

# **GUIDELINES**

## **ON TECHNICAL SUPERVISION OF NUCLEAR SHIPS, NUCLEAR FLOATING FACILITIES AND NUCLEAR SUPPORT VESSELS IN SERVICE**

ND No. 2-030101-024-E



**St. Petersburg  
2022**

# **GUIDELINES ON TECHNICAL SUPERVISION OF NUCLEAR SHIPS, NUCLEAR FLOATING FACILITIES AND NUCLEAR SUPPORT VESSELS IN SERVICE**

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Guidelines on Technical Supervision of Nuclear Ships, Nuclear Floating Facilities and Nuclear Support Vessels in Service of Russian Maritime Register of Shipping (RS, the Register) have been approved in accordance with the established approval procedure and come into force on 1 July 2022.

The present edition of the Guidelines is based on the 2017 edition, taking into account Circular Letter No. 110-312-2-1104c dated 12.03.2018, the amendments and additions developed immediately before publication.

From the date of entering into force of these Guidelines, the Guidelines on Technical Supervision of Nuclear Ships, Nuclear Floating Facilities and Nuclear Support Vessels in Service, 2017, become null and void.

The Guidelines are intended for surveyors, ship crews and shipowners.

**REVISION HISTORY**

(purely editorial amendments are not included in the Revision History)

For this version, no amendments to be included in the Revision History are available.

## **1 GENERAL REGULATIONS FOR TECHNICAL SUPERVISION**

### **1.1 SCOPE OF APPLICATION**

**1.1.1** Guidelines on Technical Supervision of Nuclear Ships, Nuclear Floating Facilities and Nuclear Support Vessels in Service<sup>1</sup> establish the types, scopes, schedule, procedure and methods of surveys of the nuclear ships, nuclear floating facilities<sup>2</sup>, nuclear support vessels<sup>3</sup> and their items for confirmation and renewal of class of the ships in service in compliance with the Rules for the Classification and Construction of Nuclear Ships and Floating Facilities<sup>4</sup> and the Rules for the Classification and Construction of Nuclear Support Vessels<sup>5</sup>.

These Guidelines also establish the technical requirements for passages and standard towing of berth-connected ships and other floating facilities fitted with marine reactor plants (RP) and/or spent nuclear fuel (SNF) storage facilities.

**1.1.2** These Guidelines are applied by the Register during technical supervision of the ships with nuclear power units (NPU) in service, under repair and conversion, and of the NS vessels, as well as during survey of berth-connected ships and other floating facilities fitted with marine RP and/or spent nuclear fuel (SNF) storage facilities prior to passages or standard towing.

**1.1.3** The requirements of these Guidelines apply to the nuclear ships and floating facilities fitted with two-circuit nuclear steam supply systems (NSSS) and pressurized-water reactor, as well as to the NS vessels.

**1.1.4** The requirements of these Guidelines supplement the requirements to types, scopes, schedule, procedure and methods of ship surveys established in the Guidelines on Technical Supervision of Ships in Service and the Rules for the Classification Surveys of Ships in Service.

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<sup>1</sup> Hereinafter referred to as "these Guidelines".

<sup>2</sup> Hereinafter referred to as "the nuclear ships or NS".

<sup>3</sup> Hereinafter referred to as "the NS vessels".

<sup>4</sup> Hereinafter referred to as "the NS Rules".

<sup>5</sup> Hereinafter referred to as "the NSV Rules".

## **1.2 DEFINITIONS AND ABBREVIATIONS**

**1.2.1** The following definitions and explanations given in the NS Rules, NSV Rules, Rules for the Classification Surveys of Ships in Service and Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships<sup>1</sup> are adopted in these Guidelines.

**1.2.2** For the purpose of these Guidelines, the following abbreviations have been adopted:

CPS — control and protection system;

EP — emergency protection;

FA — fuel assembly;

HPG — high-pressure gas;

LRW — liquid radioactive waste;

MCP — minimum controlled power;

NPU — nuclear power unit;

PS — physical security;

RM — radiation monitoring;

RS — radiation safety;

RS Rules — Rules for the Classification and Construction of Sea-Going Ships, Rules for the Equipment of Sea-Going Ships, Rules for the Cargo Handling Gear of Sea-Going Ships, Load Line Rules for Sea-Going Ships, Rules for the Classification Surveys of Ships in Service;

SG — steam generator;

SRW — solid radioactive waste;

SSS — steam supply system;

UT — ultrasonic testing.

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<sup>1</sup> Hereinafter referred to as "the Rules for Technical Supervision".

### **1.3 SCOPE OF PERIODICAL SURVEYS**

**1.3.1** The requirements of these Section supplement the appropriate requirements specified in Section 2, Tables 2.1.1-1 and 2.1.1-2, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

Additional scope of periodical surveys of the nuclear ships and NS vessels is given in [Table 1.3.1](#).

**1.3.2** Scope and methods of technical supervision of special equipment of the nuclear ships and NS vessels are specified in the appropriate sections of these Guidelines.

**1.3.3** Scope of periodical surveys of the electrical equipment being part of the equipment and systems of the nuclear ships and NS vessels shall be determined by 2.2.7, 2.3.4 and 2.4.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, unless otherwise specified in these Guidelines.

**1.3.4** Scope of surveys to be carried out in compliance with the requirements of these Guidelines may be changed based on the structure of the ship's nuclear power unit (NPU), expired service life of equipment, results of the previous survey, mode of operation, nature of repair conducted, etc.

**1.3.5** Scope of surveys and possible operation of the equipment and machinery, which service life is expired or will be expired during the expected life, shall be determined by the Register in each particular case and may cause a loss of life or operating limitations.

Service life of the basic equipment of the nuclear ship and NS vessel shall be extended in compliance with the valid normative documents.

Table 1.3.1

**ADDITIONAL SCOPE OF PERIODICAL SURVEYS OF A NUCLEAR SHIP AND NUCLEAR SUPPORT VESSEL**

**Symbols:**

O — close-up inspection with access, opening-up or dismantling being provided where necessary, and/or opening by means of remote inspection and non-destructive testing;

C — external examination;

M — measurements of wears and/or residual thicknesses, clearances, insulation resistance, etc., actual actuation parameters of all types of protection after their check and regulation for compliance with the specified values;

H — pressure tests (hydraulic, pneumatic);

P — operational testing of machinery, equipment and arrangements, external examination included;

E — control of the availability of valid documents and/or stamps testifying to the instrumentation being calibrated by the competent authorities, if subject thereto.

Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
		3	4	5	6	7	8	9	10	11	12	13	14
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Additional surveys of ships subject to docking with an interval of at least 36 months are given in the Table.													
Additional surveys of ships subject to "Additional Surveys of Ships Depending on Their Purpose and Hull Material" of the Rules for the Classification Surveys of Ships in Service, depending on purpose of ships and hull material.													
<b>1</b>	<b>Hull</b>												
1.1	Underwater hull (external examination and internal examination of the adjacent compartments):												
1.1.1	shell plating in the areas of collision, grounding and stranding protection, core handling equipment, used fuel assemblies, SRW and LRW storage facilities, including spaces and cofferdams of controlled area and supervised area		O	O		O <sup>1</sup> M	OM		O <sup>1</sup> M	OM		O <sup>1</sup> M	OM

Guidelines on Technical Supervision of Nuclear Ships, Nuclear Floating Facilities and Nuclear Support Vessels in Service (Section 1)

Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.1.2	collision protection		C	O		O	OM		O	OM		O	OM
1.1.3	grounding and stranding protection		C	O		O	OM		O	OM		O	OM
1.1.4	meshes of sea chests and ice boxes, ice withdrawal fins and ice protection, pneumatic flushing arrangements		C <sup>1</sup>	C		C <sup>1</sup>	O		C <sup>1</sup>	O		O <sup>1</sup>	O
1.2	Above-water hull (external examination and internal examination of the adjacent compartments):												
1.2.1	shell plating in the areas of collision protection, core handling equipment, spent nuclear fuel (SNF) assemblies, SRW and LRW storage facilities, including spaces and cofferdams of controlled and supervised areas		C	O	C	O	OM	C	OM	OM	C	OM	OM
1.2.2	collision protection		C	O	C	O	OM	C	O	OM	C	O	OM
1.2.3	shielding barrier on open decks	C	C	O	C	C	O	C	C	O	C	C	O
1.3	Containment:	In case of containment depressurization, its occasional survey shall be conducted and containment shall be tested for leak tightness											
1.3.1	hatch covers, covers, doors, windows, cable boxes, shut-off and safety valves of containment	C	C	OH	C	O	OH	C	O	OH	C	O	OH
1.3.2	containment bulkheads with lining, biological shielding units	C	C	OH	C	O	OH	C	O	OH	C	O	OH
1.3.3	fastening of metal-water shielding tanks			O			O			O			O
1.4	Shell doors in hull	C	C	OH	C	O	OHP	C	O	OHP	C	O	OHP
1.5	Shielding barrier <sup>2</sup>	C	C	OH	C	O	OH	C	O	OH	P	O	OH
1.6	Main mast	C	C	O	C	C	O	C	C	O	P	C	O
<b>2</b>	<b>Equipment and machinery</b>												
2.1	Nuclear reactors:												
2.1.1	vessel	P	P	O <sup>3,4</sup> HP	P	P	O <sup>3,4</sup> HP	P	P	O <sup>3,4</sup> HP	P	P	O <sup>3,4</sup> HP
2.1.2	covers with their attachments	P	P	O <sup>3,4</sup> HP	P	P	O <sup>3,4</sup> HP	P	P	O <sup>3,4</sup> HP	P	P	O <sup>3,4</sup> HP
2.1.3	internal removable and non-removable parts			O <sup>3,4</sup> HP			O <sup>3,4</sup> HP			O <sup>3,4</sup> HP			O <sup>3,4</sup> HP
2.1.4	safety devices	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.2	Control and protection systems (actuators)	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.3	Cores <sup>4</sup>	E	E	CE	E	E	CE	E	E	CE	E	E	CE

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Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
2.4	Specialized tanks for SSS needs (high-purity water, containment drenching system, emergency cooling, special-purpose drainage system, etc.)	C	C	O	C	C	OH	C	C	OH	C	C	OH
2.5	Parameter testing arrangements, instruments and arrangements	PE	PE	PE	PE	PE	PE	PE	PE	PE	PE	PE	PE
2.6	SSS machinery:												
2.6.1	primary coolant circulating pumps	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.2	fresh water pumps for equipment cooling and protection	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.3	core emergency cooling pumps	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.4	sea water pumps for equipment cooling	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.5	pumps and ejectors of primary water drainage, storage and discharge system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.6	pumps and ejectors for SSS spaces drainage system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.7	primary make-up pumps	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.8	automation hydraulic pumps	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.9	pumps of residual heat removal system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.10	pumps of containment hatch cover drives	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.11	pumps of decontamination tank	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.12	pumps of decontamination solution preparation system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.13	high-purity water recycle pumps	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.14	pumps of containment pressure reduction system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.15	pumps of sorbent hydraulic handling system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.16	pumps for SSS spaces ventilation cooling	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.17	high pressure air compressor units	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.18	high pressure gas compressor units	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.6.19	controlled area fans	P	P	OP	P	P	OP	P	P	OP	P	P	OP
2.7	SSS fittings	P	P	OHP	P	P	OHP	P	P	OHP	P	P	OHP
2.8	Spare parts, special tools and rigging			C			C			C			C

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Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
<b>3</b>	<b>Pressure vessels and units</b>												
3.1	Steam generators <sup>5</sup> :	P	P	HP	P	P	HP	P	P	HP	P	P	HP
3.1.1	case			O <sup>6</sup>			O <sup>6</sup>			O <sup>6</sup>			O <sup>6</sup>
3.1.2	pipng systems, fuel assemblies			O <sup>6</sup>			O <sup>6</sup>			O <sup>6</sup>			O <sup>6</sup>
3.1.3	supporting structures			O			O			O			O
3.1.4	safety devices	P	P	OP	P	P	OP	P	P	OP	P	P	OP
3.1.5	fittings and valves	P	P	OHP	P	P	OHP	P	P	OHP	P	P	OHP
3.2	Pressure compensators <sup>5</sup>	P	P	HP	P	P	HP	P	P	HP	P	P	HP
3.3	Primary and tertiary filters, activity filter refrigerator <sup>5</sup>	P	P	HP	P	P	HP	P	P	HP	P	P	HP
3.4	Hydraulic chambers <sup>5</sup> :	P	P	HP	P	P	HP	P	P	HP	P	P	HP
3.4.1	case			O <sup>7</sup>			O <sup>7</sup>	P	P	O <sup>7</sup>	P	P	O <sup>7</sup>
3.4.2	internal structures			O <sup>7</sup>			O <sup>7</sup>	P	P	O <sup>7</sup>	P	P	O <sup>7</sup>
3.4.3	supporting structures			O <sup>7</sup>			O <sup>7</sup>	P	P	O <sup>7</sup>	P	P	O <sup>7</sup>
3.5	Heat-exchangers <sup>8</sup> for equipment fresh water cooling circuit	P	P	OP	P	P	OHP	P	P	OHP	P	P	OHP
3.6	Draining and bilge containers <sup>8</sup> (montejus)			CH			CH			CH			CH
3.7	Gas receivers <sup>8</sup>	P	P	P	P	P	HP	P	P	HP	P	P	HP
3.8	Air receivers <sup>8</sup>	P	P	OP	P	P	OHP	P	P	OHP	P	P	OHP
3.9	Hydropneumatic cylinders <sup>8</sup>	P	P	OP	P	P	OHP	P	P	OHP	P	P	OHP
3.10	Metal-water shielding tanks	P	P	P	P	P	P	P	P	P	P	P	P
<b>4</b>	<b>NS and NSV systems</b>												
4.1	Primary coolant circulating system	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.2	Primary coolant purification system	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.3	Primary coolant filling and make-up system	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.4	Residual heat removal system	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.5	Core emergency cooling system	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.6	Deaeration system	P	P	P	P	P	P	P	P	P	P	P	P
4.7	Primary water drainage system <sup>5</sup>	P	P	P	P	P	P	P	P	P	P	P	P
4.8	Primary pressure compensation system <sup>5</sup>	P	P	HP	P	P	HP	P	P	HP	P	P	HP

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Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
4.9	Secondary system (to the secondary circuit)	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.10	Fresh water system for equipment cooling and protection	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.11	Steam generator overpressure prevention system	P	P	OP	P	P	OP	P	P	OP	P	P	OP
4.12	Decontamination solution preparation system	P	P	P	P	P	P	P	P	P	P	P	P
4.13	SSS spaces drainage system	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.14	Air ventilation and purification:	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.14.1	containment fittings	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.15	Sea water system for equipment cooling	P	P	HP	P	P	HP	P	P	HP	P	P	HP
4.16	Liquid radioactive waste (LRW) collection, storage and discharge system	C	C	OHP	C	C	OHP	C	C	OHP	C	C	OHP
4.17	Automation hydraulic and fitting control system	P	P	HP	P	P	HP	P	P	HP	PG	P	HP
4.18	High-pressure air	P	P	P	P	P	P	P	P	P	PG	P	P
4.19	Medium-pressure air	P	P	P	P	P	P	P	P	P	PG	P	P
4.20	Containment pressure reduction (containment drenching) system	P	P	HP	P	P	HP	P	P	HP	PG	P	HP
4.21	Explosive mixture removal system			C			C			C			C
<b>5</b>	<b>SSS electrical equipment</b>												
5.1	Stand-by power source	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.2	Emergency power source	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.3	Transient power supply source	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.4	SSS electric actuator starters	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.5	Switchboards and cable network of SSS essential consumers	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.6	Main and emergency lighting of spaces important for SSS safety	P	P	OMP	P	P	OMP	PG	P	OMP	P	P	OMP
5.7	Arrangements for power supply switchover	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.8	Signalling systems of door closing, general alarm system and ship internal communication in controlled area spaces	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
5.9	Control, monitoring and alarm panels in the main machinery control room, local valve and handling operations control stations	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP

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Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
		3	4	5	6	7	8	9	10	11	12	13	14
1	2	3	4	5	6	7	8	9	10	11	12	13	14
5.10	Electric drives:												
	.1 primary coolant circulating pumps	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.2 fresh water pumps for equipment cooling and protection	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.3 core emergency cooling pumps	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.4 sea water pumps for equipment cooling	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.5 pumps of primary water drainage, storage and discharge system	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.6 SSS spaces drainage pumps	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.7 primary make-up pumps	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.8 automation hydraulic pumps	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.9 pumps of residual heat removal system	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.10 pumps of containment hatch cover drives	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.11 pumps of decontamination tank	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.12 pumps of decontamination solution preparation system	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.13 high-purity water recycle pumps	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.14 pumps for containment pressure reduction system	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.15 pumps of sorbent hydraulic handling system	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.16 pumps for SSS spaces ventilation cooling	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.17 pumps of high-pressure air compressor units	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.18 high-pressure gas (HPG) compressor units	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP
	.19 controlled area fans	P	P	OMP	P	P	OMP	P	P	OMP	P	P	OMP

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Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
<b>6</b>	<b>NSSS automatic control, monitoring, alarm and protection systems</b>	Operational testing (P) shall be carried out in compliance with the valid operating documentation											
6.1	NPU control, monitoring and protection system:	P	P	P	P	P	P	P	P	P	P	P	P
6.1.1	parameter setting units, control units, pressure and level regulators, amplifying devices, parameter sensors, panels and their components	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP
6.1.2	fitting, pulse pipelines	P	P	OP	P	P	OP	P	P	OP	P	P	OP
6.2	NSSS control and protection system	P	P	P	P	P	P	P	P	P	P	P	P
6.2.1	Control and protection regulators, means of parameter setting and power and temperature measurement: their functional and amplifying control units, starting equipment, sensors, alarm units, panels and their components	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP
6.2.2	Drives of control and protection regulators, their position and travel indicating arrangements, limiting devices	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP
6.3	Centralized NPU parameter monitoring system:	P	P	P	P	P	P	P	P	P	P	P	P
6.3.1	automatic parameter control devices, periodic data recorders, alarm system, indication system, sensors, panel components, etc.	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP
6.4	Indication, locking, alarm and protection system:	P	P	P	P	P	P	P	P	P	P	P	P
6.4.1	signal, protection, locking and measuring devices	MP	P	OMP	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP
6.4.2	mimic diagrams, panel components, etc.	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP	MP	MP	OMP
6.5	Instrumentation	E	E	ME	E	E	ME	E	E	ME	E	E	ME
<b>7</b>	<b>Radiation safety</b>												
7.1	Biological shielding <sup>9</sup>	C	C	OCM	C	C	OCM	C	C	OCM	C	C	OCM
7.2	Core handling equipment <sup>10</sup> :												
7.2.1	pump station	P	P	OP	P	P	OP	P	OP	P	P	OP	P
7.2.2	movement control mechanism with support	C	C	OP	C	C	OP	C	C	OP	C	C	OP

*Guidelines on Technical Supervision of Nuclear Ships, Nuclear Floating Facilities and Nuclear Support Vessels in Service (Section 1)*

Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
7.2.3	pressure flange fastening and pressure flange and reactor lid blow device	C	C	OP	C	C	OP	C	C	OP	C	C	OP
7.2.4	handling container	P	P	OP	P	P	OP	P	OP	P	P	OP	P
7.2.5	hydraulic puller	C	C	OP	C	C	OP	C	C	OP	C	C	OP
7.2.6	armor for handling removable reactor arrangement	C	C	OP	C	C	OP	C	C	OP	C	C	OP
7.2.7	arrangement for storage, transportation and installation of neutron emission device	C	C	OP	C	C	OP	C	C	OP	C	C	OP
7.2.8	grips and stoppers	C	C	OP	C	C	OP	C	C	OP	C	C	OP
7.3	spent fuel assemblies (FA) storage facilities	C	C	O	C	C	O	C	C	O	C	C	O
7.4	LRW storage and treatment equipment	C	C	OHP	C	C	OHP	C	C	OHP	C	C	OHP
7.5	SRW storage equipment	C	C	OP	C	C	OP	C	C	OP	C	C	OP
7.6	Radiation monitoring (RM) systems and means:												
7.6.1	Radiation monitoring (RM) system <sup>11</sup>	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
7.6.2	radioactivity control arrangement of primary, secondary and tertiary media <sup>12</sup>	P	P	EMP	P	P	EMP	P	P	EMP	P	P	EMP
7.6.3	arrangements for radioactivity control of media to be removed from ship to environment <sup>12</sup>	P	P	EMP	P	P	EMP	P	P	EMP	P	P	EMP
7.6.4	control units of radiation situation in inhabitable spaces of the ship <sup>12</sup>			EMP			EMP			EMP			EMP
7.6.5	control panels, mimic diagrams, alarm means	P	P	P	P	P	P	P	P	P	P	P	P
7.6.6	instrumentation <sup>12</sup>	E	E	E	E	E	E	E	E	E	E	E	E
<b>8</b>	<b>Physical security system</b>	Operational testing (P) shall be carried out in compliance with the valid operating documentation											
8.1	Intrusion protection facilities	P	P	PM	P	P	PM	P	P	PM	P	P	PM
8.2	Security alert system devices	P	P	PM	P	P	PM	P	P	PM	P	P	PM
8.3	Access monitoring and control system facilities	P	P	PM	P	P	PM	P	P	PM	P	P	PM
8.4	Facilities of optoelectronic surveillance and situation assessment system	P	P	PM	P	P	PM	P	P	PM	P	P	PM
8.5	Operational communication and address system facilities	P	P	PM	P	P	PM	P	P	PM	P	P	PM
8.6	Data protection system facilities	P	P	PM	P	P	PM	P	P	PM	P	P	PM
8.7	Power supply and lighting system facilities	P	P	PM	P	P	PM	P	P	PM	P	P	PM

*Guidelines on Technical Supervision of Nuclear Ships, Nuclear Floating Facilities and Nuclear Support Vessels in Service (Section 1)*

Nos.	Item to be surveyed	Survey of a ship											
		Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special	Annual	Intermediate	Special
		Age ≤ 5 years			5 < Age ≤ 10 years			10 < Age ≤ 15 years			Age > 15 years		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Bottom survey of the ship's hull shall be carried out, as a rule, at dry-docking of the ship. In justified cases, at the shipowner's written request, as an alternative to the bottom survey in dry dock, annual and intermediate in-water surveys may be carried in accordance with 2.5.8 of Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service. The decision on such a possibility shall be within the competence of the RS Head Office (RHO).												
2	Shielding barrier tests (H) may be omitted when pressure within the shielding barrier is maintained below atmospheric pressure.												
3	Survey shall be carried out in accessible places without dismantling after scheduled measurements in case no reactor core refueling is performed.												
4	Survey shall be carried out prior to reactor core loading in compliance with the requirements of 3.4, when the reactor core refueling is performed.												
5	Hydraulic tests shall be combined with the reactor.												
6	Survey shall be carried out during replacement of piping system.												
7	Survey shall be carried out in the course of primary pumps dismantling.												
8	Hydraulic tests shall be combined with systems which they are serving.												
9	Biological shielding shall be tested for efficiency by radiation monitoring (RM) system and portable devices.												
10	Survey shall be carried out prior to the reactor core loading.												
11	Operational testing of radiation monitoring (P) means the external examination and sequence operational testing in case of an idle unit, and then with the unit being operated at multiple power levels, up to the nominal one.												
12	Instrumentation (activity sensors, etc.) shall be checked under the standard radiation sources with valid expiry date within the terms prescribed by the competent bodies for such measurements, the examination results shall be submitted to the Register.												
<p><b>Note.</b> Examination and operational testing of the RM system immediately prior to the fueling or repair works related to the circuit opening shall be carried out by the competent persons of the shipowner and recorded in the ship's documentation.</p>													

## **1.4 GENERAL INSTRUCTIONS**

**1.4.1** Shipowner shall:  
notify the Register in advance of the expected repairs or alterations in the SSS structure;  
arrange preparation of SSS or its separate components to survey by the Register in the  
scope previously agreed with RS;

inform the Register on the readiness to survey.

**1.4.2** Measures for the survey provision shall comply with the requirements of  
Section 4, Part I "General Provisions" of the Rules for the Classification Surveys of Ships in  
Service.

**1.4.3** For all items of technical supervision (equipment or its separate components)  
to be installed on the nuclear ship and NS vessel, the documents shall be submitted verifying  
the RS technical supervision during their manufacture in accordance with the Nomenclature  
of Items of the Register Technical Supervision (refer to Appendix 1 to Part I "General  
Regulations for Technical Supervision" of the Rules for Technical Supervision).

## **2 HULL SURVEY OF A NUCLEAR SHIPS AND NUCLEAR SUPPORT VESSELS**

### **2.1 GENERAL**

**2.1.1** This Section establishes the additional requirements to the hull of steel ships with the purpose, dimensions and structures complying with the scope of application of the NS Rules and NSV Rules.

The requirements of this Section apply also to the shielding barrier structures and separate components of the shielding barrier and shielding barrier in general, including biological shielding directly adjacent to the containment. In this case the biological shielding is only considered as a structural part without considering its protective features.

**2.1.2** During survey of the hulls of the nuclear ships and NS vessels the requirements of Part I "General Provisions" of the Rules for the Classification Surveys of Ships in Service shall be met.

**2.1.3** Survey of the hull of the nuclear ship and NS vessel shall be carried out during initial survey a special, intermediate and annual surveys. Survey of the hull in dry dock is a part of special and intermediate surveys.

**2.1.4** The procedure of survey of the hulls of the nuclear ships and NS vessels set forth in these Guidelines is an addition to the requirements specified in 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1, 2.4.2 and 2.5, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**2.1.5** At all types of survey, the containment and shielding barrier shall be properly prepared for the survey:

- .1** the examined spaces shall be cleaned, ventilated and decontaminated, where necessary;
- .2** as deemed necessary by the RS surveyor, insulation or protective coatings shall be removed;
- .3** where necessary, the RS surveyor may require dismantling of structures, equipment or piping which make access difficult for the components' examination.

## **2.2 SCOPE OF SURVEY**

**2.2.1** The summarized scope of additional survey of the hull structures of the nuclear ship and NS vessel during periodical surveys is given in [Table 1.3.1](#).

**2.2.2** Survey of the containment and shielding barrier, as well as all the adjacent components and structures shall be carried out during all types of periodical surveys of the nuclear ships.

**2.2.3** After every repair of the containment components, the containment shall be subject to leak test according to the procedure and standards approved by the Register. Leak test of the separate shielding barrier spaces shall be carried out at discretion of the Register after significant repair of the gastight barrier structures.

## **2.3 ANNUAL SURVEY**

**2.3.1** Scope of annual survey of the hull of the nuclear ship and NS vessel shall comply with 2.2.2 and Table 2.1.1-1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and additional surveys in accordance with [Table 1.3.1](#) of these Guidelines.

**2.3.2** During annual survey of the hull of the nuclear ship the following shall be done:

**.1** all closures of containment spaces and shielding barrier, their drives and position indicators shall be examined to determine their technical condition and completeness;

**.2** fittings of systems and cable boxes, as well as doors, hatches, windows of the containment shall be examined and subject to leak test;

**.3** parameter testing arrangements of negative pressure maintenance in the containment and shielding barrier shall be examined and operationally tested;

**.4** controlled area barrier on open decks shall be examined;

**.5** hull structures in way of the reactor in accessible places, collision, grounding and stranding protection shall be examined.

## **2.4 INTERMEDIATE SURVEY**

**2.4.1** Scope of intermediate survey of the hull of the nuclear ship and NS vessel shall comply with 2.3.2 and Table 2.1.1-1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [Table 1.3.1](#) of these Guidelines, including survey in dry dock.

**2.4.2** During intermediate survey of the hull of the nuclear ship, in addition to annual survey, hull structures in way of the reactor, collision, grounding and stranding protection shall be thoroughly examined to determine technical condition of the shell plating and primary structural elements. Where structures with wear are detected, the assessment of technical condition shall be performed with determination of parameters of deformations, cracks and fractures, as well as residual thickness measurements in compliance with Section 5, Part I "General Provisions" and Annex 2 to the Rules for the Classification Surveys of Ships in Service. Damage and wear of the hull structures which affect or, in the opinion of the RS surveyor, may affect the integrity and strength, shall be subject to thorough and prompt repair prior to the survey completion.

## **2.5 SPECIAL SURVEY**

**2.5.1** Scope of special survey of the hull of the nuclear ship and NS vessel shall comply with 2.4.2 and Table 2.1.1-1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [Table 1.3.1](#) of these Guidelines, including survey in dry dock. In addition to the requirements for annual and intermediate surveys, special survey of the hull shall include thorough examinations, tests and checks of sufficient extent to confirm that the condition of hull structures in way of the reactor, collision, grounding and stranding protection, as well as of the piping passing under the unit comply with the applicable requirements of the Rules for the Classification Surveys of Ships in Service and meet the intended purpose for a new period of class of five years to be assigned, subject to proper maintenance and operation, and periodical surveys being carried out at the due dates.

**2.5.2** Prior to each special survey, the following shall be surveyed and tested in compliance with the requirements of the technical documentation:

- .1 hatch covers of the operator's room and fuel assembly storage facility;
- .2 covers, doors, windows of the containment and controlled area spaces;
- .3 cable boxes of the containment and controlled area spaces;
- .4 containment shut-off and safety valves and fittings;
- .5 lining of containment bulkheads;
- .6 leak test of containment;
- .7 metal structures of the main mast spaces.

**2.5.3** During special survey the containment shall be subject to leak test according to the procedure and standards approved by the Register. Leak test of the separate shielding barrier spaces shall be carried out only after significant repair of the barrier structures.

**2.5.4** The extent and procedure of testing both of the separate containment components and containment in general shall be determined based on the condition of the hull structures. Testing shall be carried out according to the program agreed with the Register.

**2.5.5** Fastenings of metal-water shielding tanks, SRW storage facilities and spent nuclear fuel (SNF) storage facilities shall be visually examined.

**2.5.6** Structural assemblies of the main mast joints shall be checked for crack formation.

## **2.6 SURVEY OF THE OUTSIDE OF THE SHIP'S BOTTOM**

**2.6.1** The scope of the annual survey of the outside of the nuclear ship and NS vessel bottom shall comply with 2.5 and Table 2.1.1-1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and additional scope of survey in accordance with [Table 1.3.1](#) of these Guidelines.

### **3 SURVEY OF NSSS EQUIPMENT**

#### **3.1 GENERAL**

**3.1.1** The requirements of this Section apply to reactors, steam generators, circulating pumps and other equipment directly included in the SSS primary circuit (heat exchangers, filters, pressure compensators — to automatic gas valves, systems and remotely-controlled fittings), as well as the secondary equipment up to the feed water and steam locking devices from the steam generator and to the tertiary equipment — within the shielding barrier.

**3.1.2** During the NSSS survey and testing, compliance with the requirements of the federal rules and regulations of nuclear power industry with regard to specifics of the ship's NPU as potential source of radiation impact on the personnel and environment shall be provided by the shipowner.

**3.1.3** Permissible limits of wear, damage, leaks in the SSS machinery and equipment shall be determined in compliance with the technical documentation and manufacturers' instructions.

**3.1.4** Assessment of permissible vibration of the main and auxiliary equipment and the SSS systems based on vibration measurement results shall be carried out according to the vibration standards of the Register or the design documentation approved by the Register.

When during survey of the NSSS main and auxiliary components the defects or failures preventing normal operation are revealed, NSSS shall be recognized unfit for operation, and the Nuclear Cargo/Passenger Ship Safety Certificate and/or Classification Certificate shall become invalid.

**3.1.5** When during survey of the NSSS main and auxiliary components the defects or failures exceeding permissible limits or dangerous for the ship's operation are revealed, NSSS shall be recognized as not complying with the requirements of the RS Rules until elimination thereof, and the Nuclear Cargo/Passenger Ship Safety Certificate and/or Classification Certificate shall become invalid.

### **3.2 SCOPE OF SURVEY**

**3.2.1** The summarized scope of additional survey of the SSS equipment during periodical surveys of the nuclear ship is given in [Table 1.3.1](#).

**3.2.2** Technical supervision during repair of the SSS equipment of the nuclear ship shall be carried out in compliance with Section 3, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service. Upon completion of the repair, all hydraulic or other tests prescribed by the NS Rules for the check of strength and tightness of the SSS components subject to opening-up shall be carried out. Such tests shall be carried out regardless the previously specified date, however, the date of the next test may be determined starting from the actual date of the last test.

**3.2.3** In case of repair of the SSS equipment without the Register approval and technical supervision, SSS shall be subject to occasional survey in scope agreed with the Register.

### **3.3 ANNUAL AND INTERMEDIATE SURVEYS**

**3.3.1** In accordance with [Table 1.3.1](#) during annual and intermediate surveys of the nuclear ship, the SSS components are generally subjected to external examination in accessible places and operational testing at multiple power levels in compliance with the Guidelines on Technical Supervision of Ships in Service.

**3.3.2** During annual and intermediate survey of the nuclear ship, the external examination shall be performed of all accessible, both by structural design and radiation safety conditions, SSS components located within the shielding barrier.

Therewith:

**.1** during the SSS external examination the documents verifying preventive and scheduled routine maintenance conducted by the shipowner shall be considered by the Register;

**.2** external examination in the accessible points of fastening of all the equipment, systems and fittings shall be carried out. In such cases, dismantling of thermal insulation and biological shielding shall only be carried out during the scheduled routine maintenance performed by the shipowner or in case when there are grounds for supposing weakening of fasteners or other defects;

**.3** compensating group and reactor emergency protection (EP) system drives, their fastenings, stanchions of the reactor control and protection system (CPS), as well as stanchion cooling systems and deaeration systems shall be examined under working pressure. Reliability of power supply and alarm cable connections shall be checked;

**.4** connections of instrumentation, ionization chambers, thermal elements, resistant thermometers, parameter sensors shall be examined. Condition of the SSS automation and alarm devices shall be operationally tested. Also, the availability of valid stamps and documents confirming verifications and calibrations performed by the competent bodies shall be checked;

**.5** primary circulating pumps and emergency cooling pumps shall be examined in accessible places. Reliability of connection of power supply electrical cables of windings and rpm alarm sensor shall be checked, cooling and deaeration systems shall be examined. Pumps shall be operationally tested for intended use; therewith, the values of starting and working current shall not exceed the values set by the technical specifications approved by the Register. Simultaneously, the operation of rpm alarm sensor shall be checked with verification of the position indication on the SSS mimic diagram;

**.6** piping and fitting of the following systems shall be examined: primary system, primary makeup system, fitting remote control system, tertiary system within the shielding barrier. The primary remotely-controlled fittings shall be remotely and manually operationally tested at random with verification of the position indication on the SSS mimic diagram;

**.7** condition of external insulation of cable routes within the shielding barrier, their connection to consumers and instrumentation shall be checked;

**.8** availability of documentation (logs, records, information on digital media) shall be checked to verify the SSS failure-free operation in the intervening period or rectification of defects revealed during operation, as well as data on checks, tests and examinations carried out during the SSS operation, including:

**.8.1** availability of documents verifying quality parameters of the primary, secondary and tertiary coolants stipulated by the normative documents;

**.8.2** documentation verifying the sufficient remaining service life of the equipment shall be checked.

Where the equipment reached the end of its service life or its remaining service life is less than the period of time expected during the year of operation, the possibility of its further operation shall be subject to special consideration of the Register in each particular case, provided the appropriate statements of the equipment designer or the firm-supplier of this equipment are available;

**.8.3** documentation verifying technical condition of the cores and their remaining lives shall be checked.

In case their condition is deviated from those regulated by the technical conditions, the shipowner shall submit to the Register a conclusion of the competent bodies in respect of their actual condition and recommendations on further operation and monitoring of the core condition;

**.9** availability of the Operating Manual of the nuclear power plant and information on ship's safety updated based on the actual condition of the ship shall be checked;

**.10** availability of the documents on handling of the primary and tertiary fission-fragment activity filters, as well as on condition of the tertiary coolant and working medium immediately prior to the filter handling shall be checked.

### **3.4 SPECIAL SURVEY**

**3.4.1** Special surveys of NSSS shall be generally carried out concurrently with the reactor core handling or other works related to NSSS and associated with opening-up of the primary circuit, replacement, repair or preventive maintenance of the equipment, machinery and arrangements being part thereof. In any case, during core unloading and before further activation of the plant, the following surveys and tests shall be performed:

- .1 survey of the double bottom, structures and foundations within reactor compartment;
- .2 survey of biological shielding;
- .3 survey and tests of pressure vessels, piping and fittings of SSS;
- .4 survey of the reactor including its assemblies to be dismantled (with the core unloaded) by means of remote inspection and non-destructive testing (NDT) arrangements;
- .5 bench tests of the compensating group drives and reactor protection system actuators;
- .6 survey and testing of the primary and tertiary systems;
- .7 integrated functional test of SSS and safety systems;
- .8 test of containment tightness;
- .9 functional tests of the RM system.

**3.4.2** In compliance with [Table 1.3.1](#) the following shall be carried out during special surveys of the nuclear ships:

- .1 internal survey and external examination of the heat exchangers, pressure vessels and other equipment operating under pressure, within the terms specified by this Section, with their subsequent operational testing with all auxiliary arrangements and equipment serving both fixed and transient modes of the NPU operation;
- .2 hydraulic, pneumatic and other strength or leak tests of the SSS separate components and its systems, as well as the restricted area spaces during operation and after repair;
- .3 monitoring of condition of the primary coolant, secondary and tertiary core components and working medium based on the analysis and documents submitted by the shipowner;
- .4 external examination and verification of effectiveness of the biological shielding with the check of actual radiation level measurements in the ship's spaces, as well as survey of hull structures providing reliability of the NPU components and containment structure fastening;
- .5 SSS operational testing (refer to [Section 5](#)).

**3.4.3** Surveys of internal chambers of the reactors, steam generators and other primary equipment during special surveys of the ship shall be generally carried out concurrently with repair related to the circuit opening-up or the works on the core handling, replacement of piping systems, primary pumps, etc.

The required minimum scope of survey (opening-up and dismantling) shall be established based on the actual survey possibility in compliance with [Table 1.3.1](#).

Therewith:

- .1 in case of the reactor core handling, the reactor vessel in the accessible places, internal components, essential fastenings, especially in the points of the estimated stress concentration for detection of fatigue damage of the material exposed to radiation shall be surveyed.

For survey of the reactor vessel and other components, the required dismantling and appropriate decontamination of surfaces shall be carried out to reduce their radioactivity to the levels permitted by the sanitary norms or survey shall be carried out by the RS-approved remote control means (ultrasonic testing equipment, periscopes, etc.). Such surveys of the reactor vessel,

internal components, essential fastenings, etc. shall be carried out at each core handling. The dates of internal survey of the SSS equipment may be changed considering the measurement results of exposure dose rate, raise of decontaminating system filters activity of the circuit coolant loss of the circuit coolant, etc. Moreover, where sufficient reasons received on the basis of such measurements and tests are available, the operating conditions of the system may be changed in respect of permissible rate of power changes at transient modes of operation;

**.2** all other components of the system directly connected with the primary circuit shall be externally and internally examined, where possible. In case of partial or complete replacement of the circulating pumps or guide vanes, the hydrochambers, their connectors and branch pipes, as well as essential fastenings in the accessible places shall be examined;

**.3** supports and fastenings of the reactors, primary pumps, steam generators and other equipment, which list shall be specified by the Register based on the SSS structural particulars;

**.4** all primary stop valves, including those of the primary pressure compensated and make-up system and the primary piping in the accessible places shall be externally examined.

A list of the primary fittings subject to survey in dismantled condition shall be specified by the Register in each case based on the results of the preceding surveys and operation;

**.5** external examination of the compensating group drives and reactor protection system shall be carried out.

Where drives are dismantled from the reactor lid, the condition of their screws and grips, reliability of connecting the drives with the reactor protection system rods shall be examined, subsequently, their bench test shall be carried out with the appropriate simulation for the check of their stroke and propel efforts, activation of position indicators and limit switched, and for the reactor protection system drives — reset time and other parameters specified by the design documentation. It is also necessary to check the tightness of strength casings of the reactor protection system drives to be filled with coolant in case of their jacket rupture.

Where no dismantling of drives is carried out, the above-mentioned check may be performed directly at the standard positions according to the RS-approved procedure.

In case of satisfactory results of tests and checks, the compensating group and reactor protection system drives shall be submitted for installation (if dismantled).

Where the compensating group and reactor protection system drives do not meet the requirements specified by the appropriate instructions and documents for their manufacture, they shall be dismantled for detection and elimination of defects and subsequent repeated testing. In this case, measures shall be taken to provide the appropriate cleanliness during works.

After dismantling and prior to assembling, the reactor protection system drive shall be subject to hydraulic test with test pressure according to the test standards of the primary circuit.

The use of life-expired compensating group and reactor protection system drives is not permitted. Life extension of the SSS equipment shall be specified according to the valid normative documents;

**.6** in case of the core replacement the shipowner shall notify the Register in advance, to be properly prepared for the survey of usually inaccessible equipment and define the scope of such survey.

In this case the following shall be submitted to the Register:

**.6.1** documents verifying manufacture of core components (fuel assemblies, casings, resistant thermometers, casings and rods of reactor protection system, etc.) under the RS technical supervision according to the RS-approved documentation;

**.6.2** new core components immediately prior to their loading into the reactor and the documents verifying compliance of the loading with the design meter chart.

Equipment directly providing the core components handling and their temporary storage (containers, loading cassette, etc.) shall be surveyed by the shipowner with the check of their tightness, cooling possibility, etc.

Handling equipment used for fuel replacement shall be surveyed and tested in compliance with the Rules for the Cargo Handling Gear of Sea-Going Ships.

The measures shall be taken for provision of the appropriate cleanliness of cavities and surfaces of the primary equipment.

The RS surveyor shall make sure that all these measures are observed;

**.7** the reactor lid and locking ring shall be surveyed. In this case, anticorrosive cladding, internal surfaces of the channels for the drives of reactor control and protection system and instrumentation, welded joints of these channels with the force plate of cover cladding, stanchions of reactor control and protection system, sealing surfaces shall be surveyed; safety valve of the filling chamber, and leak tightness of the filling chamber and the chamber cooling the lid of the tertiary reactor shall be operationally tested.

Fastening of control and protection system wires shall be examined. Where necessary, based on the examination results the hydraulic tests of channels of the control and protection system drives and instruments, as well as NDT of welds shall be carried out;

**.8** plates, screens, fastenings of the compensating group rods, their guides and other internal reactor components and assemblies shall be surveyed (considering the provision of proper radiation safety).

The RS surveyor shall inspect the availability of documents verifying the calibration test of openings in the removable assemblies of the reactor plates.

Scope of these surveys shall be specified by the RS surveyor in each particular case based on the extent of repair or handling to be performed.

When any defects are detected on the surveyed reactor components, the elimination or removal thereof shall be considered by the Register in each particular case. When any details are replaced, new items and their installation in the reactor shall be submitted to the RS surveyor together with the documentation verifying the quality of their manufacture and compliance with the technical specifications approved by the Register;

**.9** during the primary circuit opening-up (dismantling of the main connectors of the reactor and pumps), pins and nuts of the main connectors shall be subject to NDT approved by RS to detect possible surface defects.

Fastening components having any surface defects shall be replaced. The data confirming the absence of inadmissible residual elongations in the fastening components of the main connectors shall be submitted to the RS surveyor. Following the assembling of the main connectors, the RS surveyor shall check the meter chart of the fastening pins extraction.

Fastening components of connection of the compensating group and reactor protection system drives shall be subject to the similar check for the absence of surface defects;

**.10** when during the repair of the primary equipment the electrical welding works are conducted, all welds shall be subject to 100 % gamma- or X-ray radiography, and when impossible, they shall be checked for absence of cracks or other defects by other approved methods, which results shall be submitted to the RS surveyor. The materials used shall be provided with the RS and the manufacturer's certificates.

**3.4.4** Internal survey and external examination of steam generator in the accessible places shall be carried out.

Therewith:

**.1** internal surveys of the steam generator shall be carried out concurrently with replacement of their piping systems or other works related to the steam generator opening-up.

In these cases, newly installed piping systems together with the manufacturer's certificates shall be submitted to the Register immediately prior to their installation at site. Simultaneously, the survey of the steam generator internal components: branch pipes, bellows glands, seals of feedwater header, etc. shall be carried out. Special attention shall be paid to examination of the internal surface lining of the steam generator shell in the points of its connection with the branch pipes.

For internal survey the steam generators shall be properly prepared and, where necessary, decontaminated to the level permitting their examination. All detected defects of the steam generator shell and its feedwater header shall be eliminated prior to its covering according to the process procedure approved by the Register.

Non-tightness of the piping systems revealed during operation shall be eliminated according to the standard process procedure approved by the Register;

**.2** when the steam generator covers connected to the housings by electrical welding are cut during the piping replacement, on completion of works on the piping replacement the covers shall be installed on site according to the process procedure of the firm (manufacturer) approved by the Register that shall provide the examination of welded joint by an approved NDT. When the steam generator covers have detachable connections with the shells, fastening components shall meet the requirements of [3.4.3.9](#) and [3.4.6](#);

**.3** hydraulic tests of the steam generator primary circuit shall be carried out in compliance with [3.4.6](#).

Leak tests of the steam generator piping systems shall be carried out following their transportation from the firm (manufacturer). Upon installation of the piping system into the steam generator shell, hydraulic tests of the primary and secondary cavities shall be performed by pressure prescribed by the steam generator designer documentation and according to the program approved by the Register for each steam generator design.

**3.4.5** All other primary equipment, filters and their cooling arrangements, pressure compensators, pumps, primary and tertiary piping and their fittings shall be surveyed in sufficient scope. In case of replacement of any kind of equipment, for newly installed items the certificates verifying their compliance with the requirements of technical specifications approved by the Register shall be submitted, and the items shall be submitted to the RS surveyor for survey. When preservation validity of the newly installed item is expired, the item shall be submitted to the RS surveyor for incoming inspection in disassembled state. Hydraulic or other strength and tightness tests shall be carried out following on-site installation. Such tests of newly installed equipment or repaired components shall be carried out in the presence of the RS surveyor according to the procedure established by the manufacturer and approved by the Register.

In all cases, during survey of the primary components with dismantling of the biological shielding, survey of the SSS essential structures shall be carried out (including the secondary and tertiary circuits, as well as hull structures located in this area).

During the SSS survey, leak tightness of piping and fittings and suspension condition shall be tested. During sea trials, the RS surveyor shall check the installation quality of piping and systems for vibration and mutual arrangement at full speed of the ship.

The check results and the appropriate statements of the competent bodies on operability of the SSS and NPU parameter testing arrangements shall be submitted by the shipowner.

**3.4.6** Hydraulic tests of the primary circuit shall be carried out following any repair or handling related to its opening-up. Calculations specifying the permitted number of hydraulic tests under the pressure exceeding the working one shall be submitted to the Register. During hydraulic tests the measures shall be taken to exclude temperature changes in the shielding barrier space and in the circuit. When it is impracticable to arrange stable temperature conditions, the calculations confirming dependence of the differential pressure in the circuit on the actual temperature values shall be submitted to the Register. Hydraulic tests of the circuit shall be carried out according to the SSS designer documentation and the program approved by the Register.

During hydraulic tests of the primary circuit, the RS surveyor shall survey all detachable connections accessible for inspection, butt welded joints, sealing of the primary components under pressure. Where necessary for survey, thermal insulation and biological shielding shall be partially removed in the extent to be specified at each testing.

On completion of hydraulic tests by the test pressure, the meter charts of elongations corrected based on the results of retightening of the reactor lid pins and circulating pumps shall be submitted to the RS surveyor.

## **4 SURVEY OF AUXILIARY MACHINERY, EQUIPMENT, SYSTEMS AND ARRANGEMENTS**

### **4.1 GENERAL**

**4.1.1** The requirements of this Section apply to auxiliary machinery, heat exchangers, pressure vessels with fittings, systems and arrangements providing preparation for start, start, stop and cooling down of NSSS, as well as auxiliary machinery, heat exchangers, pressure vessels with their fittings, systems and arrangements of the NS vessels.

**4.1.2** At each type of surveys or tests the shipowner shall submit to the RS surveyor the records in the ship's logs on all defects detected in operation of machinery, equipment, heat exchangers, vessels and their systems during the preceding operating period and on repairs or replacements performed. Prior to operational testing of machinery and equipment, the RS surveyor shall make sure that the check of instrumentation has been conducted.

**4.1.3** Auxiliary machinery, equipment, heat exchangers, pressure vessels of systems containing active media shall be properly prepared for surveys and tests to reduce the activity levels at their surfaces to the permissible values.

**4.1.4** Determination of technical condition of auxiliary machinery, equipment, arrangements and systems shall be carried out based on the results of surveys and tests. In case of wear of any essential components of machinery, heat exchangers, pressure vessels, systems and arrangements casting doubt in the reliability of further operation of this machinery, equipment, arrangement or system, they shall be subject to procedure of determination of residual dimensions by one of the approved methods and, where necessary, performing a check calculation of repair or replacement of such component.

For determination of technical condition, the requirements of Section 5, Part I "General" of the Rules for the Classification Surveys of Ships in Service shall be met, taking into consideration the requirements of the firm (manufacturer) documentation.

## **4.2 SCOPE OF SURVEY**

**4.2.1** The summarized scope of survey of the auxiliary machinery, heat exchangers and pressure vessels, systems and piping, specified in [4.1.1](#), during periodical surveys of the ships is given in [Table 1.3.1](#).

**4.2.2** Scope and procedure of survey of the particular items of technical supervision are specified in the relevant chapters of this Section. In this case, application of the provisions of Section 2, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service shall be determined by the Register in each particular case.

**4.2.3** All machinery, equipment, arrangements, systems indicated in [4.1.1](#) shall be subject to surveys and tests in accordance with [Table 1.3.1](#) to be carried out during survey of the main equipment of the nuclear ship and NS vessel at periodical surveys of the ship.

Such surveys may be conducted within Continuous Survey in accordance with 2.6, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**4.2.4** Survey of automatic and remote control, monitoring, protection and alarm components shall be carried out in accordance with the requirements of 2.2.8 and 2.4.8, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, taking into consideration [Section 6](#) of these Guidelines.

### 4.3 AIR RECEIVERS, HEAT EXCHANGERS AND PRESSURE VESSELS

**4.3.1** Survey schedule and scope of air receivers, heat exchangers and pressure vessels are given in 2.4.5.7 and item 5.2 of Table 2.1.1-1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, unless otherwise specified in the designer or firm (manufacturer) documentation.

**4.3.2** Internal survey of the air receivers, heat exchangers and pressure vessels, including those inaccessible for internal survey, shall be carried out at each special survey of the ship in accordance with 2.4.5.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, unless shorter terms of survey are specified in the designer or firm (manufacturer) documentation.

**4.3.3** Hydraulic tests of the air receivers, heat exchangers and pressure vessels may be required by the RS surveyor on the internal survey results.

Hydraulic tests of the air receivers, heat exchangers and pressure vessels inaccessible for internal survey shall be carried out starting from the second special survey, and thereafter — at each second special survey. Vessels filled with exhaust gases shall be subject to hydraulic tests at each special survey.

Accessibility of the heat exchangers and pressure vessels for internal survey shall be determined in accordance with 2.4.5.7.4.2, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

Hydraulic tests shall be carried out in accordance with 2.4.5.7.5, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

Hydraulic test of newly installed heat exchangers and pressure vessels after the transportation is mandatory, however, in particular cases, on agreement with the Register, it may be replaced by NDT.

**4.3.4** After minor repair of the air receivers, heat exchangers or pressure vessels, they shall be subject to hydraulic test by test pressure equal to  $1,25P_{working}$ . After major repair and replacement, the test pressure shall be assumed as  $1,5P_{working}$ , unless otherwise specified by the firm (manufacturer) requirements.

Instructions on technical supervision during repair of the air receivers, heat exchangers and pressure vessels are given in the internal repair documents intended for surveyors in accordance with 2.4.5.7.10 of part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**4.3.5** The external examination and operational testing of auxiliary machinery, heat exchangers, pressure vessels and other NPU auxiliary equipment of the nuclear ship and equipment of the NS vessel shall be carried out together with operational testing of the arrangements or systems serving them.

Therewith:

**.1** during special survey the RS surveyor shall verify the compliance of operating parameters of the machinery or arrangements with those specified by the RS Rules or RS-approved technical specifications;

**.2** during annual survey the operational testing and external examination of the machinery, heat exchangers and vessels shall be carried out by the RS surveyor;

**.3** duration and scope of operational testing of equipment during special and annual surveys depends on the technical condition thereof and shall be agreed with the RS surveyor.

#### **4.4 CONDENSATE FEEDING SYSTEM AND MAIN STEAM SYSTEM**

**4.4.1** The requirements of this Chapter apply to those components of the condensate feeding system and main steam system, which technical supervision is not regulated by any other sections of these Guidelines, namely: fittings of the steam generator power control, stop valves, main steam and feed water piping within the controlled and supervised areas, etc. These requirements supplement the requirements given in 2.4.5.8, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**4.4.2** The summarized scope of technical supervision of feed and condensate pumps, deaerators, filters, their fittings, as well as the main and berth-connected condensers is given in 2.1.1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and regulated by the technical documentation of firms (manufacturers).

**4.4.3** During special surveys of the nuclear ship, the condensate feeding system and main steam system shall be subject to thorough examination with provision of access to them, where necessary, and subsequent operational testing.

Feed water fittings and any other automatically controlled fittings of the SSS power control, main locking steam and water fittings installed directly in the vicinity of the steam generator shall be submitted for survey. Piping, clamps and their fastenings, piping penetrations in the containment bulkheads, pulse piping and their fittings shall be also subject to examination (refer also [Section 6](#)).

Therewith:

**.1** where necessary, the insulation of piping and fittings shall be removed and residual thickness measurement of pipe thickness by one of the RS-approved methods or their dismantling for survey of internal cavities shall be carried out.

In each case the scope of opening-up shall be specified by agreement with the RS surveyor, unless otherwise specified in the RS-approved technical specifications for manufacture of fittings of arrangements for these systems;

**.2** in case of repair of the condensate feeding system or main steam system piping or replacement of fittings having non-detachable connections with piping, the hydraulic tests of a section or piping in general shall be carried out by the test pressure specified in the NS Rules or technical specifications approved by the Register. In this case, the certificates for the materials used and fittings installed shall be submitted to the RS surveyor.

Hydraulic tests by the test pressure may be also conducted in case of doubt in the technical condition of piping or fittings.

The system is considered to have passed the test if no cracks, ruptures, visible residual deformations, leaks and similar defects are found.

Following each hydraulic test, the external examination and operational testing are mandatory. Operational testing of the SSS power control fittings or other remotely controlled and automated fittings shall be carried out in the scope and according to the program prescribed for the pre-start check of the SSS components;

**.3** during close-up surveys, hydraulic strength and leak tests, external examinations and operational testing special attention shall be paid to:

**.3.1** absence of working medium gaps and deterioration symptoms of piping, fittings, clamps, etc.;

**.3.2** condition of detachable joints of compensators, devices for bleeding, insulation, means of manual, local and remote operation;

**.4** system of emergency cooling of reactors shall be surveyed with verification of readiness for operation. The said check, as well as other checks related to necessity of the primary circuit parameter change to the limiting settings may be conducted by simulation according to the appropriate programs;

**.5** all branch pipes of the condensate feeding system and main steam system at high-pressure sections from the feed water piping to the steam generator and from the steam generator to quick-release valve of the main turbines (to cooling, pressure gauges, sampling apparatus, etc.) and the appropriate fittings shall be examined. Where provided by the system design, it is necessary to make sure of its working condition;

**.6** valves of emergency supply of feed water to the intake ring main of feed pumps directly from hot wells shall be examined with verification of readiness for operation;

**.7** piping and fittings of steam supply to harbor condenser shall be examined and operationally tested.

**4.4.4** During annual surveys an external examination of the systems and arrangements listed in [4.4.3](#) shall be carried out, with their subsequent operational testing for intended use. In this case, at the RS surveyor's discretion, the scope of checks may be reduced, however, operation of the main components of the condensate feeding system and the main steam system shall be checked in any combination specified in the Operating Manual of the nuclear power plant.

## 4.5 HIGH-PRESSURE GAS SYSTEM

**4.5.1** The requirements of this Chapter apply to the high-pressure gas (HPG) systems, gas receivers, gas compressors and their fittings, including automatic remotely controlled valves of the HPG system with pressure compensators.

**4.5.2** The summarized scope of survey of the machinery, pressure vessels and other HPG system equipment during periodical surveys of the ship is given in [Table 1.3.1](#).

Scope and procedure of surveys and tests of the particular items of technical supervision are given below.

**4.5.3** Pressure vessels — gas receivers shall be subject to tests starting from the second special survey, and thereafter — at each second special survey. Scope and procedure of tests are specified in [4.3](#).

**4.5.4** Test pressure value during hydraulic tests of the gas receivers shall be set in accordance with 2.4.5.7.6, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, unless otherwise specified by the manufacturer technical specifications approved by the Register.

In case the gas receivers and their systems are subjected to repair with their tightness broken, then after repair they shall be subject to hydraulic strength tests and other leak tests. In this case, the value of test pressure during hydraulic tests of the gas receivers shall be determined based on the repair being conducted: for minor repair —  $1,25P_{working}$  but in any case it shall not be less than  $P_{working} + 100$  kPa; for major repair —  $1,5P_{working}$  if the technical specification for manufacture of this equipment approved by the Register do not specify higher pressure values.

Holding time of the gas receivers during hydraulic tests by test pressure with disconnected pump shall be equal to 5 — 10 min.

Following hydraulic tests, the gas receivers and their systems shall be subject to leak tests during the time period sufficient for thorough examination but not less than 1 h. Leak test may be conducted by working medium.

Therewith, repair of gas receivers of their systems, as well as tests, shall be carried out under the RS technical supervision.

**4.5.5** The survey of the HPG system during special survey of the ship shall be generally carried out concurrently with the appropriate survey of the reactor unit.

During special surveys the following shall be examined:

**.1** gas compressors in dismantled condition.

Necessity of dismantling shall be determined by the RS surveyor in each particular case based on the established terms of technical maintenance of the compressors and their expired service life.

The measurement results and wear conditions of the essential components shall be checked by the RS surveyor. During survey of the compressors the cylinder blocks and head covers, liners, membranes, moving parts, safety valves, coupling boxes, foundation frames shall be examined.

Survey of the compressors may be combined with their scheduled overhaul;

**.2** automated, remotely controls valves for gas supply to volume compensators.

Valves, seal housings, rods, pneumatic actuator components, bellows glands shall be examined;

**.3** piping and bellows-type valves of the HPG system, pulse tubes of the pressure sensors, their fastenings, gas intake piping from ashore, fittings and arrangements for high-pressure air supply, gas blowing system.

On completion of survey and tests, the HPG systems, machinery and equipment shall be subject to external examination and operational testing for intended use with verification of the specification parameters established by the NS Rules or technical specifications approved by the Register.

Duration of such operational testing shall be established depending on technical condition of the equipment. The check may be combined with gas transportation procedure.

**4.5.6** Survey of the HPG system during annual survey of the ship shall be carried out on completion of all repairs and maintenance, overhauls and opening-up, periodical check of instrumentation, charging of the system with gas, gas leak test and other works that determine the operational readiness of the system.

Therewith:

**.1** during survey the operational testing for intended use and external examination of the machinery, gas receivers, piping, fittings and other equipment of the HPG system shall be carried out.

Fastenings of gas receivers, pressure gauges and their pulse piping shall be checked;

**.2** compressors shall be operationally tested for gas pumping from one cylinder group to another or gas intake from the shore. Therewith, the operation of electric drive, cooling system, safety valves shall be checked. Their actuation pressure shall not exceed  $1,1P_{working}$ , unless otherwise specified in the manufacturer's technical documentation;

**.3** apart from this, the HPG system shall be operationally tested for intended use in compliance with the valid Operating Manual of the nuclear power plant (refer also to [Section 5](#)).

In this case the following shall be checked:

**.3.1** operation of pressure control arrangements in the system;

**.3.2** means of information and parameter warning alarm;

**.3.3** actuation of automatic remotely controlled valves on the signals of pressure rise or pressure drop in the circuit (in case of remote control);

**.3.4** warning alarm for overpressure or pressure drop in the circuit (where necessary).

The check method, as well as the possible lockout of the reactor protection system shall be established in compliance with the valid Operating Manual of the nuclear power plant;

**.3.5** radiation level of the cylinder surfaces with SSS in operation for monitoring of the gas activity in gas receivers (the appropriate meter chart shall be submitted to the RS surveyor).

## **4.6 TERTIARY AND QUATERNARY SYSTEMS**

**4.6.1** The requirements of this Chapter apply to the pumps, heat exchangers, filters, piping, tanks and fittings of the tertiary and quaternary circuits located outside the containment.

**4.6.2** The summarized scope of surveys of the above-mentioned tertiary machinery and equipment during periodical surveys of the ship is given in [Table 1.3.1](#).

Surveys, testing and operational testing of the quaternary machinery, equipment and systems shall be carried out in the scope and according to the procedure specified in 2.4.5.8, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, as well as in the Operating Manual of the nuclear power plant.

Scope and procedure of surveys and tests of the particular items of technical supervision are given below.

**4.6.3** All the tertiary and quaternary components shall be subject to surveys and tests, which scope and procedure are given in [4.1](#) and [4.2](#).

**4.6.4** The values of test pressure during hydraulic tests of heat exchangers and tests following their repair shall be established in compliance with the technical specifications of the manufacturers and the relevant standards established for hydraulic tests of the tertiary and quaternary systems and equipment and approved by the Register.

**4.6.5** Survey of systems and equipment shall be generally carried out concurrently with the appropriate SSS survey.

Measurement results and wear conditions of the essential components shall be checked by the RS surveyor.

Scope of opening-up shall be established based on the necessity of measurements and considering the expired service life or other conditions as stated in the technical instructions.

**4.6.6** During special surveys the following shall be checked:

**.1** pumps (casings, shafts with bearings, wheels, coupling boxes, foundation frames);  
**.2** heat exchangers (shell in the accessible places, covers, chambers, tube plates, branch pipes and their flanges, tubes and their seals, fastening of heat exchangers and their foundations) — refer to [4.3](#).

Accessibility of the heat exchangers for internal survey in scope enabling to assess their technical condition shall be specified in accordance with the requirements of 2.4.5.7.4.2, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service;

**.3** pump electric drives with the check of their thermal protection;

**.4** tanks, piping and their fittings.

High-purity water tanks, their fastenings, fittings, tertiary piping outside the shielding barrier, explosive mixture removal piping, fittings with local and remote control, pulse piping and piping of working water or air supply, installation of water level, pressure drop sensors, etc. shall be examined.

Tightness of bellows-type valves of cooling water supply and discharge to the primary circulating pumps, control and protection system stanchions, cooling pump and other equipment located in the containment shall be checked.

The tertiary and quaternary components shall be tested by test pressure following their repair. In this case the certificates for the materials used and finished products, as well as the documents verifying the quality of welding works performed shall be also submitted to the RS surveyor.

**4.6.7** On completion of survey and tests, the tertiary system and equipment shall be subject to operational testing for intended use with verification of the specification parameters of the main equipment established by the operating documentation or technical specifications approved by the Register. Duration of such checks shall be established on agreement with the RS surveyor.

**4.6.8** During each special survey the RS surveyor shall check the documentation of the tertiary coolant quality based on the chemical and radiochemical analysis results. Content of chlorides and oxygen shall be verified with the standard instrument readings.

Operation of the tertiary and quaternary system and equipment with SSS in operation shall be checked in compliance with the valid SSS operating documentation. Scope of checks shall be established in each particular case depending on scope and results of the overhauls and preliminary checks performed.

**4.6.9** During annual surveys the following shall be checked:

**.1** operation of the tertiary and quaternary pumps in the main and standby modes, each for its heat exchanger; then operation of each pump for the other side cooler;

**.2** operability of fittings and reliability of their switching from the local stations and remotely, as well as the reliability of operation of the remote drives and position indication of the fittings;

**.3** automatic actuation of pumps and opening of the relevant fittings at pressure drop in the circuit with the check of alarm for pump operation and fitting position;

**.4** remote start and stop of the pumps, as well as their start subsequent to preliminary de-energization;

**.5** operation of level indicators located on the tertiary expansion tanks;

**.6** operation of explosive mixture removal piping by its purging with high-pressure air or any other approved method (e.g., by supply of air to the expansion tank from the supply ventilation ducts of the spaces);

**.7** working order of piping and fittings of the draining and sampling systems.

**4.6.10** Occasional survey of the tertiary and quaternary components shall be carried out on completion of all repairs and maintenance performed within the specified periods in accordance with operating documentation and technical instructions.

## **4.7 PRIMARY MAKE-UP SYSTEM**

**4.7.1** The requirements of this Chapter apply to the primary make-up pumps, core emergency cooling pumps, transfer pumps, filters, tanks, piping and fittings of the make-up system to the primary supply valves, as well as the water treatment and core emergency cooling systems.

**4.7.2** The summarized scope of survey of the above-mentioned machinery and equipment during periodical surveys of the ship is given in [Table 1.3.1](#). Scope and procedure of surveys and tests of the particular items of technical supervision are given below.

**4.7.3** All components of the water treatment and primary make-up system and core emergency cooling system operating under pressure shall be subject to surveys and tests, which scope and procedure are given in [4.3](#).

**4.7.4** The value of test pressure during hydraulic tests of the primary equipment or systems under pressure shall be specified according to the technical documentation of the SSS designer or the appropriate standards established for the primary systems and equipment and approved by the Register.

**4.7.5** Survey of the water treatment systems and equipment, primary make-up and core emergency cooling systems shall be generally carried out concurrently with the relevant SSS survey.

The measurement results and wear conditions of the essential assemblies and components shall be checked by the RS surveyor. Scope of opening-up shall be established based on the possibility of measurements, the expired service life or other conditions specified in the technical instructions.

**4.7.6** During special surveys the following shall be checked:

**.1** make-up pumps (cylinder blocks and head covers, liners, pistons, valve boxes, bearings, couplings, gears, safety valves in dismantled condition, foundation frames);

**.2** transfer pumps and core emergency cooling pumps in scope established for centrifugal pumps (refer to 2.4.5.5.6, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service);

**.3** bellows-type valves (remotely controlled and locally controlled, stop and stop non-return);

**.4** make-up piping, suction and delivery, feed water tanks, piping and fitting of emergency reactor flushing, pulse, sampling, working air or water piping to the remotely controlled fittings. Fastenings of tanks, piping and fittings, system penetrations in the shielding barrier structures shall be examined;

**.5** fastening of level sensors on the tanks, fitting position indicators, cable connections thereto.

**4.7.7** On completion of survey, the water treatment and the primary make-up system and the core emergency cooling system shall be subject to operational testing with verification of the specification parameters established by the NS Rules or technical specifications approved by the Register. Duration of such operational testing shall be established depending on technical condition of the equipment. The operational testing shall be carried out in accordance with the RS-approved program.

**4.7.8** Survey of the water treatment and the primary make-up system and the core emergency cooling system during annual survey of the ship shall be carried out within the established period in compliance with the technical instructions of manufacturers.

During annual survey, prior to start of the SSS operation, the following shall be checked:

**.1** operation of make-up pumps at nominal pressure in the primary circuit;

**.2** operation of safety valves of make-up pumps;

**.3** operation of transfer pumps and emergency reactor flushing pumps;

.4 operability of remotely controlled fittings, including remotely controlled and manual fittings of emergency reactor flushing pumps with the check of valve position indication on the SSS mimic diagram;

.5 remote start and stop of the make-up pumps;

.6 operability of the level indicators in the feed water tanks with the check of indication on the mimic diagram of the upper and lower levels;

.7 working order of sampling piping and fittings.

The make-up system shall be operationally tested in compliance with Operating Manual of the nuclear power plant.

#### 4.8 COMPRESSED AIR, WORKING WATER SYSTEMS FOR REMOTELY OPERATED FITTINGS AND AUTOMATION HYDRAULIC PUMPS

**4.8.1** The requirements of this Chapter apply to the machinery, pressure vessels, tanks, piping, fittings and other equipment of high-pressure and medium-pressure air, as well as automation hydraulic systems.

**4.8.2** The summarized scope of surveys of the machinery, pressure vessels and other equipment of the above-mentioned systems during periodical surveys of the ship is given in [Table 1.3.1](#).

Scope and procedure of surveys and tests of the particular items of technical supervision are given below.

**4.8.3** Machinery, pressure vessels, their piping and other equipment shall be subject to surveys and tests, which scope and procedure are given in [4.3](#).

Air receivers, hydropneumatic vessels and other pressure vessels, as well as independent tanks together with their serving arrangements shall be subject to hydraulic tests according to the procedure and within the terms specified in [4.3](#).

Compressed air piping shall be hydraulically tested according to the procedure and within the terms specified in 2.4.5.8.12, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

Compressor air coolers shall be subject to hydraulic test by test pressure during the third special survey, and thereafter — every 10 years.

**4.8.4** Air receivers, hydropneumatic vessels and other pressure vessels, as well as independent tanks together with their serving arrangements shall be subject to hydraulic tests according to the procedure and within the terms specified in [4.3](#).

Compressed air piping shall be hydraulically tested according to the procedure and within the terms specified in 2.4.5.8.12, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

Compressor air coolers shall be subject to hydraulic test by test pressure during the third special survey and subsequently — every 10 years.

**4.8.5** The values of test pressure during the hydraulic tests shall be established in compliance with the technical specifications of the equipment manufacturers approved by the Register, however, they shall be at least  $1,25P_{working}$  working pressure for the vessel accessible for internal survey in scope allowing to determine their technical condition, and at least  $1,5P_{working}$  for the vessels inaccessible for such survey.

Accessibility of pressure vessels for survey shall be established by 2.4.5.7.4.2, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

In case the pressure vessels, their systems or other equipment are subjected to repair with their tightness broken, then after repair they shall be subject to hydraulic test by the above stated test pressure, if the higher test pressure is not indicated in the RS-approved technical specifications for the manufacture of this equipment. Simultaneously, the certificates for the materials used and conclusions of the welding quality shall be submitted to the RS surveyor.

**4.8.6** Pressure vessels and arrangement, as well as compressed air piping and working water delivery piping shall be subject to external examination under the working pressure with their operational testing for intended use.

In case the pressure vessels, compressed air piping or other equipment operating under air pressure or joint pressure of water and air are subject to repair with their tightness broken, then after hydraulic tests the repaired components shall be tested for tightness by the test pressure not lower than the working pressure during the period sufficient for their examination but not less than 1 h. Leak tests shall be carried out by working medium or compressed air.

**4.8.7** During special surveys the following shall be surveyed and tested:

**.1** air receivers and hydropneumatic pressure vessels.

Their internal survey and hydraulic test by test pressure shall be carried out within the above stated terms. Fastenings of the vessels, fittings, pressure and level sensors, safety valves in dismantled condition shall be examined.

Hydraulic tests of hydropneumatic vessels shall be carried out by a competent person of the shipowner and checked by the RS surveyor based on the records in the ship's documentation;

**.2** compressors in dismantled condition.

Scope of dismantling shall be established based on provision of measurements and examinations of components and assemblies and their expired service life. The results of measurement or wear determination shall be submitted to the RS surveyor on request. During survey of compressors the cylinder blocks and head covers, cylinder liners, pistons, piston rods, crankshafts, bearings, safety valves of stages in dismantled condition, air-, water-, oil coolers, coupling boxes, absorbers, foundation frames shall be examined;

**.3** pressure reducing valves, pneumatic- and hydraulic distribution fittings and remotely operated pneumatic- and hydraulic fittings — on a sample basis in dismantled condition allowing to determine their technical condition.

Scope of dismantling and list of fittings subject to overhaul shall be established in each particular case at the RS surveyor's discretion depending on their expired service life, maintenance performed or other provisions specified in technical instructions establishing procedure and terms of overhauls;

**.4** automation hydraulic pumps in scope specified in 2.4.5.5, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service;

**.5** compressed air piping, including compressed air for the HPG system and special drainage system before the first locking arrangements and working water of automation and remotely controlled fittings to the switchgear rooms, pulse piping;

**.6** automation hydraulic tanks, their fastenings, fittings, level sensors, cable connections, etc.

Starting from the second special survey, the tanks shall be surveyed and tested in compliance with 2.4.2.2.3 and 2.4.2.5, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service;

**.7** electric drive of the above-mentioned equipment.

On completion of survey and tests, the compressed air piping, air receivers, hydropneumatics vessels, machinery and equipment of working air and water systems shall be subject to operational testing for intended use with verification of the specification parameters established by the RS rules or technical specifications approved by the Register. Duration of the operational testing shall be established on agreement with the RS surveyor. Pressure vessels shall be surveyed in scope specified in 2.4.5.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, taking into consideration [4.3](#) of these Guidelines.

**4.8.8** Survey of equipment and systems of working air and water of the remotely controlled fittings and automation hydraulic fittings during annual surveys shall be carried out together with survey of all SSS on completion of all repair and maintenance works to be carried out in compliance with the technical instructions of the manufacturers. Survey shall be carried out at working air and water pressure in the systems and pressure vessels.

During annual survey the following shall be checked:

**.1** operation of high air pressure compressors together with the electric drive operation.

Therewith, the operation of safety valves, air coolers, cooling system shall be checked;

**.2** operation of pressure reducing valves;

**.3** operation of safety valves of air receivers and other pressure vessels;

.4 operation of drying unit with operational testing of safety valves and protection components of the unit against the inadmissible temperature rise (at the RS surveyor's discretion);

.5 operation of automation hydraulic pumps according to the standard procedure;

.6 the possibility of compressed air supply to the HPG system and receipt of compressed air from the ship's network;

.7 operation of air reducing valves in the remotely controlled fittings, drying and sorbent handling systems;

.8 operation of sensors and level indicators on the automation hydraulic tanks, hydropneumatics cylinders, as well as pressure gauges with the check of the operation at the local control station and the mimic diagram in the main machinery control room;

.9 operation of pneumatic and hydraulic remotely controlled distributors of air receivers and hydropneumatics cylinders with the check of actuation at the local control station and the mimic diagram in the main machinery control room;

.10 operation of distributors of remotely controlled fittings with the check of actuation of fitting position indicators on the mimic diagram in the main machinery control room.

All examinations and checks shall be carried out prior to SSS putting in operation. Check of the compressed air system and working water components for the remotely controlled fittings and automation hydraulic system with SSS in operation shall be carried out in the scope prescribed by the Operating Manual of the nuclear power plant.

## **4.9 SPECIAL-PURPOSE AND CIRCUIT WATER DRAINAGE SYSTEMS**

**4.9.1** The requirements of this Chapter apply to the machinery, devices, pressure vessels, piping and fittings providing drainage (by gravity or vacuum pumping) of the controlled area and supervised area spaces, reception and storage of sewage waters, and the primary piping during drainage, deaeration, sampling and other works at different modes of the reactor operation, discharge of active waters to shore.

**4.9.2** The summarized scope of surveys of the above-mentioned equipment during periodical surveys of the ship is given in [Table 1.3.1](#).

Scope and procedure of surveys and tests of the particular items of technical supervision are given below.

**4.9.3** Machinery, pressure vessels, their piping and fittings shall be subject to surveys and hydraulic tests in scope specified in [4.3](#) and being the maximum possible for radiation safety reasons. In case the radiation level on their surfaces is in excess of the permissible one, carrying out of hydraulic tests may be accepted by the Register. Therewith, in case the radiation levels on their surfaces are in excess of the permissible ones, the hydraulic tests of pressure vessels may be carried out without the preliminary internal survey and external examination under pressure but with the check of their tightness by the remote pressure instruments and radiation safety system, provided the appropriate control channels are available on board the ship. In similar cases the tests of the vessels by double media (water — air) may be carried out.

**4.9.4** Survey of equipment and piping shall be generally combined with the opening-up of unattended spaces for scheduled maintenance. In this case the components of other systems located in these rooms shall be surveyed, tested or operationally tested.

Survey of equipment in unattended spaces shall be carried out according to the program previously agreed with the shipowner and under the supervision of the radiation safety service.

**4.9.5** Pressure vessels inaccessible for survey due to radiation safety reasons, shall be, at least once in 15 years, subject to the appropriate treatment aimed at radiation reduction to the acceptable levels and submitted for external examination by the test pressure together with their piping in the scope and according to the procedure given in 2.4.5.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and this Section of the Guidelines.

Necessity of carrying out their internal survey shall be determined by the RS surveyor based on the results of the external examination and hydraulic test.

**4.9.6** In case the pressure vessels or their piping are repaired, on completion of the repair they shall be submitted to all types of surveys and tests specified in 2.4.5.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [4.3.4](#) of these Guidelines.

Moreover, they shall be subject to leak tests by compressed air at the maximum working pressure permitted for these vessels. Time of tests shall be sufficient for survey of the repaired components but not less than 1 h. In this case the RS surveyor shall check the certificates verifying the proper quality of the materials used and the conclusions on the welding quality.

**4.9.7** During special surveys the following shall be checked:

**.1** vacuum pumps with their pressure vessels.

Therewith, the main components of the pumps shall be examined in the scope allowing to define their technical condition, their piping and fittings, couplings with the engines, foundation frames and fastenings;

**.2** bottom-and-side valves in dismantled condition, their fastenings and drives with subsequent hydraulic test in compliance with the valid RS rules. Overhaul of the valves shall be carried out during dry docking of the ship;

**.3** bilge and drainage water storage tanks in the maximum possible extent from the point of view of radiation safety considering the requirements of this Chapter.

Where the access to them is available, they shall be surveyed and subject to hydraulic test in the scope and according to the procedure specified in 2.4.5.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and in this para.

The values of test pressure during hydraulic and pneumatic tests of different purpose tanks shall be established in compliance with the technical specifications of the manufacturers approved by the Register, however, they shall be at least  $1,25P_{working}$  working pressure for hydraulic tests and  $1,0P_{working}$  for pneumatic leak tests.

During survey of tanks, their foundations, fastenings, overflow pipes, level and pressure sensors shall be also examined;

**.4** bilge wells in the controlled spaces and level sensors therein.

Where necessary, the internal examination of non-return arrangements of scupper pipes may be conducted by the RS surveyor;

**.5** piping of systems, their fastenings and penetrations in the bulkheads and platforms, track fittings, its drives, position indicators;

**.6** active water ashore discharge station.

The following shall be examined:

- discharge fittings,
- biological shielding integrity,
- activity sensor fastenings,
- flushing and blowing systems.

The operability of communication and alarm, reliable closing of shell doors and manholes shall be checked.

On completion of survey of special drainage system and draining circuit waters with all their serving arrangements, machinery and equipment shall be operationally tested for intended use with check of the specified characteristics established by the NS Rules and NSV Rules or technical specifications approved by the Register. Such checks are recommended to be carried out concurrently with the scheduled procedures.

**4.9.8** Survey of machinery, arrangements and special-purpose and circuit water drainage system during annual survey of the ship shall be carried out on completion of all repairs and maintenance performed in accordance with technical instructions of the manufacturers. This survey shall be carried out concurrently with their operational testing. Where repairs related to their insufficient tightness have been conducted, the repaired components or systems in general shall be preliminary tested in the scope and according to the above-mentioned procedure. Annual survey shall be carried out prior to starting of the SSS operation.

During annual surveys the following shall be checked:

**.1** operation of vacuum pumps with the check of pressure drop and the time of its creation in water storage tanks and possibility of draining the tank for the own leakage collection;

**.2** operation of the special-purpose drainage system injectors.

This check shall be conducted on permission and under the supervision of the radiation safety service. At the RS surveyor's discretion, operational testing at clear water may be allowed;

**.3** operation of bilge system and vacuum drainage system.

Duration of checks shall be specified on agreement with the RS surveyor. The availability and operability of hoses with slot-type receptacles, their reliable connection to the system shall be checked;

**.4** operation of active water ashore discharge station.

The check shall be combined with the actual discharge operations, therewith the attention shall be paid to the tightness of connections, operability of fittings, possibility of flushing and blowing-off of the system on operation completion. Simultaneously, the operation of activity sensor and operability of its information channel to the RM system control panel and the mimic diagram in the main machinery control room shall be checked;

**.5** operation of remote level measurement system in the bilge and drainage water tanks and the limit position alarm with the check of readings on control panels in the main machinery control room and based on the secondary instruments of the systems' local control station;

**.6** operation of level sensors in bilge wells of the drainage system and fitting position indicator with the check of audible and light alarm on the mimic diagrams in the main machinery control room and special systems' control station;

**.7** operation of mechanical remote drives of the special-purpose drainage system fittings;

**.8** operation of pressure devices with the check of the readings on control panels in the main machinery control room and using the secondary instruments of the systems' control station;

**.9** operation of safety valves for protection of inadmissible pressure rise in the bilge and draining water tanks.

Safety valves shall be adjusted for pressure specified by the appropriate technical instructions. On completion of the check, the valves shall be sealed by the repairer control body.

#### **4.10 SORBENT UNLOADING AND LOADING SYSTEMS OF PRIMARY AND TERTIARY FILTERS**

**4.10.1** The requirements of this Chapter apply to machinery, vessels, fixed and detachable piping and fittings of new sorbent receipt and storage system and handling of spent sorbents.

**4.10.2** All types of surveys, tests and operational testing of the above-mentioned systems shall be carried out in compliance with the requirements of 2.4.5.5, 2.4.5.7, 2.4.5.8, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [Section 7](#) of these Guidelines, considering valid instructions on receipt of clean sorbents and handling of spent sorbents and shall be carried out only at initial survey of the ship.

**4.10.3** Systems, machinery and equipment for reception, storage and handling of low-used sorbents shall be subject to survey by a competent person of the shipowner and monitored by the RS surveyor based on the records in ship's documentation.

#### **4.11 VENTILATION SYSTEM OF SSS SPACES**

**4.11.1** The requirements of this Chapter apply to the machinery, arrangements and systems providing ventilation of the main and auxiliary equipment of the SSS spaces.

**4.11.2** The summarized scope of surveys of the above-mentioned equipment during periodical surveys of the ship is given in [Table 1.3.1](#).

Scope and procedure of surveys and tests of the particular items of technical supervision are given below.

**4.11.3** All components of the ventilation system, serving both directly SSS and the spaces where this ventilation equipment is installed, are subject to surveys, which scope and procedure are specified in 2.4.5.5, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [4.1](#), [4.2](#) of these Guidelines. Survey of the exhaust ventilation equipment shall be carried out in the scope sufficient for the reliable determination of technical condition and operability of this equipment.

**4.11.4** Survey of the ventilation system and equipment shall be generally carried out concurrently with the appropriate SSS surveys with subsequent complex check of all the equipment firstly with inactive SSS, and then during its operation at the ship's full speed.

**4.11.5** The results of wear measurements of the essential assemblies and machinery components shall be submitted to the RS surveyor.

**4.11.6** Heat exchangers of the ventilation system (coolers and heaters) shall be subject to survey by the Register only following their major repairs. Surveys and testing during periodical surveys of the ship shall be carried out by the competent persons of the shipowner in the scope and within the terms specified in 2.4.5.7.1, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service. The results of these surveys and tests shall be verified by the RS surveyor according to the ship documentation records.

**4.11.7** During special surveys the following shall be checked:

- .1 supply and exhaust fans;
- .2 tight flaps, installed directly on the containment bulkheads, and their drives;
- .3 remote control drives of throttle butterfly valves for pressure drop adjustment in the operator's room and SSS spaces, as well as other drives of the ventilation fitting control;
- .4 ventilation ducts and wells in all accessible places;
- .5 various purpose sensors, their fastenings and cable connections.

On completion of survey, the ventilation system of the SSS spaces shall be subject to external examination and operational testing with the check of the specified microclimate condition characteristics and pressure drop in the attended spaces specified by the technical documentation of the ship's designer.

Activation of the containment isolation arrangements shall be checked in case of rise of pressure and other parameters specified by the technical instructions.

**4.11.8** Survey of the ventilation system of the SSS spaces during annual and intermediate survey shall be carried out together with the appropriate survey of SSS in general on completion of repair and maintenance works performed within the prescribed periods in compliance with the technical instructions of the manufacturers and considering the relevant requirements of the Operating Manual of the nuclear power plant.

Therewith, the following shall be checked:

- .1 operation of the main and standby fans;
- .2 operation of heat exchangers and ventilation filters of the SSS spaces;
- .3 operation of ventilation fitting both from the remote drives and from the manual drive;
- .4 reliability of the containment isolation arrangements;
- .5 indication of the fans and fittings operation on control panels in the main machinery control room and pressure drop readings in the spaces;

**.6** operability of light and audible alarm channels in the main machinery control room at the rise of air temperature after the air receivers above the permissible one;

**.7** operability of channels for remote measurements of air temperature in the ventilated spaces located in front of air receivers and behind them;

**.8** serviceability of air radioactive contamination monitoring channels in the ventilated spaces of the automated RM system;

**.9** operability of automatic steam supply valves to air heaters and quality of the set air temperature maintenance.

**4.11.9** Technical condition of the ventilation system of the SSS spaces shall be determined based on the results of surveys and testing taking into consideration the requirements of 2.4.5.5.6, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [Section 6](#) of these Guidelines.

## **5 NSSS OPERATIONAL TESTING**

**5.1** During the SSS special, annual and intermediate surveys on completion of all repair works, a complex functional check of all the SSS systems and equipment shall be carried out, including nuclear safety systems and equipment. The checks shall be carried out according to the procedures and programs developed by the system designer and approved by the Register.

**5.2** During special, annual and intermediate surveys, the examination and operational testing of all the SSS control, monitoring, alarm and protection systems shall be carried out, including:

**.1** operational testing of communication means of the SSS spaces with the main and emergency control stations having main and standby electric power supply;

**.2** external examination and completeness check of spare parts of the SSS machinery, systems and arrangements;

**.3** check conducted by the competent bodies of condition, completeness and dates of the mandatory verification and calibration of instrumentation providing control of the SSS operation.

**5.3** The SSS complex operational testing during special, annual and intermediate (in case the system is taken out-of-operation) surveys shall be carried out together with the ship's power plant according to the RS-approved program. The total duration of tests shall include the time required for the SSS testing at different (recommended) power levels, including the maximum one. In case more than one reactor is available on board the ship, their testing at the maximum power levels may be carried out in turn.

Based on the results of the equipment operational testing, the RS surveyor shall determine the necessity and scope of overhaul of the SSS components, its control and protection devices and systems, service facilities, as well as the necessity, scope and duration of repeated tests (operational testing).

**5.4** At monitoring of the nuclear safety systems and equipment, the following shall be checked:

**.1** failure-free operation of control actuators of the emergency protection (EP) system, compensating group, their limit switches, algorithms of passing the EP system signals via all types of protection settings, response of signal lamps and mimic diagram;

**.2** core residual heat removal systems.

Check of automated and remotely controlled control channels of cooling down means and fittings with flow and pressure in systems control, response of lamps of the equipment and fitting condition shall be carried out;

**.3** operation of core emergency cooling system.

The system shall be separately checked for each reactor with the check of activation of the track and control fittings, pressure in pulse piping of pressure drop regulators, adjustment of operating feeding means. Where autonomous electric pumps are used in the emergency cooling system, the settings and algorithm of automatic start of the main and standby means of cooling water supply shall be checked. Tightness of non-return-stop valves of all the system ducts shall be checked. Operation both of the standard and standby emergency cooling systems shall be checked. Operational testing shall be carried out in compliance with the Operating Manual of the nuclear power plant. The permissible reactor power level and the sequence of check operations in this case shall be specified in the RS-approved procedure;

**.4** containment isolation arrangements:

**.4.1** closure tightness of the covers, doors, manholes and response of the limit switches indication in the main machinery control room;

**.4.2** remote opening-closing of the emergency pressure-relief valve and automatic activation of the valve by simulating the pressure rise signal in the operator's room;

**.4.3** remote and then automatic closing-opening of shut-off valves, isolating the SSS space and the operator's room, settings of its activation and mimic diagram response;

**.5** primary pressure rise prevention system.

When the primary circuit is fitted with safety valves, the pressure actuating settings shall be checked. When the primary circuit is fitted with other automated means excluding its over-pressurization, the actuating settings, passing of electrical signals and operation of executive devices shall be checked;

**.6** containment pressure reduction system.

Check of the containment pressure reduction system shall be carried out in compliance with the instruction of the firm (manufacturer) considering its design particulars. Where a drenching system of the shielding barrier is used, the tightness of removable branch pipes shall be tested by gas or compressed air prior to operational testing.

During the system test the following shall be checked:

**.6.1** operability of the pumps, fittings and sensors;

**.6.2** indication of the equipment signals and system sensors on the control panel in the main machinery control room.

Where safety devices are used as the pressure reduction system, external examination of the devices, piping (ducts) of steam-water mixture and its condensing means shall be carried out;

**.7** operation of systems and equipment not directly providing the SSS operation at the power that shall be checked prior to mooring trials according to the RS-approved programs.

**5.5** Availability on board of the actually updated Operating Manual of the nuclear power plant shall be checked.

**5.6** Following the functional checks, obtaining of the minimum controlled reactor power, warming-up, making (where necessary) of neutron measurements and obtaining the energy power level, SSS shall be operationally tested during mooring trials together with the servicing auxiliary machinery, arrangements, equipment and systems providing its power operation in combination with the ship's steam turbine unit and during the sea trials according to the RS-approved programs.

During mooring trials, the SSS control, monitoring, alarm and protection means and systems shall be checked for intended use in the scope specified by the appropriate sections of the Operating Manual of the nuclear power plant and [Section 6](#) of these Guidelines.

**5.7** The scope of the SSS complex operational testing during mooring and sea trials shall be established on agreement with the RS surveyor. The scope of tests may be based on the results of the system operation in the preceding period of time, absence of major repair, satisfactory results of routine maintenance and preliminary checks, etc. or failures in operation of separate components, major repair, etc. However, in each case the scope of tests shall be sufficient for the comprehensive operational testing for intended use of all the SSS components providing its warming-up, operation at different power levels and cooling.

**5.8** At the SSS operational testing during mooring and sea trials, all the components of the main power plant related to SSS and served by the interdependent control system shall be checked. Their check shall be carried out both at the active interdependent control system (when provided by the Operating Manual of the nuclear power plant) and without it.

**5.9** Where SSS is operated at full power, the radiation levels at least in the habitable spaces shall be checked, the check data shall be submitted to the RS surveyor for comparison with the data specified in the Nuclear Ship Safety Information.

In case the check data are deviated of those indicated in the Safety Assessment of the nuclear power plant and the ship, the Register may consider the conclusions of the competent organizations on the admissibility of the actual levels with the analysis of reasons of their increasing, and the Nuclear Ship Safety Information shall be brought in compliance with the actual situation. Where, based on the opinion of the competent organizations, the increase of radiation levels in any habitable spaces or a group of spaces is inadmissible or they exceed the value prescribed by the valid sanitary norms, the measures aimed at reduction of the radiation level in these spaces to the acceptable levels shall be taken by the shipowner (operator). The summary list of measures taken for this purpose shall be agreed with the Register.

The repeated check of actual levels in such spaces shall be carried out. The check results and the appropriate correction of the Nuclear Ship Safety Information shall be submitted to the RS surveyor.

## **6 SURVEY OF NSSS AUTOMATIC CONTROL, MONITORING, ALARM AND PROTECTION SYSTEMS**

### **6.1 GENERAL**

**6.1.1** The requirements of this Section apply to the systems and arrangements of automatic control of the nuclear ship SSS, means of automation of its separate machinery and arrangements, systems and arrangements of local, remote and centralized control of its operating parameters, as well as the equipment providing the SSS safe operation in emergency modes.

In respect of survey of the nuclear ship equipment and automation systems, which operation has no direct impact on the SSS safe operation, the requirements of 2.2.8 and 2.4.8, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service shall be met.

**6.1.2** Survey of the SSS automatic control, monitoring, alarm and protection systems is aimed at verifying the possibility of establishing and maintaining the specified modes of the SSS operation in general and its particular main and auxiliary arrangements, as well as reliability of its protection in case of inadmissible change of one or several parameters of its operation or operation of the ship's machinery providing its service.

**6.1.3** Survey of the SSS automatic control, monitoring, alarm and protection systems shall be carried out during special, annual and intermediate surveys of the ship, as well as during occasional surveys carried out after major repairs of these systems or their separate components, their modification or replacement changing the principles of operation of the components or the system in general.

**6.1.4** During survey of the SSS automatic control, monitoring, alarm and protection systems, the technical documentation (plans, diagrams, technical descriptions, etc.) shall be submitted to the RS surveyor in the extent sufficient for verification of compliance of the specified parameters and characteristics with the valid NS Rules, fulfillment of design and other requirements of the RS-approved documents.

**6.1.5** Prior to survey or operational testing, the RS surveyor shall review the documentation submitted by the shipowner on all replacements, repairs and routine maintenance of the SSS automatic control, monitoring, alarm and protection systems.

**6.1.6** Prior to survey and operational testing of the SSS automatic control, monitoring, alarm and protection systems, check shall be carried out of the availability of the valid documents and/or stamps confirming verification and calibration of instrumentation by the competent bodies in case they are subject thereto.

In case of the complete expiry of the expected life, such instrumentation or arrangements shall be replaced or the competent conclusions (of the designer or the manufacturer) on their operability for the entire service period shall be submitted to the RS surveyor.

**6.1.7** At each type of survey, the equipment of the SSS automatic control, monitoring, alarm and protection systems shall be properly prepared for survey, providing, where necessary, access to their separate components.

The appropriate plans, diagrams, files and other necessary documentation shall be submitted to the RS surveyor.

**6.1.8** Technical condition of the SSS automatic control, monitoring, alarm and protection systems shall be determined based on the results of examinations, measurements and operational testing (refer to [Table 1.3.1](#)), which scope and procedure are determined in the technical specifications for manufacture of these systems, relevant instructions of the manufacturers and in the Operating Manual of the nuclear power plant.

The possibility of temporary or limited SSS operation in case of wear, damage or defects of the separate components or channels of the SSS automatic control, monitoring, alarm and protection systems shall be subject to special consideration by the Register in each particular case. In this case the appropriate conclusions of the competent organizations (designer or manufacturer) on such a possibility indicating limitations on the SSS operation shall be submitted to the Register.

## **6.2 SCOPE OF SURVEY**

**6.2.1** The summarized scope of surveys of the SSS automatic control, monitoring, alarm and protection systems during periodical surveys of the ship is given in [Table 1.3.1](#).

The detailed scope of survey of the SSS automatic control, monitoring, alarm and protection systems is specified in [6.3](#).

**6.2.2** When any system during the first 15-year cycle is replaced by a new one or modified in the extent sufficient for its recognition as a new one, the period of 15-year cycle may be determined from the date of its modernization (replacement) regardless of the fact whether this period corresponds to any special survey or not.

**6.2.3** Scope of the systems' survey on expiry of the 15-year cycle shall be established depending on the their condition considering repairs and replacements performed.

**6.2.4** Survey of the SSS automatic control, monitoring, alarm and protection systems shall be generally carried out concurrently with the scheduled repair and examinations of these systems.

Scope of separate examinations of the system components, operational testing shall be specified by the RS surveyor in each particular case, depending on the requirements of technical instructions, expired service life, repair work, etc.

**6.2.5** Scope of survey of the SSS automatic control, monitoring, alarm and protection systems newly developed and installed on ships, as well as being at the experimental operation stage shall be subject to special consideration of the Register in each particular case.

**6.2.6** Survey of the power supply equipment of the SSS automatic control, monitoring, alarm and protection systems (switchboards, transformers, switching and distributing devices, instrumentation, cable routes, etc.), as well as the means providing switchover of these systems to standby or emergency power supply shall be carried out in the scope and according to the procedure specified in 2.2.7, 2.3.4 and 2.4.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**6.2.7** Survey of the pressure vessels being part of the automatic control systems shall be carried out in compliance with the requirements of 2.4.5.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service and [4.3](#) of these Guidelines.

### **6.3 CARRYING OUT OF SURVEY**

**6.3.1** The survey of the SSS automatic control, monitoring, alarm and protection systems during periodical surveys of the ship shall be generally carried out concurrently with the SSS relevant surveys. On completion of survey of these systems, the complex operational testing of the systems for intended use shall be carried out, with check of their operating parameters providing safe regulation, monitoring and protection of the system.

The complex testing of the SSS automatic control, monitoring, alarm and protection systems shall be preliminary carried out on the cold system and then with SSS in operation according to the appropriate program approved by the Register.

**6.3.2** Technical documentation on the SSS automatic control, monitoring, alarm and protection systems (files, logs, logs of measurement and routine inspections, reports, etc.) allowing to determine the compliance of the systems with the requirements imposed thereon in the preceding period of operation, routine maintenance, replacements, etc. shall be reviewed by the RS surveyor.

Wear measurements of the essential mechanical components of the system, linear travel values, travel time, electrical circuit parameters and other valued specified by the technical specifications approved by the Register and enabling to assess technical condition of the system and the degree of compliance with the requirements imposed to them shall be also submitted.

**6.3.3** Survey of the SSS automatic control, monitoring, alarm and protection systems during special surveys of the ship shall be, where possible, carried out concurrently with the scheduled repairs, inspections of these systems, which scope and terms are established by the technical specifications approved by the Register.

During special surveys the following shall be checked and operationally tested:

- .1** local and main panels of monitoring and control and their components (keys, toggle-switches, indication and alarm devices, instruments, cable routes, etc.);
- .2** regulators and measuring devices of different purpose, their amplifying arrangements and executive devices, parameter sensors, pulsing devices, position indicators of regulators, etc.;
- .3** actuators and drives of regulators and protection;
- .4** mimic diagrams and their power units;
- .5** cable routes, inputs and outputs in the accessible places.

Measurements of electrical parameters of the main channels of systems and electrical equipment at the specified modes of operation and the values of stroke and travel of the arrangements regulating the SSS power shall be performed and submitted to the Register. Insulation resistance measurements shall be carried out.

Operational testing of the SSS automatic control, monitoring, alarm and protection systems shall be carried out on completion of the overhaul of their main components immediately prior to the SSS start in compliance with the Operating Manual of the nuclear power plant.

This testing shall be carried out according to the program agreed with the Register with simulation of starts, mode changing and stop of particular machinery and arrangements, operation of remotely controlled fittings, passing of signals to the automated control and emergency protection systems according to the limited parameter values and actuation of the appropriate signals to the general ship electric power supply systems. Therewith, execution of commands by the monitoring, control and protection systems and alarm due to the parameters overriding on the mimic diagrams and on the key devices of the panels shall be checked.

Survey and operational testing of the monitoring, control, alarm and protection systems with SSS in operation shall be carried out in scope not less than during annual survey of the ship.

**6.3.4** Survey and operational testing of the SSS automatic control, monitoring, alarm and protection systems during annual survey of the ship shall be carried out in compliance with the Operating Manual of the nuclear power plant prior to commissioning of SSS in service and with SSS in operation. Scope of checks shall be subject to special consideration of the Register in each particular case and shall be determined based on the results of the preceding operation of the systems, performed overhauls, replacement or maintenance repairs. However, the check of power adjustment, compliance of the specified and actual power, actuation of alarm signals for the power control, parameter control means and the appropriate alarm is mandatory.

## **7 RADIATION MONITORING**

### **7.1 GENERAL**

**7.1.1** The requirements of this Section apply to the following equipment of the nuclear ship and NS vessel intended for provision of radiation monitoring (RM):

- .1** radiation safety (RS) systems;
- .2** radiation monitoring (RM) means providing storage, treatment and removal of active or able to be active media from the ship;
- .3** facilities for decontamination of spaces and equipment.

**7.1.2** During all types of periodical surveys of the nuclear ships and NS vessels, the documents verifying the necessary measures aimed at provision and maintenance of the ship and environment RS shall be submitted to the RS surveyor.

These measures are verification of effectiveness of the biological shielding and, where necessary, decontamination of spaces and equipment.

Verification of effectiveness of the NS biological shielding shall be carried out at each SSS power raising, and for the NS vessels — at each special survey.

In respect of the means providing storage, treatment and removal of active or able to be active media from the ship, the relevant provisions of Sections [4](#) and [6 shall be met](#). Survey of the arrangements providing the ship and environment RS shall be carried out in the scope specified for equipment comprising these arrangements.

**7.1.3** During periodical surveys of the ship, decontamination facilities are not subject to surveys, however, the shipowner shall submit to the Register the documents verifying their operable condition.

## **7.2 RADIATION MONITORING SYSTEM**

**7.2.1** Survey of the radiation monitoring (RM) systems is aimed at performance and reliability check of their operation at any mode of the NPU service and main engineering equipment of the NS vessel during repair, loading and other work connected with high radiation hazard on board the ship and during the leak test of the primary, secondary and tertiary circuits of the nuclear ship.

**7.2.2** Survey of the RM systems, as well as of the systems and means providing the allowed radiation situation on board the ship shall be carried out during the SSS periodical surveys and after major repair of systems in whole or their separate components.

**7.2.3** During the survey, the RS surveyor shall examine the relevant technical documentation (plans, diagrams, technical specifications, etc.) in the scope necessary for establishing the compliance of the regulated parameters and characteristics with the valid NS Rules and NSV Rules or other RS-approved documents.

**7.2.4** Surveys of radiation monitoring systems shall be generally carried out concurrently with their scheduled repair and examinations. The shipowner shall in advance notify the Register of the estimated repairs or routine inspections for it to carry out the relevant surveys and be properly prepared for them.

**7.2.5** Operational testing of radiation monitoring systems shall be carried out as per the programs recommended by the system manufacturer and approved by RS, however, in all cases operational testing of the following system components is mandatory:

- .1** arrangements of channels for the tightness control of the primary, secondary and tertiary circuits;
- .2** arrangements and channels of radioactivity control of the primary, secondary and tertiary media;
- .3** arrangements and control channels for radiation situation on board the ship;
- .4** arrangements for radioactivity control of media to be removed to environment;
- .5** control panels of the radiation monitoring systems.

Therewith, the information output on the nature and value of radioactive parameters in the controlled points with the appropriate warning may be checked by the RS surveyor on a case-by-case basis.

**7.2.6** Survey of electrical equipment of the RM system shall be carried out in the scope and according to the procedure specified in 2.2.7, 2.3.4 and 2.4.7, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**7.2.7** Prior to survey and testing of the RM system, materials verifying operability of instrumentation and devices and availability of sufficient service life of the equipment and arrangements being parts of this system shall be submitted to the RS surveyor.

The data on checking of the sensors under the standard radiation sources shall be submitted to the RS surveyor.

The service life of the RM system established on the basis of the survey results shall not exceed the useful time or resources of the separate components specified by the manufacturer.

**7.2.8** During all types of surveys, the RM system shall be properly prepared for survey and testing. The scope of opening-up (where necessary) shall be established by the Register on agreement with the shipowner based on the expired service life, previous service results, prior overhauls and replacements, their results, etc.

**7.2.9** Technical condition of the RM system shall be determined based on the examination, measurement results of electrical parameters of its separate arrangements and channels, operational testing, which scope and procedure are specified in the technical specification for their manufacture and other RS-approved documents.

**7.2.10** In case of failures, damage, etc. of the separate components or channels of the RM system, the possibility of temporary operation of the system shall be defined by the designer and shall be subject to special consideration by the Register in each particular case.

## **8 PHYSICAL SECURITY**

### **8.1 GENERAL**

**8.1.1** The requirements of this Section apply to the complex of engineering facilities of the physical security (PS) system.

**8.1.2** Survey of the PS engineering facilities, such as structural components of hull and superstructures (decks, bulkheads, doors, hatch covers and purpose-built structures — booms, grating, reinforced doors) shall be carried out in the scope and according to the procedure specified in 2.2.2, 2.3.2 and 2.2.4, Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service.

**8.1.3** Survey of the PS engineering facilities including the components and arrangements of the systems:

- .1** intrusion protection system;
- .2** security alert system;
- .3** access monitoring and control system;
- .4** optoelectronic surveillance and situation assessment system;
- .5** operational communication and address system (including wire and radio communication means);
- .6** data protection system;
- .7** electrical power supply and lighting system

shall be carried out in the scope and according to the procedure specified in 2.2.7 (for electrical equipment) and 2.2.8 (for computers and computer systems), Part II "Survey Schedule and Scope" of the Rules for the Classification Surveys of Ships in Service, as well as in compliance with the requirements of Part XIII "Physical Security" of the NS Rules.

## **8.2 SURVEY SCOPE AND PROCEDURE**

**8.2.1** The summarized scope of survey of the PS engineering facilities during periodical surveys of the ship is given in [Table 1.3.1](#).

**8.2.2** Technical condition of the PS system shall be determined based on the results of examinations and operational testing.

## **9 TECHNICAL REQUIREMENTS FOR PASSAGES AND STANDARD TOWING OF BERTH-CONNECTED SHIPS AND OTHER FLOATING FACILITIES FITTED WITH MARINE REACTOR PLANTS AND/OR SPENT NUCLEAR FUEL STORAGE FACILITIES**

### **9.1 DEFINITIONS AND ABBREVIATIONS**

**9.1.1** In this Section the use is made of the definitions and abbreviations specified in [1.2.1](#) and [1.2.2](#) of these Guidelines and Section 8 "Passages and Towing" of the Guidelines on Technical Supervision of Ships in Service.

In addition, the following definitions are used in this Section.

**Administration** means the Government of the State whose flag the ship is entitled to fly.

**Head of towing** means a person responsible for towing. A master of a towing boat may be assigned as such.

**Responsible organization** means the organization having overall responsibility for the nuclear ship recognized by the Administration.

**Personnel (work-related exposed persons)** means crew members to be exposed to ionizing radiation according to their occupation.

**Physical security** means a combination of measures and engineering facilities to prevent sabotage and theft regarding to nuclear materials, nuclear plants and storage facilities.

**Operating organization** means an organization established in compliance with the legislation of the Russian Federation and recognized by the appropriate governing body on nuclear energy control fit for operation of a nuclear plant, source of radiation or storage facility and perform, using one's own resources or with the involvement of other organizations, the activities on placement, design, construction, service and decommissioning of the nuclear plant, source of radiation or storage station, as well as the activities on handling of nuclear materials and radioactive substances.

**Nuclear materials** mean the materials containing or able to reproduce splitting (fissile) nuclear substances.

In addition, the following abbreviations are used in this Section:

NF — nuclear fuel;

NM — nuclear materials;

NPU — nuclear power unit;

NRS — nuclear and radiation safety;

RP — reactor plant.

## **9.2 GENERAL**

**9.2.1** The requirements of this Section apply to provision of passages and standard towing of berth-connected ships and other floating facilities fitted with marine reactor plants (RP) and/or SNF, LRW and SRW storage facilities<sup>1</sup>, including decommissioned and disabled naval ships and support vessels or their afloat parts (units) containing RP or SNF storage facilities with unloaded fuel.

**9.2.2** Passages and standard towing of ships with RP and/or SNF, LRW and SRW storage facilities are fully covered by the requirements of Section 8, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service (except for requirements related to passages without people on board). In this Section the additional requirements are specified which shall be provided due to special purpose of ships in order to ensure safety of the personnel, shipping in the adjacent area, environment and the towed facility. Additional requirements are mainly related to provision of the NPU and NM NRS and PS.

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<sup>1</sup> Hereinafter referred to as "the ships with RP and/or SNF, LRW and SRW storage facilities".

### **9.3 PASAGE PLANNING AND ORGANIZATION**

**9.3.1** In accordance with Federal Law of the Russian Federation No. 170-FZ "On Nuclear Energy Use" of 21 November 1995, operating organization<sup>1</sup> is responsible for NRS, PS, handling of NM and radioactive substances during towing of ships with RP and/or SNF, LRW and SRW. This provision shall apply to the items covered by the above-mentioned Federal Law.

**9.3.2** The responsibility for the safety of ships and other floating facilities with NPU and radiation sources transported after construction to the place of service where the final part of tests and acceptance thereof is carried out, in accordance with Federal Law of the Russian Federation No. 170-FZ "On Nuclear Energy Use" of 21 November 1995 shall be held by the principal design organization and shipbuilding organizations, and operating organizations after the commissioning.

**9.3.3** Passages of ships with the RP and/or SNF, LRW and SRW storage facilities in case the RP and/or SNF storage facilities contain nuclear fuel (NF), as well as when LRW and SRW are available on board the ships, shall be carried out with the crew on board consisting of the sufficient crew members being trained in compliance with the requirements of the normative documents. Passages without the crew are permitted on agreement with the Register, provided the Security Substantiation developed by a competent organization is submitted.

**9.3.4** Passages and standard towing of ships with the RP and/or SNF, LRW and SRW storage facilities, apart from the normative documents specified in 8.3.5, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service, the requirements of the normative documents and instructions on provision of safety of special equipment of these ships (RP, SNF, LNW and SRW storage facilities) shall be met.

**9.3.5** The scheduled passage arrangement shall be reviewed by the RS surveyor when specifying the requirements for preparing the ship with RP and SNF, LNW and SRW storage facilities for the passage and the measures required for observation of the established limitations.

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<sup>1</sup> In terms of the Code of Safety for Nuclear Merchant Ships it means the responsible organization.

#### **9.4 PASSAGES REVIEW BY THE REGISTER**

**9.4.1** When solving the passage of ships with RP and SNF, LNW and SRW storage facilities (during review of the shipowner's request, considering a passage plan, survey of ship, etc.) the RHO Ships-in-Service Department shall request a conclusion of the RS Branch Office for Nuclear Ships for the ships under construction or the RS Branch Office for in-service supervision, when the ship is in service, so far as relevant to the RS Branch Office activities.

## **9.5 DEVELOPMENT AND APPROVAL OF PASSAGE PLAN**

**9.5.1** The passage plan shall be developed in compliance with the requirements of Section 8, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service. Due to the fact that the disabled ships are considered, no description of machinery installation is available.

**9.5.2** In addition to the documents developed in compliance with [9.5.1](#), the following shall be developed and submitted to the Register for review:

**.1** assessment of the object RS during the passage, including the RS substantiation for the personnel (crew) and environment, as well as estimation of consequences of emergency flooding of the object;

**.2** supplement to the instruction for the Master of the towed facility with technical and organizational measures for the NRS provision and prevention of radioactive waste discharge;

**.3** document for the PS provision of the towed facility on the route;

**.4** emergency plan in the event of bad weather, especially in respect of drifting or hiding in refuge;

**.5** emergency plan in the event of accident and muster lists in compliance with the requirements of 7.2.5 of the Code of Safety for Nuclear Merchant Ships for the towed ships with NPU.

Documentation specified in this para shall be developed by the competent organizations having the relevant certificates and licenses. Additional requirements for provision of safety of navigation, equipment and outfit, NS, PS and particulars of towing via the territorial seas of foreign states specified in [9.6 — 9.10](#) shall be taken into consideration.

**9.5.3** Depending on the passage object, area and conditions of the passage it may be necessary to enlarge the scope of the plan documentation or its reduction may be accepted.

**9.5.4** Where, based on the service conditions, the passages of ships with RP and/or SNF, LTW and SRW storage facilities between their quay berth and other ports are of a systematic nature (e.g., passage of the NS vessels to be transported for provision of one-route operation), such towing may be considered as standard towing in compliance with 8.8, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service.

## **9.6 REQUIREMENTS TO PROVISION OF SAFE NAVIGATION DURING PASSAGES AND STANDARD TOWING OF SHIPS WITH RP AND/OR SNF, LRW AND SRW STORAGE FACILITIES**

**9.6.1** The requirements for ensuring seaworthiness and the procedure of assigning and observation of weather restrictions (extreme wave height, wind force, bow freeboard, sufficient draught, availability of weather forecasts for the passage area, etc.) are set forth in Annex 47 to the Guidelines on Technical Supervision of Ships in Service.

**9.6.2** In addition to the requirements specified in [9.6.1](#), the following requirements shall be observed for provision of safety during the passage of ships with the RP and/or SNF, LRW and SRW storage facilities:

**.1** due to higher risk, transportation of passengers on the towed ships with RP and/or SNF, LRW and SRW, as well as transportation of cargo not related to the operation of such ships are prohibited;

**.2** NM (except for fuel in NR and in the SNF storage facility) shall be transported as cargo in compliance with the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships<sup>1</sup>, the International Maritime Code for Dangerous Goods<sup>2</sup> or the national Regulations for the Maritime Transport of Dangerous Goods;

**.3** no radioactive wastes, except for the own ones shall not be transported on board of the towed ship, unless they are the cargo of the ship in compliance with the accepted international agreements or national regulations;

**.4** for all period when fuel is available in the reactor of the towed ship with RP and/or SNF, LRW and SRW storage facilities, NPU and/or SNF storage facilities shall be under the supervision of the qualified personnel keeping the watch in the central reactor control room on board the ship with RP and in the central handling control room of the ship with the SNF storage facilities. Supervision of the filled-in LRW and SRW storage facilities may be carried out by other means ensuring equal security level;

**.5** stability and unsinkability of ships with RP and/or SNF, LRW and SRW storage facilities during the passage shall comply with the requirements of the NS Rules and NSV Rules, accordingly;

**.6** during transportation of SNF in transport packages on the towed ships, apart from the requirements of the IMDG Code or Regulations for the Maritime Transport of Dangerous Goods, the requirements of the INF Code in respect of the damaged stability, fire-fighting regulations, temperature control in cargo spaces, structural characteristics, cargo stowage equipment, electric power supply, radiation protection, as well as control, personnel training and shipboard emergency plan shall be met;

**.7** towed ship transporting the SNF cargo shall be surveyed and shall have a certificate as provided by the INF Code;

**.8** based on the provisions of failure-free operation of the electrical equipment of systems essential for the SSS security (in the cooling-down mode), during towing of ships with RP, the ship's inclining shall be limited by the following values: continuous heel up to 30°, rolling up to 45°, trim up to 10°;

**.9** due to load limitations (3g), heel (15°) and trim (5°), the operation of the LRW treatment equipment on the NS vessels during the towing is prohibited.

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<sup>1</sup> Hereinafter referred to as "the INF Code".

<sup>2</sup> Hereinafter referred to as "the IMDG Code".

## **9.7 REQUIREMENTS TO EQUIPMENT AND OUTFIT OF THE TOWED FACILITY**

**9.7.1** The requirement of 8.6 of the Guidelines on Technical Supervision of Ships in Service to the equipment and outfit of the towed facility shall be met.

**9.7.2** In addition to the requirements specified in [9.7.1](#), the following requirements to equipment and outfit of the towed ships with the RP and/or SNF, LRW and SRW storage facilities shall be observed:

**.1** fuel and oil storage required for operation of standby and emergency sources of electric power supply ensuring the operation of RP and SNF storage facilities, residual heat removal and maintenance of media temperature within the prescribed limit shall be calculated. Also, the operation of the following shall be mandatorily provided:

- .1.1** navigational lights;
- .1.2** internal and external communication;
- .1.3** emergency lighting;
- .1.4** fire alarm and fire extinguishing systems;
- .1.5** drainage system;
- .1.6** other shipboard systems in compliance with the passage organization provided;

**.2** prior to the passage, the necessary store of decontamination means, protective clothing, protective footwear and other personal protective equipment shall be provided with due regard to possible emergency situations with RPE and/or SNF, LRW, SRW storage facilities.

## **9.8 NRS PROVISION DURING TOWING OF SHIPS WITH RP AND/OR SNF, LRW AND SRW STORAGE FACILITIES**

**9.8.1** During preparation for towing of ships with RP and/or SNF, LRW, SRW storage facilities by the operating organization and the crew (personnel) for NRS provision, the following measures shall be planned and fulfilled:

- .1 check of technical condition of the systems serving RP, SNF storage facilities and their equipment;
- .2 check of serviceability and emergency preparedness (including fire-fighting) of the accident-prevention systems;
- .3 reactor pile-down and NPU cooling-down;
- .4 radiation safety audit of the spaces and external surfaces of the facility;
- .5 decontamination of external surfaces (where necessary);
- .6 decontamination of the controlled area spaces;
- .7 sealing of the containment and shielding barrier;
- .8 check of containment tightness;
- .9 unloading and proper discharge of LRW and SRW (where possible);
- .10 fastening of equipment, SRW containers, etc. (where necessary);
- .11 restriction of the personnel access to the containment spaces, as well as to the SNF storage facilities in the condition of normal towing;
- .12 check of operability of the centralized system and portable RM means;
- .13 tightening of the engineering circuits of SSS and LRW tanks, valve sealing.

**9.8.2** Based on the results of measures performed in compliance with [9.8.1](#), the Report on Assessment of Technical Condition, ensuring NRS during preparation of the ship for the towing (similar to the Reports of Appendices D and E to RD 31.21.17.95 "Organizational and Technical Requirements for NRS Provision During Dry Docking of Ships with NPU and NS Vessels").

Performance control of the measures specified in [9.8.1](#) shall be conducted by the Register, bodies of the Federal Service for the Supervision of Environment, Technology and Nuclear Management (Rostekhnadzor) and executive bodies authorized to carry out public sanitary and epidemiological control within their authorities.

**9.8.3** During radiation safety audit, the power levels of gamma-radiation intensity and radioactive contamination of surface on the housing, in the service and accommodation spaces, SNF, LRW and SRW storage facilities, holds, as well as the levels of air activity concentration in the object spaces and emission of the ventilation system shall be measured.

The scope of audit shall be determined for each ship project by the operating organization on agreement with the executive bodies authorized to carry out public sanitary and epidemiological control.

The measured levels shall not exceed the check values established and agreed in compliance with the requirements of the Basic Sanitary Rules for Radiation Safety (OSPORB-99/2010).

**9.8.4** In case of absence on board the ship or a failure of the standard RM system, the ship shall be fitted with the sufficient quantity of portable dosimetry control means intended for operation in the normal and emergency conditions. This equipment shall include the devices of alpha-, beta-, gamma- and neutron dosimetry, instruments for air sample activity and contamination level measurement.

Sufficient number of separate dose meters shall be provided for all persons on board the ship.

**9.8.5** In addition to those required for conventional sea-going ships, on board the towed ships the operating documentation describing their actual condition and the radiation safety condition shall be available.

**9.8.6** Occurrence of emergency situations during the towing shall be prevented by technical measures taken during preparation for the facilities for the passage, and organizational measures taken during the towing.

**9.8.7** During the towing of the ship with the crew, there shall be available a plan for the crew protection in case of radiation accident and a normative document on prevention and response to the radiation accident and fire.

**9.8.8** Nuclear safety during the passage shall be provided by the observation of the requirements of the federal standards and the Rules on Nuclear Safety of Nuclear Power Units of Ships (NP-029-01) related to the RP maintenance и Safety Regulations for Storage and Transportation of Nuclear Fuel on the Nuclear Energy Facilities (NP-061-05) related to the maintenance of SNF and new fuel assembly storage facilities, as well as the NPU Operating Manual and shipboard instructions.

**9.8.9** To ensure the nuclear radiation safety during the passage, the following conditions shall be met:

**.1** control of radiation situation on the towed ship during the towing shall be continuously maintained by the standard RM system and/or portable devices;

**.2** during towing of the ship, performance of works, which may result in the change of radiation situation in spaces, shall be prohibited;

**.3** when the overpower of the equivalent dose, specified radiation levels and the maximum levels of contamination by radioactive substances are detected, measures for recovery of radiation situation shall be taken with subsequent RM. The measurement results shall be indicated in the report that shall be sent to the local executive body authorized to carry out public sanitary and epidemiological control;

**.4** during normal towing, the access to the containment of RP and the SNF, LRW and SRW shall be restricted;

**.5** any works associated with the opening-up of spaces and systems containing radioactive substances shall be avoided.

**9.8.10** During the passage planning, it is necessary to consider the List approved by a decree of the RF Government of the RF Sea Ports to which calls of ships and other floating facilities with the NPU and radiation sources are permitted. The passage cannot be performed in case the planned port of call is not specified in this List.

Moreover, the shipowner (operating organization) on the agreement with the executive bodies authorized to carry out public sanitary and epidemiological control, shall arrange the compliance with the requirements of sanitary regulations SP 2.6.1.01-04 "Provision of Radiation Safety of the RF Ports at Calling and Staying of the Nuclear Ships, Nuclear Support Vessels and Floating Nuclear Power Units (SPRBP-04)" for preparation of the ship for call to the port and the port for receipt of facilities with RP and NS vessels which are planning to call to this port.

## **9.9 PROVISION OF PHYSICAL SECURITY OF NPU AND NM DURING TOWING**

**9.9.1** In accordance with Federal Law of the Russian Federation No. 170-FZ "On Nuclear Energy Use", the requirements to provision of physical security (PS) of NPU, sources of radiation, NM and RS storage stations are stipulated by the standards and regulations in the field of the nuclear energy use.

**9.9.2** The basic requirements on arrangement, provision of PS of NM, NPU and NM storage stations are stipulated by the Regulations for the Physical Security of Nuclear Materials, Nuclear Power Units and Nuclear Material Storage Stations approved by the Decree of the RF Government No. 456 of 19.07.2007 developed on the basis of the RF obligations and the IAEA recommendations on the NM and NPU physical security.

**9.9.3** The requirements for the PS provision on board the ships with RP and SNF shall be determined in compliance with the NM category, categories of consequences of unauthorized actions in respect of the PS matters and the requirements stipulated by the federal standards and regulations "Requirements to Physical Security of Ships with NPU and Ships Transporting NM (NP-085-10)", as well as the requirements to the NM and NPU PS specified in the RS rules.

**9.9.4** The passage of the ship shall be carried out only when the NM and NPU PS is provided.

Provision of the NM and NPU PS during the passage of the ship shall be determined by a document on the PS provision of the towed facility to be developed with the passage plan in compliance with the terms of reference of the passage customer.

**9.9.5** The principles of the NM and NPU PS provision, including the functions of security guard engaged by departments of the internal military forces of the RF Ministry of the Interior (MVD), escorting by the naval ships or maritime formations of the RF Federal Security Service (Border Service), use of the crew and others shall be defined by the shipowner based on the results of the vulnerability analysis in the terms of reference for the passage plan and shall be corrected on the results of performance evaluation.

**9.9.6** During towing to provide the NPU and NF PS it is necessary to:

- .1** minimize the total time of the passage route;
- .2** where possible, eliminate the towing boat change and minimize the time of the replacement tug boat;
- .3** eliminate application of marks and signs on board the ships informing of the ship's purpose;
- .4** select the route of the towing convoy outside the emergency areas, unfavourable crime situation, natural calamities and other extreme situations; minimize the scope of persons informed of the route, schedule of travel and terms of the passage;
- .5** provide the availability of the appropriate permit for the persons operating the tug, escort and security guard;
- .6** arrange preliminary notification of the receiver by the sender on the planning passage indicating the passage category, estimated time of arrival to the destination point and exact place of delivery (transfer), etc.;
- .7** start towing only upon receipt of the written confirmation from the recipient:
  - .7.1** on the readiness to accept the facility;
  - .7.2** on the availability of the license for performing the activities in the nuclear energy use;
  - .7.3** on the use of coding means and special communication channels for transfer of messages on the ship's passage;

**.8** in advance arrange the interaction of the sender and recipient with the relevant territorial security bodies, internal affairs and the Navy in order to mutually specify the additional measures to provide protection and security of the towed ship, rebuffing of a feasible attack to the convoy during the voyage or in case of emergency situation occurrence on the route;

**.9** provide examination of the towed facility and the tug prior to departure for the absence of the arrangements able to damage the tug and/or promote executing of unauthorized operations;

**.10** provide interaction of the sender (recipient) and the ship's pilot.

**9.9.7** Specialists, members of the crews or teams involved in the provision of the NPU PS during the ship's passage, as well as the security guard personnel and the accompanying persons shall receive a briefing and medical examination, as appropriate.

**9.9.8** In respect of all unauthorized actions in connection with the towed ship with RP and SNF, the operating organization shall within an hour notify the State Atomic Energy Corporation "Rosatom" and Situation and Crisis Center of Rosatom, FSB and the RF Ministry of the Interior (MVD) bodies and, where necessary, other participants of counterterrorism, as well as Rostekhnadzor, then it shall submit written reports within 10 days.

**9.9.9** Procedure, notification arrangement, communication channels shall be specified in the Physical Security Plan for the passage, where a section containing the requirements for interaction with the counterterrorism activity participants shall be provided.

**9.10 FEATURES OF TOWING OF NON-SELF-PROPELLED SHIPS WITH RP  
AND/OR SNF STORAGE FACILITIES THROUGH TERRITORIAL SEA  
AND TO FOREIGN PORTS**

**9.10.1** According to the UN Convention on the Law of the Sea, the coastal state may require the foreign ships exercising the right of innocent passage through its territorial sea to use such sea lanes and traffic separation schemes as it may designate or prescribe for the regulation of the passage of ships. Such requirements may be imposed also for the towed ships with the RP and SNF storage facilities.

**9.10.2** The passage route of the ships with RP and SNF storage facilities shall be plotted by the traditional shipping routes. Observance of all formalities on notification of the coastal states and receipt of the data on availability of restrictions in the routes through their territorial sea shall be carried out by the lawyers and performed by the operating organization and the governing body of the nuclear energy usage directorate via the RF Ministry of Foreign Affairs.

As a rule, the passage plan of such ships along the route shall not include call of convoy to the foreign ports.

Where, due to weather conditions or in case of the towing boat or the towed ship defect a call to the foreign port (port of refuge) may be required, simultaneously with the notification of the convoy passage it is necessary to submit a request to the RF Ministry of Foreign Affairs for notification (obtaining a permit) of a foreign state on the possibility of the convoy calling to its ports or closed roads for waiting out of bad weather, change the tow boat, etc.

Besides, in compliance with the Convention on the Physical Protection of Nuclear Material (CPPNM), a Member State responsible for receiving assurances that the NM will be protected at all the levels described in Annex I to Convention, shall identify and inform in advance States which the NM is expected to transit by land or internal waterways, or whose airports or seaports it is expected to enter.

**9.11 ASSESSMENT OF TECHNICAL CONDITION OF THE SHIP  
AND CHECK OF FULFILMENT OF THE SCHEDULED MEASURES PRIOR TO PASSAGE**

**9.11.1** In addition to the scope of survey specified in 8.6, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service, the following requirements shall be met in respect of the towed ships with RP and/or SNF, LRW and SRW storage facilities:

**.1** survey of the ship shall be carried out in compliance with the requirements of [1.3](#) of these Guidelines in respect of the hull structures, equipment and machinery of the NPU and SNF, LRW and SRW storage facilities required for providing security of the facility during the passage;

**.2** RP of the nuclear ships and floating facilities shall be kept in safe condition, standby and emergency diesel generators shall be in operable condition and capable of providing the ship service systems' operation, as well as residual heat removal on taking RP out of service and cooling down for the whole period of passage;

**.3** SNF storage facilities of the NS vessels and floating power units (with unirradiated fuel) shall comply with the requirements of the NSV Rules;

**.4** independent emergency power supply sources on NS vessels with SNF storage facilities to be installed in compliance with 8.2.1 of the NSV Rules shall be properly functioning.

**9.11.2** The scope of surveys to be carried out in accordance with the requirements of these Guidelines may be changed on the RS surveyor's discretion, who shall consider the structure of the ship's NPU in each particular case (SNF, LRW and SRW storage facilities) the expired service life of the equipment, the preceding survey results and operating mode, nature of the repair performed, etc.

## **9.12 ISSUE OF DOCUMENTS**

**9.12.1** The results of the survey of ship prior to the passage shall be documented in compliance with 8.7, Part II "Carrying Out Classification Surveys of Ships" of the Guidelines on Technical Supervision of Ships in Service.

### **9.13 FEATURES OF SURVEYS OF FACILITIES WITH MARINE RP**

**9.13.1** During preparation for towing of the facilities with marine RP, the Register shall review the documents of the passage plan in respect of the towing ship under the RS technical supervision.

**9.13.2** Readiness of the facility with marine RP in respect of the safe navigation, provision of NRS and PS shall be checked by the regulating bodies of the RF Ministry of Defense (Navy).

**9.13.3** On the customer's (shipowner's) request or in case the item with marine RP is decommissioned from the RF Ministry of Defense (Navy), the requirements of the RS normative documents may apply to these items.

Russian Maritime Register of Shipping

**Guidelines on Technical Supervision of Nuclear Ships,  
Nuclear Floating Facilities and Nuclear Support Vessels in Service**

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