coordinately available to the DP control system during operation. The position reference systems shall produce data with adequate accuracy. Provision shall be made for visual and audible alarm to indicate deviations from true data or excessive degradation of the signals from the position reference systems.

8.10.2 For Class 1 DP systems, at least two independent position reference systems shall be installed.

8.10.3 For Class 2 and 3 DP systems, at least three independent position reference systems shall be installed.

8.10.4 When two or more position reference systems are required, they shall not all be of the same type, but jointly such systems shall involve at least two different physical principles for position reference.

8.10.5 For Class 3 DP systems, one of the position reference systems shall be connected to the back-up control system and located in a space separated by "A-60" class bulkhead from the spaces containing other position reference systems.

8.11 EXTERNAL FORCE SENSORS

8.11.1 For the DP systems, provision shall be made for at least the following external force sensors determining:

heading;

magnitude of ship motions;

wind speed;

wind direction.

The sensors shall be selected on the basis of the operating requirements with due regard to the acceptable performance characteristics.

8.11.2 For Class 2 or 3 DP systems where required accuracy of keeping ship's position or heading is fully dependent on correct signals from external force sensors, at least three independent external force sensor systems shall be available for each parameter (e.g. three gyro compasses or three heading sensors engaging other physical principles, but in compliance with 8.11.1, shall be provided for heading).

8.11.3 For Class 3 DP systems, one group of sensors of each type, in addition to the requirements set forth in 8.11.2, shall comply with the requirement for separation thereof by "A-60" class bulkhead from other sensors.

8.12 ALARM AND MONITORING SYSTEM

8.12.1 In addition to the requirements set forth in 2.4, the alarm and monitoring system shall be arranged with facilities to preserve and indicate the data on failure alarms and change in their state.

8.12.2 Parameters monitored by the alarm and monitoring system shall be subdivided structurally into parameters, which to a certain degree are informative, and parameters, which when alarmed require immediate actions to be taken by the personnel.

8.13 CABLE ROUTEING AND PIPING OF DP SYSTEM MACHINERY AND DEVICES

8.13.1 For Class 1 and 2 DP systems cable routes of electrical equipment and control systems, as well as hydraulic, fuel and lubricating oil and other piping shall be installed with due regard to the requirements set forth in 16.8.4, Part XI "Electrical Equipment" and Section 5, Part VIII "Systems and Piping".

8.13.2 For Class 3 DP systems, cables of stand-by electric and electronic equipment and piping of stand-by support systems and control systems shall not be routed together with cables and piping systems of the main equipment through the same spaces (compartments). Such installation may be only accepted in cases when the cables of stand-by equipment and, in turn, piping of stand-by systems run in "A-60" class fire-protective ducts. Use of cable connection boxes is not allowed in fire-protective ducts.

8.14 REQUIREMENTS FOR NON-DP SHIP SYSTEMS

8.14.1 Single failure in ship systems not directly part of the DP system (e.g. fire-extinguishing systems, engine-room ventilation systems, air heating and conditioning in ship spaces and accommodations, emergency stop systems of fuel, lubricating oil transfer pumps, ship ventilation, etc.) shall not affect DP system operation, exceeding criteria as specified in 8.5.5 and 8.5.6.".