TECHNICAL CODE OF COMMON PRACTICE **TCP264-2010 (02300)**

ORGANIZATION AND OPERATION PRINCIPLES OF LOCALIZATION SAFETY SYSTEMS FOR THE NUCLEAR POWER PLANT

This technical code draft is not applicable before its approval

Ministry of Emergency Situations of the Republic of Belarus

Minsk

UDC: 621. 039. 584 –78 (083.744) ICS: 27.120.20; 27.120.99 PC: 01
Key words: nuclear power plants, localization safety systems, organization, operation

Foreword

Goals, fundamental principles of state regulation and governance in the sphere of technical regulation and standardization are established by The Law of the Republic of Belarus «On technical regulation and standardization».

1. It was DEVELOPED by the State Scientific Institution "Joint Institute for Power and Nuclear Research - SOSNY" of NASB

INTRODUCED by the National Academy of Sciences of Belarus

2. APPROVED by the Regulation of the Ministry of Emergency Situations of the Republic of Belarus of _____ 2010 No _____

3. FIRST INTRODUCTION (With the abolition of PNAE G-10-021-90 «Rules of organizing and operating of localization safety systems for nuclear power plants", approved by *Gospromnadzor* of the USSR of 04.05.1990 No 4)

Published in Russian

Content

Introduction

This technical code of common practice is developed according to:

- Resolution of the Council of Ministers of the Republic of Belarus about the State scientific and technical programs in 2006 – 2010 on 04.01.2006 No 5
- State scientific and technical program "Nuclear and physics technology for the national economy of Belarus" approved by the Order of the Chairman of the State Committee on Science and Technology of the Republic of Belarus of 06.07.2006 No 180
- Plan of the basic preparatory work that must be completed before the beginning of the construction of the nuclear power plants in Belarus, approved by the Resolution of the Council of Ministers of the Republic of Belarus of 18.07.2006 No 905-9.

This technical code of common practice designed according to the laws and regulations including the technical normative legal acts of the Republic of Belarus in the field of nuclear energy, radiation safety, and other acts of the Republic of Belarus, and requirements and recommendations presented in the documents of the IAEA and EUR for the design of the reactor containment systems for nuclear power plants, as summarized in the following documents:

- Safety of nuclear plants: Design. Safety standards series No NS-R-1. IAEA: Vienna, 2000;
- Designing the reactor containment systems for nuclear power plants. Manuals. A series of IAEA Safety Standards No NS-G-1.10. The IAEA in Vienna, 2008;
- Chapter 9. Containment System. Volume 2. Generic Nuclear Island Requirements. European Utility Requirements for LWR Nuclear Power Plants. Revision C. April 2001.

This technical code was developed with account of the experience of the USSR and the Russian Federation in the field of design, construction and operation of the nuclear power plants, consolidated in NP-010-98 Rules for Design and Operation of localizing safety systems in the Nuclear power plants.

TECHNICAL CODE OF COMMON PRACTICE

ORGANIZATION AND OPERATION PRINCIPLES OF THE LOCALIZATION SAFETY SYSTEMS FOR THE NUCLEAR POWER PLANT

Effective date

1. Field of application

This technical code of common practice (further - technical code) refers to the republican technical normative legal acts in the field of nuclear energy. It determines the main technical and organizational requirements for the design and operation of the localization safety systems of the land based stationary nuclear power plant (further - NPP) with the pressurized water reactor - the Water-Water Energetic Reactor (VVER).

The requirements of this technical code are used in the design, manufacture, construction, installation, testing and operation of the localization safety systems of the NPP on the territory of the Republic of Belarus.

The requirements of this technical code are mandatory for all legal entities and individuals engaged in the activities related to the location, design, construction, commissioning and operation of the localization safety systems and their components at the NPP, that operate in the entire territory of the Republic of Belarus.

2. Normative references

In this technical code are used references on the following technical normative legal acts (further - TNLA):

- TCP 170-2009 (02300) General provisions for providing safety of Nuclear Power Plants
- GOST 380-2005 Common quality carbon steel. Grades
- GOST 5520-79 Rolled carbon, low-alloy and alloy steel sheets and plates for boilers and pressure vessels. Specifications
- GOST 5632-72 High-alloy steels and corrosion-proof, heat-resisting and heat treated alloys. Grades
- GOST 7350-77 Rolled steel corrosion-resistant and heat-resistant. Specifications
- GOST 14637-89 Rolled plate from carbon steel of general quality. Specifications
- GOST 19281-89 Rolled steel with increased strength. General specifications
- GOST 21779-82 System of ensuring of geometrical parameter accuracy in construction. Manufacturing and assembling tolerances

Note! When using this technical code, it is advisable to check the TNLA in the catalog made as of 1st January of the current year using relevant information indexes published in this year.
If the referenced documents are replaced (changed), it shall be guided replaced (changed) documents when using this technical code.
If the reference of technical code canceled without replacement, It is used the part of the context without touching this reference.

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3. Terms and definitions

The following terms are used in this technical code with the relevant definitions:

3.1 explosions (hydrogen): Status of production process at the nuclear power plant, with which the possibility of explosion prevents, or in case of its occurrence, it is prevented the exposure of workers (personnel) and the population, as well as weakened the impact of hazard explosion factors of hydrogen-containing mixtures on the systems and components of the nuclear power plants.

3.2 explosion protection (hydrogen): Measures to prevent the exposure of workers (personnel) and the population, as well as weaken the impact the impact of hazard explosion factors of hydrogen-containing mixtures on the systems and components of the nuclear power plant

3.3 sealed enclosure: The set of elements of building and other structures that are protecting the area around the reactor facility or other object containing radioactive substances, that form a boundary, planned by the project, and prevent the spread of radioactive substances exceeding the established limits in the environment.

3.4 airtight premise(s): The space closed airtight enclosure.

3.5 leaktightness: The ability of component or system limit distribution of liquid and gaseous substances, aerosols, including pairs.

3.6 leakage value: Quantitative characterization of leakage that is equal to the number of medium withdrawn from the controlled volume with certain parameters per unit time.

the design value of leakage: Leakage value for the system (element) according to the project.

actual leakage value: Leakage value that obtained by checking (tests) of the system (element).

3.7 the accident localization zone: Space limited by the hermetic enclosure in which radioactive substances are kept according to the plan of the nuclear power plant.

3.8 isolation devices: flaps, valves and other fittings, providing isolation (sealing) of accident localization zone from the environment.

3.9 the source of the initiation of the explosion: technological device or physical process (for example, an electrical discharge, chemical reaction, etc.), the action of which may lead to the combustion process.

3.10 operational availability: The probability that the system is in operable state at any given time (excluding planned periods when the use of the system is not provided) and, from this moment, it will run smoothly within the specified time interval.

3.11: localization safety systems: Systems (components) designed to prevent or limit the spread of radioactive substances and ionizing radiation released during normal operation, emergencies and accidents for the envisaged project boundaries and their release into the environment.

3.12 hatch, door: Elements of hermetic enclosure providing the passage of workers (personnel) of the nuclear power plant and (or) transporting equipment and materials through building structures protecting accident localization area.

3.13 stress-strain state: State of pre-stressed reinforced concrete building structures, protecting accident localization area that characterized by increased tension of tendons passing inside concrete.

3.14 low concentration limit of flame propagation: The minimum percentage of combustible material in a homogeneous mixture with the oxidizing substance that make possible the propagation of the flame over the mixture at any distance from the source of ignition.

3.15 penetrations sealed: Elements of hermetic enclosures, providing the intersection of building structures, protecting the accident localization area (in compliance with the leaktightness of the hermetic enclosure) with interface pipes, air ducts, electric cables, ionization chambers and rotating (moving) parts of remote mechanical fittings.
3.16 rarefication: The difference between the atmospheric pressure and the absolute pressure in accident localization area, when the value of the absolute pressure does not exceed the atmospheric pressure.
3.17 accident localizing system: The complex of localization safety systems combined the implementation of a common security function and interact in the process of its implementation.
3.18 desensitization of explosive mixtures: Dilution of explosive mixtures, non-flammable gas or vapor to the state, excluding the flame spread on the mixture.
3.19 gateway: Construction (room) or a device, which is an element of the hermetic enclosures and designed for the passage of a nuclear power plant workers (personnel) and (or) transportation of equipment and materials in (from) the accident localization area maintaining hermetic sealing enclosure.

4. Designations and abbreviations

The following designations and abbreviations are used in this technical code:
NPP - nuclear power plant;
VVER - the Water-Water Energetic Reactor;
BCC – block control center;
HE - hermetic enclosure;
ALA - accidents localization area;
BDBA - beyond design basis accident;
LSS - localization safety systems;
MCPL - minimum controlled power level;
LCLP - low concentration limit of flame propagation;
ROS NNP - Report on the safety of the nuclear power plants;
PCW - pre-commissioning work;
SPM - scheduled preventive maintenance;
EMD - engineering and manufacturing documentation;
RCC - reserved control center;
ALS - accident localizing system;
TCP - technical code of common practice;
TNLA - technical normative legal act.

5. General requirements for organization of the localizing safety systems and their components

5.1 General regulations

Design, engineering, manufacture, construction, installation, testing and operation of LSS components must be performed in accordance with the requirements of the relevant technical regulations in the field of TNLA and standardization with regard to the requirements of nuclear and radiation safety and the requirements of the TCP.

5.2 Design basis

5.2.1 The LSS and their components are developed as a part of plant design, in accordance with the requirements of the TCP 170, this technical code and other TNLA in the field of nuclear energy and other fields, the validity of the use of which must be confirmed by the Ministry of Emergency Situations of the Republic of Belarus when licensing.

5.2.2 In case of absence of the necessary TNLA, proposed specific technical decisions are justified and established by the developer in the NPP project in accordance with the attained level of science and technology. The acceptability of such decisions is confirmed by the Ministry of Emergency Situations of the Republic of Belarus.

5.2.3 The LSS and their components must fulfill the following basic functions of security:

- Prevent or limit the spread of radioactive substances and ionizing radiation emitted during normal operation, emergencies and accidents beyond ALA;
- To protect the system and (or) the components from external environmental influences, whose failure could result in the release of radioactive substances exceeding the design value of the leak;
- To reduce the atmosphere pressure in ALA;
- Remove heat from ALA;
- Reduce the concentration of radioactive substances in ALA;
- Monitor the concentration of explosive gases in ALA;
- Maintain the concentration of explosive gases in ALA below the LCLP.

The usage (non-usage) of these or other functions of the LSS are established by nuclear power project and is justified in the ROS NNP.

5.2.4 The following LSS and their components or a combination of them (ALS) may be provided to perform the safety functions at the NPP listed in 5.2.3, for example:

- HE
- Passive vapor condensation system
- The system of passive sprinklers
- The active sprinkler system
- Ventilation and cooling systems
- Hydrogen explosion protection systems
- System of the emergency installations of gas and aerosol cleaning

5.2.5 If the project provides for the use of nuclear power or storage of radioactive substances and they may go beyond the capacities or the premises in which there are, in an emergency. It must be defined boundaries for each room (capacity), and includes a set of the LSS in NPP project, performing the functions of preventing or limiting the spread of radioactive substances.

5.2.6 The LSS and their components must be designed (or protected) in accordance with TCP 170 requirements of external and (or) internal exposure, and their combinations (including earthquakes, shock waves, jets, flying objects, the efforts of the connected pipes, etc.) resulting from accidents.

5.2.7 The project of the NPP shall contain an analysis of the functioning of the LSS at impacts associated with severe core damage and exit the melt outside of the nuclear reactor.

5.2.8 When BDBA is taken into account in the NPP (in accordance with the established list of BDBA in NPP project) as a rule, it shall be provided the technical means to reduce the consequences in case of damage to the HE with increasing pressure and temperature above the projected values, to hold the molten fuel in the BDBA by providing its subcriticality, to prevent hydrogen explosion for radioactive emissions into the environment.

Note! Hereinafter, the expression "as a rule" means that this requirement is predominant, and retreat from it shall be justified.

5.2.9 The external shell of HE structures executed in the form of double containments shall perceive external influences, as well as exposure arising from the annular space between the shells.

The internal shell must perceive the impact of internal and external dynamic effects (e.g., seismic, impact of aircraft crash), transmitted to it through the supporting structures, as well as exposure arising from the annular space between the shells.

5.2.10 When there are radioactive substances (except radioactive materials used for maintenance and repair) in BDBA, as a rule, break the sealing of HE is prohibited.

It is allowed depressurization of HE during the BDBA with stopped and dampened nuclear reactor (with the active zone reliably brought to a subcritical state) when adopting special technical and organizational measures stipulated and justified in NPP project.

5.2.11 All leaks entering the annular space of the internal shell, under normal use, emergency situations, in case of accidents and post-emergency conditions must be removed from it by a ventilation system, if necessary using a cleaning.

5.2.12 In the annular space of the double containment of the HE, under normal use, emergency situations, in case of accidents, as a rule, it is necessary to create and maintain a negative gauge pressure, even under the worst wind conditions established by NPP project.

5.2.13 It shall be given a list of utility systems that pass through the HE constructions or connected to them according to NPP project, as well as the following information:

- connection of the utilities with the primary circuit piping, or BDBA and other components of the system within the HE;
- name system (component), which is connected to utilities, behind HE boundaries.

5.2.13 It shall be analyzed possible leaks of radioactive substances from systems located in BDBA, during normal operation and emergency situations in NPP project.

5.2.14 It shall be determined, in NPP project, the time elapsed from the start of the design basis accident with loss of coolant to the moment when it becomes possible to access employees (personnel) to ALA.

5.2.15 Components of the LSS must be usually available for inspection, testing, repair, decontamination and maintenance.

5.2.16 The LSS and their components must maintain their functions when they are tilted, the value of which must be defined in NPP project.

5.2.17 The LSS and their components must withstand, stipulated in the project of the NPP, number of tests (at the HE test parameters for leaks and strength) without loss of efficiency.

5.2.18 LSS project shall include measures to prevent the harmful effects of microorganisms on the components of the LSS, which are in contact with solutions in normal operation and emergency situations.

5.2.19 The project of the NPP shall contain measures to prevent the formation of ice on the surfaces of the technological components of the LSS effected by low ambient temperatures or be described the methods for saving functional ability of these components.

5.2.20 The design of the active components of the LSS (insulating devices, hatches, doors, gateways, safety devices and bypass) shall provide the conduction of individual tests on the operation and leaktightness, as well as inspection and repair (including the sealing surfaces) when the nuclear reactor is stopped.

5.2.21 They must ensure the independence of the LSS and their components from the technological systems or other security systems as much as possible during the design. It is necessary to provide accomplishment of the required security features for the LSS during the accident, regardless of the failures of other systems that led to the accident.

5.2.22 The project of the NPP shall identify and take into account all the mechanisms of aging that negatively affect the characteristics of the LSS and their components (metal corrosion, creep of tensile reinforcement, shrinkage and cracking of concrete, embrittlement of hermetic sealing etc.).

5.2.23 They shall consider the use of passive systems and inherent safety features in the design of the LSS and their components.

5.2.24 The LSS and their components shall be able to perform their function in the normal operation of energy sources, and if they fail to operate.

5.3 Reliability operations

5.3.1 Reliability indexes of the ALS components must confirm non-exceedance probability of accidental releases established in the TCP 170 requirements.

5.3.2 It must be made calculations of reliability indexes for each the LSS.

5.3.3 Readiness calculations proving the fulfillment of the requirements given in 5.3.1 and 5.3.2 shall be included (or provides links to them) in the ROS NNP.

The calculations shall be based on operational experience or the conservative approach.

5.4 Requirements for the control

5.4.1 The technical condition of the components of the systems, structures or devices, failure of which may be influenced on the efficiency of the LSS and their components shall be periodically monitored during the SPM.

5.4.2 The collection, processing, recording and storage of information on controlled thermal, chemical, and other parameters characterizing the operation of the LSS and their components, the need of their submission to the BCC and the RCC, as well as reservation of measuring channels must be justified in the project of the NPP.

5.4.3 In the structures of tanks, swimming pools or water tanks relating to the LSS, it shall be provided control of the basic parameters of their working substances, the amount of which is determined and justified in the project of the NPP.

5.4.4 The Project of the NPP for double sealed shells must provide with the BCC control exercised degree of vacuum in the annular space between the internal and external shells.

5.4.5 The project of the NPP shall include monitoring of the concentration of hydrogen in all sealed areas and submit the information to the BCC.

5.4.6 The concentration of hydrogen in hermetic spaces of the NPP shall controlled by two independent measuring channels.

5.4.7 The amount of hydrogen control points in the premises of ALA must be selected considering possible locations of hydrogen accumulation.

5.4.8 Control of hydrogen concentration in ALA in all considered project modes (including BDBA) shall be provided continuously with submission of the information about the concentration of hydrogen to the operational staff in the BCC.

5.4.9 The information about the vapor concentration and oxygen in ALA shall go to the BCC during an accident.

It is allowed to receive the information about concentration using the other parameters by calculation.

The frequency of reporting shall be justified in NPP project.

5.4.10 Possibility of using certain types of devices and equipment in the BDBA (including mixtures of hydrogen explosions) is determined in the project of the NPP taking into account the experience of the industrial development of devices and equipment.

5.4.11 The project of the NPP shall provide means of signaling, that begins to alarm in case of exceeding the design value of the hydrogen concentration in ALA.

5.4.12 The project of the NPP shall provide the BCC control of radioactive substance concentration in the atmosphere, released into the vent pipe from the annular space for double sealed shells.

5.4.13 All active components of the LSS shall be monitored and controlled from the BCC. The necessity and extent of control, a method of managing active components of the LSS from the RCC, as well as the need to control the volume and passive components with mechanical moving parts from the RCC and BCC shall be determined by the project of the NPP.

5.4.14 As a rule, the project of the NPP shall provide means of registration of the stress-strain state and temperature of HE due to the possibility of excessive pressure in HE over 4.9 KPa.

5.4.15 The project of the NPP shall include the possibility to control the level of pre-stressing tendons during the operation of the power generator unit.

5.4.16 The project of the NPP shall provide an opportunity to obtain the information about the opening (closing) doors with locks for workers (personnel) and transport gateway hatches from the BCC and RCC.

5.4.17 The design of the components of HE, such as hatches, doors and gateways, shall provide the possibility of control of their leaktightness after each cycle of opening and closing from the outside towards ALA.

5.4.18 The project of the NPP shall provide the control of the position of hatch covers, cloths of doors, gateways elements, which are the components of HE. It shall be done from the BCC and RCC. A list of premises, which require this control, is determined by the project of the NPP.

5.4.19 The project of the NPP shall provide periodic testing of safety and bypass devices to check their operation and leaktightness during the SPM.

5.4.20 Periodic monitoring of leaktightness during the operation shall be provided for welded joints, gateways or penetrations with embedded items, as well as the embedded items with hermetic steel cladding during the period of the SPM.

5.4.21 Liquid level control shall be provided on the premises, the floor and walls of which have a hermetic steel covering to prevent the destruction of the equipment in these premises or piping in an accident.

5.4.22 The project of the NPP shall provide the control of the BCC over leakage through the walls and floor of premises (the bottom of the containers), which are a part of the defense and at the same time serving the capacity for any working substances.

5.5.23 As a rule, the project of the NPP shall provide the monitoring of the state of the components of the LSS for timely detection of harmful effects of microorganisms.

The frequency and volume of the control shall be justified in the project of the NPP.

5.5.24 NPP project shall provide the visual inspection (in accessible areas) of the impact of the aging mechanism of the construction of the LSS and their components, including corrosive wear of the component's surface of the LSS.

The frequency and volume of the control shall be justified in the project of the NPP.

6. Hermetic enclosure requirements

6.1 General requirements

6.1.1 HE is designed to perform the following main functions:

- Prevent or limit the spread of releasing radioactive substances beyond ALA;
- Protect the system and (or) their components against external environmental influences to prevent radioactive release exceeding the design value of leakage.

The use (non-use) of these functions are established by the project of NPP and justified in the ROS NNP.

6.1.2 Taking into account functions that are established by the project of NPP, HE may include:

- steel or reinforced concrete constructions with hermetic covering (including the metal cladding with an anchoring system);
- components that are installed in engineering structures of HE (penetrations, hatches, doors, gateways, bypass and safety devices, and embedded items of these components);
- Areas of distribution pipeline crossing the HE or connecting with HE within the insulating devices;
- Equipment and pipeline communications beyond building structures of HE and that is involved in the formation of ALA;
- Isolating devices.

6.1.3 The value of the weakening the dose of ionizing radiation for HE components shall not lead to exceeding the regulatory limits of the radiation impact on workers (personnel), population and environment. It must be justified in the project of the NPP taking into account other structures in the distribution area of ionizing radiation.

6.1.4 The value of the weakening the dose of ionizing radiation for HE, made in the form of double sealed shells shall be determined for each shell.

6.1.5 The project of the NPP shall provide testing of the value of the weakening the dose of ionizing radiation for HE during the PCW.

6.1.6 The project of the NPP must limit the output of the ionizing radiation through the gaps between the separate components of HE performing the function of biological protection against ionizing radiation.

6.1.7 The building constructions of HE may consist of a box-type structures, single or double sealed shells of cylindrical, spherical or other form, made of steel or reinforced concrete, pre-stressed or not.

6.1.8 As a rule, they shall provide for HE made in the form of double protective shells that the annular clearance between the inner and outer protective shells formed a single volume in order to maximize mixing and dilution of any radioactive release from the internal shell in the accident.

6.1.9 Engineering structures of the HE shall be designed the way that gives the opportunity of testing in accordance with the requirements of section 11.

6.1.10 They shall use [1], [2], [3] and [4], when designing building constructions of HE performing the function of biological protection against ionizing radiation.

6.1.11 Metal fittings of building constructions of HE must be designed to take into account the possible corrosive wear.

6.1.12 Protective layer shall be determined with regard to the aggressiveness of the environment and usage period of the structures to protect metal fittings of reinforced concrete structures of HE.

6.1.13 As a rule, reinforced concrete structures of HE are designed with the use of jointed reinforcement rod that must be made without welding.

6.1.14 The project of the NPP shall contain the information about the permissible cycles of load on HE in strength and leaktightness tests during the whole usage period taking with regard to commissioning and operational tests.

6.1.15 The possibility of periodic tightening of tendons shall be provided in reinforced concrete structures of HE, made of pre-stressed concrete.

6.1.16 Replacement of tendons must be provided for shells.

6.1.17 The project of the NPP shall contain information about the safety criteria for concrete structures of HE made of pre-stressed concrete. These criteria justify operation of the NPP at failure of certain tendons.

6.1.18 It is allowed to use a hermetic steel cladding in the design of reinforced concrete structures as the timbering.

Concreting of reinforced concrete structures of HE shall be carried out with the use of removable timbering. The exceptions are the surfaces with steel cladding.

6.2 Hermetic steel cladding

6.2.1 Concrete surfaces within HE (along the boundaries of evil) shall be covered with metal in order to ensure the project leakage values.

Polymer materials can be also used as hermetic cladding, but its usage must be justified and approved according to established procedure.

6.2.2 Connections of parts of the hermetic steel cladding within each other and with other components of HE shall be made by welding and allow periodic checking for leaks.

If it is impossible to perform checks for leaks, it shall be performed remedial measures and given relevant justification.

6.2.3 The hermetic steel cladding shall be designed in accordance with [5].

6.2.4 The type and step of anchoring must be chosen to perform the function of hermetic steel cladding in the case of design basis accidents and accounted BDBA.

6.2.5 Brand of hermetic steel cladding must be selected in accordance with Annex A.

6.2.6 The thickness of hermetic steel cladding shall be calculated with regard its design features, usage period and leaktightness requirements.

6.2.7 Hermetic steel cladding only of the floor and walls is allowed (with justification of the plant design) in the premises of the NPP, in which there is a probability of occurrence of radioactive substances during the operation, but cannot be the appearance of excess pressure above 4.9 kPa.

The covering of the wall shall not be less than 200 mm above the potential level of the liquid in full emptying containers located in the room or piping due to their destruction.

6.2.8 Premises that serve as capacities for any working substances (the level of which must be maintained at a design level) the walls and floors of which are a part of HE shall have a hermetic covering made of stainless steel.

6.3 Embedded items

6.3.1 Embedded parts are designed in accordance with the requirements of TNLA and technical regulations of this technical code.

6.3.2 Materials for embedded parts, affecting the leaktightness of HE (strips, plates) shall be selected in accordance with Annex A.

Materials for embedded items (anchors, strips, plates and other items) shall be selected in accordance with [6], as well as anchoring elements for hermetic steel cladding, that do not affect the leaktightness of the HE.

6.3.3 The methods and the fixing points of the hermetic steel cladding to the embedded items of reinforced concrete building structures of HE must be brought into the working documentation.

6.3.4 They shall give a device or location for fixing scaffolding, cradles and other mounting elements in the working documents for the hermetic steel cladding.

6.4 Hatches, doors, gateways and their embedded items

6.4.1 HE shall be equipped with gateways to preserve its leaktightness and provide transportation of equipment and passage for workers (personnel) in ALA (and exit) through the HE.

6.4.2 It is allowed to use the hatches and (or) door instead of gateways on condition of compliance with the requirements of 5.2.10.

6.4.3 The number of inputs (outputs) for HE of reactor compartment shall be at least two. The number of inputs (outputs) for other HE is defined and justified by the project of the NPP.

6.4.4 If the hatches and doors of communication are provided by the project of NPP during maintenance and repair between separated parts of ALA.

As if the leaktightness requirements are extended to them, they must also meet the requirements of this subsection.

6.4.5 Connection of embedded items (frames hatches and doors, embedded items for gateways) with hermetic cladding must be performed by welding.

Connection of gateway with embedded items shall also be carried out by welding.

6.4.6 Constructions of hatches, gateways, doors and embedded parts shall provide leaktightness and the multiplicity of weakening of the dose rate of ionizing radiation during the normal operation and design basis accidents and accounted BDBA.

6.4.7 The value of the permissible leakage through the hatches, doors and gateways at the design pressure shall be determined by the project of the NPP and indicated in the technical regulations for the supply.

6.4.8 Doors and gates (including hatches, doors and gates of gateways) must be opened inside of ALA to the opening of the hatches, doors and gates compressed against to the frame in case of emergency overpressure. Besides, it is acceptable to use of structures with open parts moved parallel to their aperture, on condition their pressing emergency overpressure to the frame from ALA.

6.4.9 It is allowed to outwardly open of the gates (the hatch) of transport gateway that located distant from ALA.

In this case, the gates (hatch) are equipped with duplicate lock, which shall keep them in the closed position during the reactor at the power. The duplicate lock must be designed for external and internal impact, in accordance with 5.2.8.

6.4.10 The structure of gateways for the passage of workers (personnel) shall provide blocking (usually mechanical) between the doors (hatches) that prevent simultaneous depressurization of both doors (hatches). It is allowed electric lock for a transport gateway between the gates (hatches) if the length of his camera more than 6 m.

6.4.11 Hatches, doors and gate of gateways shall be provided with valves for pressure equalization with the pointers of their position when it is necessary.

The valves shall have a lock that prevents simultaneous opening of them.

6.4.12 Mechanisms of opening and closing the door (hatch) of the gateway must be equipped with electrical, hydraulic or other actuators. One person both outside and inside of ALA or gateway must operate these mechanisms.

6.4.13 The required sequence of actions of gateway mechanisms, shall be completed with the minimum number of operations to provide normal and full execution of its functions (the entire cycle of closing-opening doors and hatches of gateway). The number of operations is defined and justified by the project of the NPP.

6.4.14 Construction of hatches, doors, gateways and their embedded parts shall be calculated for strength in accordance with [7].

6.4.15 The anchoring of embedded parts of hatches, doors and gateways without affecting on leaktightness of HE is developed in accordance with the requirements of regulations of building TNLA.

6.4.16 Hatches that used during evacuation, doors and gates shall be placed above the maximum liquid level, which may be in the premises during an emergency.

6.4.17 For double hermetically sealed shells, workers (personnel) pass in the annular space between the internal and external shells must be carried out through sealed doors established in the external protective shell. The number of the doors is determined with regard of the fire safety requirements of TNLA.

6.5 Penetrations

6.5.1 The intersection of engineering structures of HE and technological and electrical communication as well as channels of ionization chambers must be performed with the help of penetrations.

6.5.2 Connection of hermetically sealed penetrations with embedded items and compound of embedded items with hermetic steel cladding must be performed by welding.

6.5.3 Sealed penetrations, as a rule, shall be provided with control chamber for testing of welds for leakage. The value of the permissible leakage through each penetration of the design pressure of the working substance of HE shall be determined by the project of the NPP and indicated in the TNLA.

6.5.4 It is not allowed to use hermetically sealed penetrations with gland packing for the internal shell (except the seals of moving parts, the use of which must be justified in the project of the NPP).

6.5.5 Sealed penetrations for electrical measurement and communication, as a rule, shall be carried out without violating the principle of group physical separation of safety channels.

6.5.6 When selecting materials for the penetrations of electric communication, it must be taken into account the thermal energy released by electrical cables. As a rule, it shall be used heat-resistant and non-combustible materials.

6.6 Isolation equipment

6.6.1 All crossing HE or connecting with HE pipes must be equipped with insulating equipment that is installed on the border of ALA. The number of isolation devices and places their installation in any situation must be determined with the preservation at least one barrier preventing the release of radioactive substances beyond the boundaries of ALA.

6.6.2 Analyzing initiators they must consider about a failure with violation of the pipeline leaktightness connected with the first contour and exiting beyond the boundaries of ALA (including isolating fittings and sealed penetrations).

6.6.3 Pipelines that are not related to the reactor unit or the working substance of ALA and protected from external and internal influences cannot be equipped with isolating devices.

6.6.4 Isolation devices cannot be set on pipelines passing through HE or be connected to them and are used for collecting the working substance from the first circuit or premises of ALA with subsequent return to them (as well as for measurements) during an accident. Besides, the requirements of this technical code for the technical elements of HE additionally extend to such piping and the equipment associated with them. When using pipes and the equipment associated with them beyond the bound of ALA without using the requirements of this technical code must comply with the requirements of 6.6.1.

6.6.5 Fittings equipped with a manually operated lock or caps are provided on the pipelines, working substance that is used only during repair.

6.6.6 When selecting the type of isolation devices, they shall consider their operating speed in order to prevent radioactive release into the environment since the beginning of an accident until complete overlap of the routes specified in [2], [3] and [4].

6.6.7 It must be a list of the initial events in the project of the NPP that determined which active isolation devices on the border of ALA must be closed.

6.6.8 In the project of the NPP, the amount of leakage beyond the boundaries of ALA shall be determined for each of the insulating device.

6.6.9 In the project of the NPP, they shall give the dependence of leakage from time (from the beginning of the initial event) for each insulating device in the case of failure of the isolation device.

6.6.10 Active isolation devices shall operate automatically after an alarm.

6.6.11 The project of the NPP shall provide measures to prevent unauthorized opening of the isolation devices that used in the time of an accident and in a post-accident period. Isolating device that is in a closed state shall not lose their function upon loss of drive power.

6.6.12 The used as insulating device, pipe fitting must meet the requirements [8] and this technical code. The value of project leaks through the elements of isolation devices (with design parameters that differ from the design parameters of ALA) shall be determined by the project of NPP based on the value given in the TNLA for the supply.

6.6.13 It is not allowed to use back valves as an insulating equipment.

6.6.14 It must be provided the means in the control system of the insulating equipment to prevent unauthorized opening or closing, leading to the radioactive release beyond the boundaries of ALA or damage system and components that are important for safety.

6.6.15 Isolation devices must be installed as close as possible to the border of ALA.

6.7 Bypass and safety devices

6.7.1 ALA, where it is provided for the discharge of working substance from one room to another or beyond the boundaries of ALA (beside the reset via the passive vapor condensation system) in accordance with the project of the NPP in order to avoid the destruction of HE in accidents, equipped with safety and (or) the bypass devices (relief valves, bursting discs, bypass (return) valves, etc.) with cleaning working substance discharged from ALA.

6.7.2 ALA that have no safety and (or) bypass devices must be fitted with such devices for a period of tests for strength at design pressure.

6.7.3 Safety devices (safety valve, diaphragm, etc.) shall have a factory stamp indicating the opening or gap pressure for the device. It is allowed to replace stigma with indelible paint to apply the required data.

6.7.4 The number of safety devices, their capacity must be determined by the project of the NPP.

6.7.5 It is forbidden to operate the NPP and test HE for leaks and strength, when safety devices are faulty.

7. **The requirement for the pressure reduction device systems, heat removal, Hydrogen explosion and cleaning fluids**

7.1 Passive vapor condensation system

7.1.1 The passive vapor condensation system is designed to perform the following main functions: reduce ambient pressure in ALA, abstract of heat from ALA.

Use (non-use) of these or other functions is set by the project of the NPP and is justified in the ROS NNP.

7.1.2 The passive vapor condensation system according to the established functions of the project of the NPP may include: bubbling device (diplegs, injectors, etc.), inlet and drainage pipes and fittings, headers (tanks, swimming pools), steam devices, pumping and heat exchange system.

7.1.3 Passive steam condensers must have a refrigerant to provide reliable condensation of the entire vapor in accidents with depressurization of the primary circuit.

The pump and heat exchange unit and other active system (components) may further be used together with passive capacitors.

7.1.4 If the passive steam condenser walls are the part of HE, they comply with the requirements of section 6.

7.1.5 Piping, equipment, elements of their fixing, and other construction must be designed to withstand the impact of the flow of vapor and possible dynamic effects.

Free open flow area of steam corridor shall be taken into account in the calculation of the distribution parameters of ALA in accidents with loss of coolant.

7.1.6 The project of the NPP shall provide measures to eliminate damage of the walls of passive capacitor pair from hydraulic shocks that can occur from vapor condensation, as well as the possible evacuation of ALA.

7.1.7 The chemical composition of the solution in the water tanks of the passive condensation system shall be determined on the basis of the requirements for the removal of radioactive substances from ALA and ensure subcritical of the reactor (for reactors with boric regulation). The project of the NPP shall provide measures to prevent non-uniformity of the solution in volume of water tanks, cleaning agents and corrections of the chemical composition of the solution.

7.1.8 The use of another design system of the passive vapor condensation in the NPP whose work is also based on processes of natural circulation and phase transitions, is set by the project of the NPP and is justified in the ROS NNP.

7.2 The system of passive sprinklers

7.2.1 The system of passive sprinklers is designed to perform the following main functions: reducing in ALA, decreased concentration of radioactive substances into ALA.

Use (non-use) of these or other functions is set by the project of the NPP and is justified in the ROS NNP.

The system of passive sprinklers according to the established functions by the project of the NPP may include: a siphon tube feeding headers, supply lines and valves, manifold with nozzles, etc.

7.2.3 The water tanks with the supply of water, as a rule, shall be placed in ALA**.**

7.2.4 The siphon tube must be sealed, and design of them shall give the possibility of leakage control.

7.2.5 The system of passive sprinklers must be designed and constructed so that it can be tested. The test conditions shall be given in the project of the NPP.

7.2.6 The chemical composition of the solution in the water tanks of the system of passive sprinklers must be determined on the basis of the requirements for the removal of radioactive substances from ALA and ensure reactor subcriticality (reactors with boric regulation). The project of the NPP shall provide measures to prevent non-uniformity of the solution in the water tanks, cleaning agents and corrections the chemical composition of the solution.

7.3 The active sprinkler system

7.3.1 General regulations

7.3.1.1 The active sprinkler system is designed to perform the following main functions: decrease in the ambient pressure in ALA, heat removal from ALA, the decline concentration of radioactive substances in ALA.

Use (non-use) of these or other functions is set by the project of the NPP and is justified in the ROS NNP.

7.3.1.2 The system of active sprinklers according to the established functions of NPP project may include: water supply units (pumps) in ALA, heat transfer equipment, water collector (tanks, swimming pools), a collector with sprinkler nozzles, node of solution mixing in the tanks, filter structure.

7.3.1.3 It shall be possible to check the efficiency of the active elements of the sprinkler system, including the sprinkler pump with readiness state of the system during power operation of the NPP.

7.3.1.4 The active sprinkler system must be designed and constructed so that it can be tested under the conditions as close as possible to the emergency, be possible to perform operations sequentially to activate the system including the transition to a source of limited time power.

7.3.1.5 A collector with sprinkler nozzles and the nozzles themselves must be designed so that the water droplets are uniformly distributed and their size shall be such that they fall within reached thermal equilibrium with the atmosphere.

7.3.1.6 The chemical composition of the solution in the water tanks of the active sprinkler system shall be determined on the basis of the requirements for the removal of radioactive substances from ALA and ensure reactor subcriticality (reactors with boric regulation). The project of the NPP shall provide measures to prevent non-uniformity of the solution in the water tanks, cleaning agents and corrections the chemical composition of the solution.

7.3.2 The water collectors of the active sprinkler system

7.3.2.1 For a continuous supply of an active sprinkler system with water entering into ALA in an accident and post-accident period, it shall be provided water headers in the project of the NPP. As water headers can be used tank-pit, pool-bubbler, water headers of other security systems if there is no information in the project of the NPP that combine the functions of the elements of these systems to a breach of the requirements to ensure nuclear safety.

7.3.2.2 The design of water headers shall be selected with regard to the number of channels of security systems, their autonomy and the preservation of efficiency. It is preferable to choose the number of water headers of safety systems in accordance with the number of channels of the system.

7.3.2.3 The design of the water headers shall include water purification supplied to the pump (e.g., filter elements in the form of multi-row labyrinth of grids), from pollution and eliminating the loss of water at any operation of the plant unit.

7.3.2.4 The water headers shall provide reduced speed of water on the way to the filter elements and eliminating formation of funnel at the entrance of water into the drain device.

7.3.2.5 Water reserve in the header, the design of its filter elements and intake devices must enable simultaneous operation of all spray pumps and other security systems that connected to water collector without disruption of water supply to the pumps. Besides, it is necessary to take into account the delay of water return to the water header to from the premises of ALA.

7.3.2.6 For water collectors, the design of which is made of reinforced concrete, It must (subject to the requirements of 6.2) be provided sealed steel covering.

7.4 Ventilation and cooling systems

7.4.1 The ventilation and cooling systems is designed to perform the following main functions: heat removal of ALA, the creation of a vacuum in ALA, decrease of concentration of radioactive substances in ALA, removing hydrogen from the mixtures of ALA, ensures the necessary degree of rarefication in the annular space between the two shells.

Use (non-use) of these or other functions is set by the project of the NPP and is justified in the ROS NNP.

7.4.2 The necessity of usage of ventilation and cooling systems as the LSS shall be determined by the project of the NPP.

7.4.3 The project of the NPP determines the necessity of working of the ventilation system in the annular space for double-sealed shells in a variety of operational and emergency modes.

7.5 Hydrogen explosion protection systems

7.5.1 The hydrogen explosion protection systems are designed to perform the following main functions: prevent the formation of explosive mixtures in ALA by maintaining the hydrogen concentration in the mixture below the figures of explosion safety, prevent the appearance of source of initiation of the explosion in ALA, ensure of explosion safety in ALA, control the hydrogen concentration in ALA.

Use (non-use) of these or other functions is set by the project of the NPP and is justified in the ROS NNP.

7.5.2 According to the functions for hydrogen explosion protection established by the project of the NPP, they can use the following systems:

- incineration system of hydrogen mixtures in ALA;
- system of removal of hydrogen from substance of ALA (including cleaning of working substances and its discharge into the environment);
- system of mixing substances in ALA;
- system of emergency and disaster desensitization.

A list of hydrogen explosion safety systems is set in the project of the NPP and is justified in the ROS NNP.

7.5.3 The LSS shall be designed with regard to the pressure generated during combustion of hydrogen mixtures. Pressure relief devices, fire prevention devices, hydraulic locks provide protection of systems (components) and premises from destruction.

7.5.4 As a rule, they shall not use materials (for thermal insulation, anticorrosion coverings, etc.) that can chemically react with hydrogen in ALA.

7.5.5 The project of the NPP shall contain an analysis about formation, accumulation, distribution of hydrogen and indicators of explosion hazards of hydrogen mixtures in systems (components) and premises.

7.5.6 It is necessary to calculate the amount of produced hydrogen both for normal operation and for emergencies, as well as for any design basis accidents and accounted of BDBA.

7.5.7 The project of the NPP shall contain the information about proven indicators of explosion safety for hydrogen mixtures.

7.5.8 The project of the NPP shall take into account temperature load and local changes of pressure in the places of potential accumulation of hydrogen.

7.5.9 When planning the premises in which there is a potential risk of occurrence of hydrogen, it is necessary to provide measures to prevent its accumulation and the formation of hydrogen in their local concentrations in the premises taking into account processes of heat and mass transfer.

7.6 System of the emergency installations of gas and aerosol cleaning

7.6.1 The system of the emergency installations of gas and aerosol cleaning is designed to perform the following main functions: decrease of pressure of the substance in ALA, reduction of the concentration of radioactive substances in ALA.

The application (non-application) of these or other functions is set by the project of the NPP and is justified in the ROS NNP.

7.6.2 The system of the emergency installations of gas and aerosol cleaning according to the established functions of NPP project may include: filter units, supply and discharge pipelines and safety devices.

7.6.3 The project of the NPP shall determine the necessity of using the system of the emergency installations of gas and aerosol cleaning as the LSS.

7.6.4 Filter elements of the emergency installation of gas-aerosol cleaning shall be available for their replacement during normal operation and in a post-accident period. It must be protection of workers (personnel) from the effects of radioactive substances and ionizing radiation.

7.6.5 When they use the "dry" method of cleaning, it shall be possible to replace and transport the used filter in a protective container. When they use the “wet" method of cleaning in a post-accident period, it shall provide for water cleaning from radioactive pollution.

7.6.6 In order to reduce the concentration of radioactive substances in case of an emergency, it could be used the system of active gas purification designed to work in conditions of normal operation. In this case, it must satisfy the requirements of this technical code.

7.6.7 The functions of the emergency systems of gas-aerosol cleaning can do emergency ventilation and cooling installations, and the installation of the hydrogen removal from ALA, if there is justification in the project of the NPP that the combination of the features will not lead to the safety violation of the NPP.

7.6.8 In the project of the NPP, measures shall be provided for testing system of filters in the places of their installation.

8. **Seals**

8.1 When selecting sealing components of the LSS (hatches, doors, locks, valves, etc.), they shall provide their replace only during the SPM. Moreover, seals shall provide the required leaktightness during normal parameters of operation, emergencies, as well as any design-basis accidents and accounted BDBA.

8.2 Particular attention shall be paid to the protection of sealing components of the LSS from the direct effects of the burning hydrogen and/or accumulation of radioactive aerosols.

8.3 Design documentation may contain a technical solution, according to which seldom-used doors, hatches, communications components of repair ventilation systems are sealed by welding using a transition element. Moreover, it shall be provided with weld quality control and its compliance with the requirements to the components of the LSS, including requirements for sealing.

9. **Materials**

9.1 Materials for components of the LSS must be chosen with regard to, for example, the required physical and mechanical characteristics (without tendency to fragility and rapid development of began damages, irradiation embrittlement), processability, weldability, efficiency under operating conditions during the usage period of the components of the LSS.

9.2 For manufacture, installation and repair of sealed steel cladding, tanks and enclosures as the components of the LSS, it shall be used the materials listed in Appendix A, and welding materials mentioned in [9]. It shall be used materials for reinforced concrete structures of HE in accordance with [5].

It shall be used materials for steel shells of HE in accordance with [10].

It shall be used materials for other components of the LSS permitted for use in accordance with the requirements [11].

9.3 Characteristics of the basic and welding materials must be confirmed by certificates from the supplier plants and meet the requirements of the TNLA, the use of which must be justified in the project of the NPP.

9.4 As a rule, the choice of materials for anti-corrosion coatings and cladding of the components of the LSS must be made in such a manner that these materials do not interfere with normal operation or implementation safety features, for example, due to aging, clogging filters of headers, or by formation of organic compounds of iodine.

9.5 The usage of materials for components of the LSS without complete data about their characteristics from the certificates of supplier plants or with the absence of the certificate is allowed after the tests confirming that the materials meet compliance with the TNLA.

9.6 The manufacturer or installation company must carry out an incoming inspection of the characteristics of materials for the production of the components of the LSS in accordance with [9]. It must be prepared testimonies after completion of works under input control (forms of certificates are listed in Annexes B and C).

9.7 If the technical requirements, the requirements of TNLA admit the possibility of the delivery of the material with different characteristics, the specific material requirements must be specified in the drawings or TNLA for manufacturing the components of the LSS.

9.8 Requirements for the control of metal state of the technological equipment and pipelines of the LSS shall be provided and justified in the project of the NPP taking into account the requirements [11] and this technical code.

10. Manufacturing, construction, installation, repair of the components of localizing safety systems

10.1 General requirements

10.1.1 Manufacturing, construction, installation, repair of the components of the LSS must be performed in accordance with the requirements of the EMD (technological instructions, map of technological processes, work projects and others.), regulating maintenance of all technological and control operations. The EMD shall be developed by the manufacturer, construction or maintenance organization in compliance with the requirements of this technical code.

10.1.2 In the process of manufacturing, construction, installation and repair of elements of LBP, producer factory, construction and installation or repair organization are obliged to implement control of the quality of the work that is provided by this technical code and the EMD. The inspection results must be recorded in documents (journal file, certificates, acts, history files, etc.) in accordance with the requirements of this technical code and current TNLA of the industry, approved in the established procedure.

10.1.3 The construction of building and other structures of the LSS shall be made in accordance with the quality assurance program developed by specialized company.

10.1.4 Quality assurance of works during manufacturing, construction, installation and repair of the components of the LSS must be carried out in the all stages of their implementation and include:

- entrance control of working documentation, quality of incoming materials, elements, semi-finished products;
- operational control during performance of the work;
- acceptance inspection of the quality of the elements;
- inspection control of production technologies and the quality of performed work.

10.1.5 Quality assurance of works shall be carried out by special services created in organizations (enterprises) and equipped with technical means providing the accuracy and completeness of the control. Quality of work is necessary controlled in accordance with the requirements of TNLA.

10.1.6 The plan of the production works for the NPP shall provide measures to exclude damage of the sealed steel cladding and other components of the LSS in the process of concreting works and installation of equipment.

10.1.7 It is allowed to work on the construction, enlargement and installation of the components of the LSS in the conditions provided with the EMD in accordance with requirements [9].

10.1.8 The components of the LSS shall be marked. The marks shall be made in the drawings and the method of them shall be given in the EMD.

10.1.9 The construction of building structures of HE shall be performed in accordance with the requirements of the construction TNLA and this technical code.

10.1.10 Selection of the composition of the concrete for building structures of HE, terms of delivery and storage components, preparation, transportation, installation and maintenance of concrete shall be carried out in accordance with a specially developed technology or plan of the production works with the phased quality control.

10.1.11 Conditions of the transportation and storage of the components of the LSS must meet the requirements of the TNLA and ensure their safety.

10.1.12 They shall coat the components of the LSS made of carbon steels with anticorrosion protective coating.

10.1.13 Welds of the components of the LSS shall be controlled before coating of anticorrosion protective coating in the area of welded joints.

Protective coating may be applied to items in the manufacturing process and consolidation after the control of the base metal and welded joints.

10.2 Requirements for the construction, installation and repair of hermetic steel cladding and strip embedded items

10.2.1 The technology of manufacturing, installation and repair of sealed steel cladding and strip embedded parts shall maintain leaktightness of confinement of ALA provided by the project of the NPP during the usage period of the NPP**.**

10.2.2 The cutting semi-finished products must be done according to the technology excluding crack formation. They allow flame cutting followed by machining of the edges of the components.

10.2.3 Formed components and bent structures must be made mechanically. They allow cold pre-bending of the edges of welded components during installation. The method and the magnitude of pre-bending of the edges of welded components must be set by the EMD.

10.2.4 Surface condition of the components of the HE in the manufacture, installation and repair must comply with the requirements of the TNLA for the supply of the metal.

10.2.5 As a rule, anticorrosion coating of the sealed steel cladding and other components of the LSS shall normally be coated at the factory at that it does not coat weld-affected zone of field welds at a distance of 100 mm from the edge of the weld. If necessary, surfaces of sealed steel cladding from carbon steel in contact with concrete walls and floor shall be covered by cement grout in accordance with the requirements of the TNLA.

10.2.6 Limit deviations of sizes of sheet elements (assembling blocks) after manufacture from the sizes given in the project of the NPP shall be specified in working documents, but in any case not exceed the following values shown in Table 1:

Table 1:

The name of control elements	The maximum allowable deviation
Dimensions	4 class of accuracy, GOST 21779
Nonflatness of sheet items (except for the edges of assembly blocks) at a base rate of 1 m, mm	10
Nonflatness the whole surface, mm	20
Deviation of the edges of assembly blocks from straightness, mm	5
Non-perpendicular of sheet elements	4 class of accuracy, GOST 21779
The position of holes for penetrations and technological embedded items relative to the base block (element) axes and the distance between the holes	5 class of accuracy, GOST 21779, but ± 5 mm
Dimensions of holes for penetrations and technology embedded items	5 class of accuracy, GOST 21779
Not mentioned in working documents limit deviations of sizes	5 class of accuracy, GOST 21779

10.2.7 The limit deviations of the elements sizes during the installation of HE shall be given in the working documents. When this information is absent in the drawings, it must not exceed the following values shown in Table 2:

Table 2:

The name of control elements	The maximum allowable deviation
Nonflatness of cladding at a base rate of 1 m, mm	10
Nonflatness the whole surface, mm	20
The position of technological embedded items and penetrations relative to the axes of buildings and elevation marks (displacement of orientation points)	2 class of accuracy, GOST 21779, but ± 10 mm
Vertical deviation	± 1,5 mm at a height of 1 m, but 35 mm
Unspecified limit deviations	5 class of accuracy, GOST 21779

10.2.8 Assembling of the components of the LSS and other works in ALA shall be conducted in accordance with the plan of the production works, in which shall be envisaged measures to ensure the safety of the sealed steel cladding (the usage of protective flooring, protective shields on the walls, protective screens in places of possible hitting during transportation, preparation of places, which can be loaded during assembly).

10.2.9 Assembling of components and pipes of the LSS in ALA shall be implemented under the plan of the production works developed before the start of the works in accordance with the requirements of this technical code and documentation for manufacturing and installation.

10.2.10 Auxiliary components (technological fastening and others) can be welded by sealed steel cladding only in the places that provided by the project of the NPP.

10.2.11 Point loads on sealed steel cladding in the lifting points, during storage and transportation in the places of HE heavy components installation and in other cases may be admitted only if it is provided by the plan of production works.

10.2.12 Concreting of overlaps and walls, sealed steel cladding that is used as a timbering must be done layer by layer. The height of the concrete layer and fixing points of sealed steel cladding must be specified in the planning documentation.

10.2.13 As a rule, connection of sealed steel cladding parts to each other and with the other components of HE shall be periodically checked for leaktightness in the process of commissioning and during the usage period as well as failure detection. It allowed not control locally weld joints of the components of the HE, made at the factory, during the construction, installation, acceptance and operation, if these joints can be checked during the test of the whole HE for leaktightness.

10.3 Requirements for welding and control of the components of localizing safety systems

10.3.1 Welding of the components of the LSS shall be performed in the accordance with the requirements of the EMD developed according to the requirements [9], and this technical code by the specialized design and engineering organization or the organization performing welding operations.

10.3.2 Procedure of checking the welding technology and quality control of welded joints and surfacing is set in accordance with the requirements [12].

10.3.3 Welding and control of tanks and casings must be performed in accordance with the requirements of the TNLA.

11. Testing of the localizing safety systems and their components

11.1 General requirements

11.1.1 The LSS and their components shall be inspected direct and full for compliance with the design indexes during commissioning, after repair and periodically throughout the usage period of the NPP.

11.1.2 Checking the seismic resistance of the technological components of the LSS (equipment, pipelines and their supporting structures) is carried out in accordance with [13].

11.1.3 The requirements for hydraulic (pneumatic) tests of equipment, pipelines, their parts and assembly units of the LSS for strength shall be stipulated and justified in the project of the NPP to meet the requirements [11] and this technical code.

11.1.4 They shall provide for the testing of the LSS and their components for compliance with design characteristics by carrying out the following types of tests: test for strength, leaktightness test and functional test.

Depending of the purpose of the LSS and their components, they must be exposed to all above mentioned tests or their individual types in accordance with the project of the NPP.

11.1.5 Test of the components of the LSS after their production must be carried out manufacturer upon factory testing programs approved in the established procedure or in accordance with the project of the NPP.

11.1.6 Tests of the LSS and their components after the construction (installation) during commissioning and during the operation must be conducted according to procedures, standard and work programs developed by the operating organization, taking into account the requirements of this technical code.

11.1.7 During the tests, they must provide for the actions preventing damage to the components of HE in the case of non-project change of test parameters.

11.1.8 Tests of HE for leaktightness and strength after installation must be conducted by pneumatic and (or) hydraulic method.

11.1.9 Tests of HE for leaktightness and strength shall be carried out on fully assembled components of the system, as well as installed providing and operating systems to the extent necessary to perform all the functions provided by the project of the NPP.

11.1.10 For pneumatic tests of HE in the project of the NPP, it shall be provided special systems or equipment, for example:

- compressor stations (for creation of increased pressure and (or) rarefication);
- delivery and bleed lines of testing medium, the discharge line must be equipped with safety valves.

11.1.11 Based on the test results of the LSS and their components, they must make protocols, statements and acts, forms of which are given in Appendix D. Test results shall be recorded in the passport of the relevant system.

11.1.12 Defects identified during the tests shall be eliminated, and then the tests shall be continued or be repeated.

11.2 Testing of hermetic enclosure for strength

11.2.1 The tests for strength of the HE are conducted once during the life cycle of the nuclear unit (when it is entered into the operation) by pressure and rarefication.

Repeated strength test must be conducted only if the components of HE affecting on strength was repaired or replaced during the operation. In the project of the NPP, they shall give the criteria in according to which they make a decision about the necessity to repeat tests for strength. The decision about conduction of repeat tests for strength is made by operation organization.

11.2.2 Pressure value of testing medium during the strength test by pneumatic method for enclosing structures of the LSS made of reinforced concrete shall be taken in accordance with [5], for enclosing structures made of steel shall be taken in accordance with [10].

If they use the type of the enclosing structures of ALA missing in the TNLA, pressure value of the testing medium during the tests of HE for strength by pneumatic method shall be adopted and substantiated in the project of the NPP.

11.2.3 When testing HE for strength, it is necessary to:

- experimentally determine the dynamics of the actual stress-strain state;
- to compare the test data with the calculated and (or) the maximum permissible criteria for evaluating of strength.

11.2.4 In order to determine the actual value of the stress-strain state and compare it with the design values of the pressure or rarefication during the test for strength, it shall be created with the speed and soaking that specified in the project of the NPP on pressure values (stages) that given in NPP project.

A further pressure increase of working substance up to the next value (stage) of the test pressure must be carried out only after obtaining reliable conclusion about the accordance of HE to design criteria of strength adopted by acceptance committee.

11.2.5 During the test for strength of HE, the following parameters shall be registered in the appropriate journals:

- the data about the visual inspection of the HE surfaces;
- the values of the stress-strain state of HE;
- changes in the geometry of HE;
- temperature of the HE components;
- tendons tension of reinforced concrete structures of HE and force of tensioned tendons;
- working substance parameters in the volume of ALA.

These parameters shall be measured at the control points of HE, which must be specified in the technical documentation and the working test program.

11.2.6 In accordance with the requirements of the TNLA, the limit values of crack opening are used as the criteria for evaluating of HE strength according to the data of visual inspection of HE in order to detect cracks in concrete.

11.2.7 The criteria for evaluation of the stress-strain state must be values or change of values of each parameter of 11.2.5 with a corresponding value of the test pressure and with the ability to carry out the functions of HE structures. These criteria must be given in a working test program.

11.3 Testing of hermetic enclosure for leaktightness

11.3.1 Test for leaktightness by air pressure corresponding to the calculated pressure is held once during the period of the PCW (after construction and assembly works). Then it is repeated at least once in 10 years and after repair or replacement of the components that influence on the leaktightness and strength, if these components cannot be controlled locally. Test of HE for leaktightness during operation shall be carried out once a year during the period of the SPM by reducing pressure that equal, as a rule, to the half of the calculated. The value of the reduced pressure must be determined by the project of the NPP.

11.3.2 HE (or its autonomous part) shall be tested for leaktightness by calculated and (or) reduced pressure.

11.3.3 Test for leaktightness by calculated rarefaction is held for HE (or its autonomous parts) that need to maintain rarefaction in operation, emergencies or accidents according to the project.

11.3.4 For plants with a bubble-vacuum system, it must be provided test by calculated and (or) reduced pressure confirming the performance of the functions of that part of HE, which serves as an air trap and test by calculated rarefaction for part of HE where it is generated during accidents.

11.3.5 During tests of HE for leaktightness, mark level of the working substance in each sump, tank as well as on the floor of ALA must correspond to its level when in operation.

11.3.6 In order to measure the value of leakage from HE and its separate parts, any method can be used if it is satisfied the accuracy of measurement of leakage values and required minimal time for testing at a given value of leakage. Besides, it shall be certified in the prescribed manner.

11.3.7 As a rule, in order to detect major defects (leaks), test for leaktightness shall begin with the evacuation of ALA (value of rarefaction is determined by the project of the NPP) followed by the creation of calculated value of rarefaction and overpressure.

11.3.8 Tests of HE for leaktightness are allowed to perform at one closed insulating fittings on each communication (near to the border of ALA). Fitting must be closed to simulate an alarm.

The rest of insulating fittings are checked for leaktightness locally with that it is closed simulating an alarm.

Local tests for leaktightness of the door (hatch) of gateway that is far from ALA must be carried out with its inflation according a test program that compiled by working documents of the gateway manufacturer.

11.3.9 The local tests of LSS components for leaktightness must be carried out to the requirements [14].

11.3.10 The observed defects (such as leakage location) must be registered in the list of observed defects, the form of which is shown in the Appendix G.

11.3.11 The criterion for evaluating of reliability of integrated test results of HE for leaktightness shall be the condition for implementation of the stabilization parameters in ALA during the tests:

- for expected values of leakage by up to 5%/day - changing the bulk temperature in ALA shall be not more than 0.025 K/h;

- for leakage values over 5%/day - exposure to the test pressure must last for 5-6 hours.

It must be received at least nine consecutive measurements in which this criterion would be fulfilled.

11.3.12 During integrated tests for leaktightness of HE, parameters of compressed air in the ALA shall be recorded (pressure, temperature, humidity) at a frequency of at least once an hour before validation criterion of result is not fulfilled:

$$\Delta L/L<0,3 \text{ when } \alpha\geq 0,95, \quad (1)$$

where ΔL - error of leakage values,%/day;

L - leakage value which is obtained during the test,%/day;

α - confidence coefficient.

11.3.13 Test of HE for leaktightness during the PCW must be carried out by at least two pressure levels - calculated and reduced. In addition, soaking over a period of stabilization of the parameters in ALA (ref. 11.3.11) shall be implemented at both pressure levels.

11.3.14 The leak value that given in the project of the NPP must be an evaluation criterion of leaktightness test results of HE during the PCW at calculated pressure:

$$(L+\Delta L)<Lp, \quad (2)$$

where L - leakage value obtained during the tests with the necessary reliability (ref. 1 .3.1 2);

Lp - leakage value that given in the project of the NPP;

ΔL - confidence coefficient, that determines the value of leakage.

11.3.15 The evaluation criterion of test results of HE for leaktightness at reduced pressure during the PCW must be the values of leakage Lcr with the required reliability (ref. 1 .3.12).

11.3.16 The evaluation criterion of test results of HE for leaktightness at reduced pressure during the operation must be a condition of the inequality:

$$Lk<1,15Lcr \quad (3)$$

where Lc = (L + ΔL) - leakage value obtained during operational tests;

Lcr = (L*cr + ΔL) - the sum of leakage values obtained at reduced pressure tests during the PCW L*cr; and confidence coefficient of its determination ΔL.

11.3.17 The value of leakage during reduced pressure tests during the PCW L*cr must be recorded in the passport of HE in order to use it as a criterion for annual operation tests.

11.3.18 The resulting value of leakage from HE shall be referred to the average value of pressure in ALA during the integrated tests reading.

11.3.19 The rate of increase and decrease of the pressure in ALA during the leaktightness test shall not exceed the values specified in the project of the NPP.

11.3.20 If any of the criteria given in paragraphs 11.3.11-11.3.16 is not be fulfilled, the test results cannot be considered as reliable.

11.3.21 The projects of the NPP must provide the possibility of air bleeding from ALA through filters, as well as the removing of fluid working substances during tests for leaktightness in operation.

11.3.22 In the case of using "absolute" method of determining leakage during the tests of HE for leaktightness, these tests shall be performed in accordance with the basic requirements for measurements during integrated tests of HE that given in Annex D.

11.4 Testing of hermetic enclosure components for leaktightness

11.4.1 Test of HE components (hatches, gateways, isolation devices, sealed doors and penetrations) for leaktightness during construction and commissioning must be conducted by stages upon completion of the installation work on the construction of HE. Components of HE, as a rule, shall be available for these tests.

They must define in the project of the NPP the components that shall be subject to leaktightness tests.

11.4.2 The tests during the commissioning include input control and test of HE components after installation. Volumes of the input control, post-construction testing and acceptance criteria shall be defined in the project (design) documentation. The tests determine leakage value.

11.4.3 The frequency of direct test of seals gateways during reactor operation at power must be given and justified in the project of the NPP using probabilistic methods of analysis.

11.5 Hydrostatic test for leaktightness of premises, headers and tanks

11.5.1 Premises, headers and tanks, which may be components of other LSS shall be hydraulically tested according to 6.2.7, 6.2.8 and 7.3.2.

11.5.2 Hydraulic tests are performed during commissioning, and periodically throughout the life cycle of the NPP and, if necessary, during the SPM.

11.5.3 The test of premises listed in 6.2.8 shall be conducted during the test of HE for strength and leaktightness. In this case the premises must be filled with water to create pressure in ALA.

11.5.4 Hydraulic tests shall be conducted at an ambient temperature of + 5 ° C and above. If it is necessary to conduct tests in winter, they shall take measures to prevent the water freezing.

11.5.5 As water filling premises, headers, tanks, they must observe the state of structures and the emergence of leaks (including from the control cavities). The test is necessary to stop if there is a leak. The water must be drained and the cause of the leak must be eliminated.

11.5.6 Premise, header, tank are considered to pass the hydraulic tests, if leakage of the tank wall surface or at the edges of the bottom (for premises and headers - from the control cavities) do not appear. And a decrease of the water level is not fixed within 24 hours.

11.6 Functional testing of the localizing safety systems and their components

11.6.1 The project of the NPP shall provide functional testing of the LSS and their components during commissioning of power generator unit and their operation.

11.6.2 The LSS and their components shall be checked periodically during operation in accordance with the requirements of the project of the NPP.

11.6.3 Functional tests of the LSS and their components during the NPP operation and commissioning of the NPP shall not lead to failure of the state of readiness.

11.6.4 During the tests, components of the LSS shall be inspected in compliance the following main characteristics and indicators to NPP project:

- characteristics of pumps and blowers systems;
- the ability of the filter elements to perform their functions;
- Indication of level gages of header and other sensors;
- capacity of pumps to perform their functions at its lowest permissible level in a header;
- time from start of pump to beginning of water flow into the header and water level in the header;
- availability of reinforcement;
- design characteristics of the sprinkler nozzles.

11.6.5 Pipelines and nozzles of the sprinkler system must be annually checked by air for continuity.

11.6.6 During functional tests of the insulating devices, it is necessary to check the efficiency of isolation devices and the time required for their closure.

11.6.7 During the functional tests of the active LSS, it must imitate an alarm signal of pressure increase, after which the system shall start to perform its functions.

11.6.8 Active isolation devices shall be subject to functional testing. The frequency of testing shall be defined and justified in the NPP project. The need to check the individual parameters of the insulating devices during full power operation of the reactor is determined and substantiated in NPP project.

11.6.9 It is necessary to conduct testing of all electrical lines associated with the LSS and their components in order to confirm that there are no deviations from the project, and that all connections are made in accordance there with them.

The frequency of testing shall be defined and justified in the project of the NPP.

11.7 Biological defense testing of components of the localizing safety systems

11.7.1 Biological protection tests of the LSS components shall be carried out before the acceptance of HE into operation in order to test their effectiveness as a biological protection.

11.7.2 The following areas of HE shall be tested:

- location doors, hatches, locks and penetrations;
- places of possible location of employees (personnel) outside of HE (during and after accidents).

Amount of tests, specific test sites and planning dose of ionizing radiation are specified in the project of the NPP.

11.7.3 Methods of test shall allow reliably determining the effectiveness of biological protection and identifying the place where the dose rate of ionizing radiation exceeds the design values.

11.7.4 The tests shall be carried out in the work program agreed on established order.

11.7.5 The test results are recorded in the passport of the LSS (the content passport of the LSS is given in Annex E). Structures of biological protection are considered as suitable for operation if there is no space in them where the dose rate of ionizing radiation is greater than a design value.

12. Exploitation of the localizing safety systems and their components

12.1 General requirements

12.1.1 It shall be determined output conditions for maintenance, repair and testing, including the minimum necessary composition of the equipment, which provide safety of the NPP. These conditions shall be reflected in the technological regulations of the power generator unit of the NPP.

12.1.2 Components of the LSS shall be checked for compliance with design specifications after their repair.

12.1.3 Testing and verification of the LSS and their components during the operation are held according with the requirements of section 11.

12.1.4 Nuclear, radiation, and general safety must be ensured during repairs.

12.1.5 Repair of the LSS components shall be made in accordance with the requirements of section 10 to their manufacture, construction and installation.

12.1.6 Operating instructions of the LSS and their components shall provide organizational measures to exclude conduction of repair works on equipment and piping under pressure.

12.1.7 The position and condition of the insulation devices and their components must be checked before switching the LSS into the work after repair or extended shutdown (over 72 hours).

12.1.8 The operation of the power generator unit is forbidden to continue, if there is leakage of the working substance from the headers of the LSS, the value of which is higher than the value established by the project.

12.1.9 The SPM and overhaul of the LSS components shall be carried out taking into account the requirements of [11], and this technical code.

12.2 The requirement for the control and checks

12.2.1 Control of technical condition and parameters of the LSS and their components shall be carried out in accordance with the technological regulations and operation manual.

12.2.2 The components of HE during the operation shall be periodically tested to determine their effectiveness as a biological protection against ionizing radiation. The frequency and volume of inspections shall be specified in the NPP project.

12.2.3 The project of the NPP shall reflect the frequency and volume of monitoring of the impact of the aging mechanisms on the LSS structure and their components including corrosive wear control of surface components of the LSS.

12.2.4 Test of the components of the LSS during the operation must be conducted in accordance with the requirements of technological regulation, operating instructions and testing program.

12.2.5 They shall develop methods (test programs) to carry out periodic tests of safety and bypass devices the activation and leaktightness during the SPM.

13. Registration and technical expert examination of the localizing safety systems and their components

13.1 The LSS and their components, which are subject to the requirements of this technical code must be registered in the Ministry of Emergency Situations of the Republic of Belarus and taken on record at the enterprise-owner equipment and pipelines after their installation before the technical inspection.

13.2 Necessity and procedure for registration of the LSS and their components, as well as the procedure for monitoring of the conduction of the technical examination by the enterprise-owner is established by the Ministry of Emergency Situations of the Republic of Belarus.

13.3 Equipment and pipelines, which are subject to the requirements of this technical code, are recorded as the LSS components, regardless of their belonging to another security system (normal operation), security classes or groups.

13.4 Nomenclature of the LSS, that shall be registered, as well as the boundaries of their registration is determined by the lists that developed and agreed in the established order.

13.5 They must be guided by the following to determine the registration boundaries of the LSS and their components:

- registration borders of pipelines (air conduits) of systems that crosses HE and is not related to the LSS, are isolating devices installed on these pipelines (air conduits) and registered as part of HE;
- If there is no insulating fittings on the pipelines (air conduits) of system that crossing HE and is not related to the LSS, in ALA, it is registered as part of HE within the boundaries from the joint of its welding to hermetic penetration (from the side of ALA) to fittings (of insulating device) outside ALA.

13.6 After registration, the LSS and their components must undergo a technical inspection before commissioning (before loading fuel into the reactor core), periodically during operation and ahead of schedule after repairs.

3.7 Technical inspection of the LSS and their components include:

- the verification of the technical documentation;
- the inspection of external and internal surfaces in accessible areas;
- Components of the LSS;
- Hydraulic or pneumatic testing of the LSS.

13.8 Technical inspection of the LSS and their components must be carried out by a commission appointed by order of the nuclear energy facilities.

13.9 Annually, they must draw up a timetable for the technical examination of LSS and their components on the NPP in accordance with the terms specified in the passports, and the timing of SPM. The schedule shall be approved by the administration of nuclear power facilities.

13.10 Tests for leaktightness of decompresses components of the LSS shall be carried out in accordance with the requirements of the documentation of the manufacturer of these components.

13.11 During external and internal examination of the LSS and their components, they check the following:

- during the initial examination – the LSS and their components are made, assembled and equipped in accordance with the requirements of this technical code and documents presented at registration, and also they are in working condition;
- during periodical and ahead-of-schedule examination – the LSS and their components are in a good working order and their further operation are possible.

13.12 Before the technical examination, the elements of the LSS shall be withdrawn from operation, disconnected from all sources of pressure, released from working substance and checked surfaces are cleaned from contamination and scum.

13.13 Before the start of the technical examination and the preceding preparatory works, the components of the LSS that are in contact with radioactive coolant must be carefully processed by decontamination solutions and washed according to the requirements of the instructions for safe operation.

13.14 Special methods of inspection of surfaces of the LSS components from the volume of which it is impossible to drain the working substance for technological reasons, for a period of examination, must be indicated in the project of the NPP.

13.15 Based on the results of technical inspection, they make an act with the conclusions about the possibility of operation of the LSS and their components and with an indication of the timing of the subsequent technical examination.

13.16 The person who responsible for the working order of the LSS and their components, is responsible for the preparation of the LSS and their components to technical inspection, implementation of the necessary technological operations, as well as compliance of TNLA and instruction of radiation safety requirements and accident prevention during of technical inspection.

14. Maintenance operations of the localizing safety systems and their components

14.1 The administration of the NPP is obliged to maintain the LSS and their components in accordance with the requirements of this technical code, ensure the safety of maintenance and functional tests of the LSS and their components, good order of their work and appoint the person, who oversees the LSS and their components and the person, who is responsible for their working order amount engineers and technical workers (personnel), that have been tested in the prescribed manner.

14.2 When operating the LSS they must observe the requirements of TNLA on nuclear and radiation safety, as well as technological requirements for power generator unit of the NPP and instructions of the LSS and their components.

14.3 In the technological regulations, they shall give the values of admissible variations of the basic technological parameters of the LSS and their components in the commissioning period of the reactor and during its power operation.

14.4 In the operating instructions for the LSS and their components, they shall give the values of volume and frequency of the maintenance and inspections of working capacity of the LSS and their components that are installed on the basis of this technical code, the project of the NPP and the results of tests during the SPM.

14.5 Verification of the active components of the LSS, the necessity of which is justified in the project of the NPP, as a rule, shall be conducted at least once a month. Functional tests of passive components of the LSS and isolation devices shall be carried out annually during the SPM.

The results of inspections shall be documented in an act and be recorded in the passport.

14.5 Operating Instructions the LSS and their components are prepared by operating personnel of the NPP.

14.6 LSS shall be prepared to work from the beginning of the loading reactor by nuclear fuel at all power levels, including MCL, as well as during the SPM in accordance with the requirements of technological regulations.

Note! Readiness for the operation of LSS means readiness to work of all its channels.

14.7 Prohibition of the reactor launch must be provided in the following cases:

- a leakage from HE the value of which exceeds the allowable by the project of the NPP;
- the unavailability to operate at least one element of the LSS (fault at least one channel), including providing and controlling security systems or in case of failure of HE tendons in the amount greater than premised by the project of the NPP;
- the unavailability to operate the bypass and safety devices of HE.

14.8 Necessity of workers (personnel) to access in ALA during the operation for the maintenance of the equipment must be justified in the project of the NPP and reflected in the technological regulations.

14.9 The NPP project must substantiate the time required to restore of the efficiency of the LSS components (with reservation) after which, if the operation is not restored, the reactor will be transferred to the subcritical state.

14.10 The list of repairs and testing results are recorded in the passport at the end of repair works and testing the operation of repairing element of the LSS, and, if it is necessary, the whole LSS.

Appendix A

(compulsory)

The steel materials that are used in manufacturing, installation and repair of the components of the localizing safety systems

Table A.1 - steel cladding and welding components of elements of functional systems to it

Material	TNLA on chemical composition	TNLA for the supply	Application area
St3sp5 St3sp2 * St3Gsp5 St3Gps5	GOST 380	GOST 14637 with amendment No1	Sheet for cladding and embedded items
08X18H10T 12X18H10T	GOST 5632 the 1991 edition	GOST 7350 the 1989 edition	Sheet for cladding and embedded items
20K	GOST 5520 the 1987 edition with amendment No3	GOST 5520** the 1987 edition with amendment No3	Sheet for embedded items
22K	GOST 5520 the 1987 edition with amendment No3	GOST 5520** the 1987 edition with amendment No3	Sheet for embedded items
09G2S 10G2S1 17GS	GOST 19281 the 1991 edition GOST 5520 the 1987 edition	GOST 5520** the 1987 edition GOST 19281** the 1991 edition	Sheet for embedded items
14G2 10HSND 15HSND 14G2AF 16G2AF	GOST 19281	GOST 19281**	Sheet for embedded items
* For thicknesses up to 5 mm ** Category 10-12			

Table A.2 - Tanks (containers)

Material	TNLA on chemical composition	TNLA for the supply		Application area
St3sp3 St3sp5	GOST 380	GOST 14637 the 1987 edition with amendment No1		
08X18H10T 12X18H10T	GOST 5632 the 1991 edition	GOST 7350 the 1989 edition		
20K 22K 09G2S	GOST 5520 the 1987 edition		GOST 5520** the 1987 edition	
* For thicknesses up to 5 mm ** Category 10-12				

Appendix B

(compulsory)

The form of the authorization certificate for installation components of the localizing safety systems

Permission for the installation
No._____ «___»_____20___
Permission for the installation of
_____ Number of "____" _____ 20____
issued by_____
(the name of the authority,

_____
issued the permit, the name of

_____
the installation company)

CERTIFICATE No. _____
about installing components of localization safety systems,
carried out in accordance with the requirements of the TCP "Rules of design and operation for localization safety systems of nuclear power plants "

_____
(the name of localization safety systems)

1 General information about LSS

Name of LSS
Name of project organization
Number of assembly drawing
Name and address of manufacturers of LSS components
Name and address of the installation company
Name and address of the owner
Name of the working substance
Estimated fluid pressure, MPa
The estimated temperature of working substance, K

2 Data on the material of the LSS components of NPP

2.1 Information about the metal sheets, structural shapes, forgings (stamping), free of tension, pre-stressed reinforcement and concrete

Name of component
The thickness of the sheet, mm (number of rental)
Grade of steel (concrete)
Technical regulations for supply
Lot number
Certificate Number
Note! For the LSS components mounted in accordance with [11], it is applied the passport content of the LSS presented in this technical code.

2.2 Information about the pipes

Name of localizing safety systems
The nominal outer diameter and wall thickness of pipe, mm
Material grade
TNLA for supply
Pipe length, m
Number of melting process
Certificate Number

2.3 Information about the equipment that affects the leaktightness

Name of equipment (penetration, hatches, etc.)

Quantity, pcs.

Drawing number (TNLA)

Basic dimensions, mm

The maximum value of the leakage in the test, m3/h

2.4 Information about the installed insulating fittings

Type of fittings

Quantity, pcs.

Place of installation, system, premises

Nominal diameter, Dn

Design pressure, MPa

The estimated temperature, K

Passport number (certificate)

Maximum allowable leakage rate, m3/h

3 Information about welding

Number of welded joints under the scheme

Category of welded joint

Welding type

Data on the filler materials (type, brand, TNLA for supply, the lot number of the certificate; certificate number)

Inspection method

The amount of control

Inspection results

Note! Indicated only for welded joints made during installation

4 Information about the welders

Surname and initials

Number of welded joints

Category

Number of certification protocol and the date of its implementation

Number of licenses

To which kinds of works are allowed

Attire on hot works

5 Results of input tension of pre-stressed reinforcement;

Numbers of tendons

The tension in the cylindrical part of the shell (effort of a tension; the measurement date)

The tension in the dome of the shell (effort of a tension, the measurement date)

6 Test Results of the LSS components

Name of components

Data of the test

Note

7 Conclusion

Components of LSS are assembled and tested in accordance with the requirements of the TCP " Rules of design and operation for localization safety systems of nuclear power plants", and EMD.

TCPxxx-2010 / WP_2

Chief Engineer _____

(signature, name)

"___" _____ 20 ___

Head of QCD _____

(signature, name)

"___" _____ 20 ___ **L.S.**

Appendix C

(compulsory)

The form of the authorization certificate for manufacturing components of the localizing safety systems

Permission for manufacturing elements

_____
(name of localization

_____
safety systems)

No._____ "____" _____ 20___

_____
(name of the authority which issued the permit,

_____
and manufacturing plant)

CERTIFICATE No. ____

On the production components_____
(name of localization

_____
safety systems)

The name of the component_____

The name of the manufacturer and its address _____

Customer _____

Order number _____ Year of manufacture _____

1 Characteristics of the product, its function.

2 Information about the basic materials.

3 Information about welding.

3.1 Welding type is used for manufacturing the element.

3.2 Data on the filler materials.

3.3 Welding is made by welders who have passed a test in accordance with

_____
(Title of the document)

4 Information about the testing of welded joints.

5 Conclusion.

Element _____
(name of localization safety systems)

It is manufactured and tested in accordance with the requirements of the TCP "Rules of design and operation for localization safety systems of nuclear power plants", TNLA on production and accepted as ready to work.

The inventory of the documents is attached.

Chief Engineer of the plant _____
(signature, name)
"___" _____ 20 ___

Head of QCD _____
(signature, name)
"___" _____ 20 ___
L.S.

Appendix D

(compulsory)

Forms of protocols, statements, acts based on the results of the tests of the hermetic enclosure and its components

PROTOCOL

of test results _____
(prior, after
_____ Sealed enclosure
construction and installation, periodic)
_____
(in a whole or its autonomous parts)
_____
(for leaktightness, strength)

Unit number _____of the nuclear power plant
"____" _____ 20___

1 About the test results _____
(pre, post-construction, etc.)
sealed enclosure _____ for leaktightness.
(in a whole or its autonomous parts)

- The tests were carried out according to the requirements of paragraphs No _____ of working program and performed in the period from _____to _____
  Schedule changes in air pressure zone of accident localization, protocols of registration parameters for determining leakage values, as well as a statement of detected defects in sealed enclosure are attached to this protocol.

1.2 Leakage values are defined for _____
(one, four, five - cross out unnecessary figure)
The values of the test pressure of air inside the sealed enclosure;
Results of calculations are shown below:
Leakage and its absolute error of measurement, %/day
Confidence probability
Initial test pressure, kPa
Start of testing at a specified pressure (date, time of day, hour)

- These leakage values are compared (in accordance with the requirements of paragraph No._____ of work program) with criteria of leaktightness, and (not) satisfy mentioned requirements.

2 About the test results _____
(pre, post-construction, etc.)
sealed enclosure _____ for leaktightness.
(in a whole or its autonomous parts)

2.1 The tests were conducted according to the requirements of the paragraphs No._____ of the work program in the period from _____ to_____ simultaneously with testing for leaktightness (see. 1.1 this protocol).

2.2 Stress-strain state of the hermetic enclosure _____
(in a whole or its autonomous parts)
defined for _____the test values
(One, four, five - to cross out unnecessary figure)
of the air pressure in the accidents localization area, are equal _____ kPa.

Evaluation of stress-strain state was carried out according to indications _____ transducers with simultaneous inspection of the concrete surface for the detection of cracks (in accordance with the requirements of point No. _____ of the work program).

Stress values in the reinforcement at the test pressure _____ kPa does not exceed ____ kPa. The exception was zones _____, where the voltage is marked up to _____ KPa.

At the elevations _____ in the areas _____, it was fixed crack-opening in _____ Mm.

After reducing the pressure in sealed enclosures, the cracks _____.
(closed, not closed)

2.3 Measured values of the stresses, deformations (displacements), the slopes, and also fixed crack opening are _____ design values
(less than, greater than)
and limit values in accordance with the TNLA.

CONCLUSION

Sealed enclosure _____
(in a whole or its autonomous parts)
of unit No. _____ of nuclear power plant:
_____ test for leaktightness;
sustained, not sustained)
_____ test for strength.
(sustained, not sustained)

The Chairman of the Commission
of the sealed enclosure acceptance _____
(signature, name)
"___" _____ 20 ___

Members of the commission _____
(signature, name)
"___" _____ 20 ___

PROTOCOL

registers parameters during the test _____
(pre, post-construction, etc.)
_____ sealed enclosure for leaktightness.
(in a whole or its autonomous parts)
Unit No. _____ of the nuclear power plant.
"__" _____ 20___

Date of testing
Measurement time, hours, minutes
The pressure inside the sealed enclosure, kPa:
- manometric
- barometric;
- absolute
Bulk temperature inside the sealed enclosure, K
The weight average gas constant inside the sealed enclosure, J / (kg × K)
The time from the start of the test h; min
Note

The head of Measurement System Group
from specialized divisions _____
(signature, name)
"___" _____ 20 ___

Responsible supervisor for acceptance _____
(signature, name)
"___" _____ 20 ___

STATEMENT

Is identified defects during testing _____
(pre, post-construction, etc.)
hermetic enclosures _____
(in a whole or its autonomous parts)
_____
(for leaktightness, strength)
Unit No. _____ of the nuclear power plant
"____" _____ 20___

Date and time of the search of defects (leaks) _____
Group (team) of search _____
Head _____
(name, phone)
Route of defects (leakages) search _____
(item number)
Additional details about the route _____
(high mark)
No S No.
Test conditions
Location of defects (leaks)
Marking of defects (defect number, test date)
Trial characteristic of defects
Note
Responsible officers _____
(signature, name)

PROTOCOL

registers parameters during the test _____
(pre, post-construction, etc.)
_____ sealed enclosure for strength.
(in a whole or its autonomous parts)
Unit No. _____ of the nuclear power plant.
"__" _____ 20___

Date of the test
Start time of the test, hours, min, sec
Testing pressure inside the sealed enclosure, kPa
Humidity inside the sealed enclosure
Area of converter inside a sealed enclosure (altitude mark; target)
Converter (number, type)

The timing from start of the test, sec
The measured temperature inside the sealed enclosure, K
The increment of the measured temperatures inside the sealed enclosure, K
Note

Responsible officers _____
(signature, name)

ACT

the elimination of defects identified during the tests _____
(preliminary,
_____ sealed
after completion, etc.)
enclosure _____
(in a whole or its autonomous parts)
_____
(for tightness, strength)

Unit No. _____of the nuclear power plant
"___" _____ 20___

1. Eliminates the defects listed in the statements of identified defects:
No._____ from _____ to the protocol test number
_____from _____.

2. All noted defects _____
(eliminated not eliminated)
(if not, specify the defect marking and the reason why it is impossible to eliminate its)

Repairs were carried out a group under the direction of:
_____
(signature, name, phone number)

3. Control of repair work carried out by methods _____
4. The inspection results_____

Executive authorities _____
(signature, name)

Responsible from specialized
division of acceptance _____
(signature, name)

Responsible supervisor for acceptance _____
(signature, name)

Appendix E

(compulsory)

Basic requirements for measurements of the hermetic enclosure during integrated testing with "absolute" method

E.1 Forced air in ALA must have:

- Relative humidity that is not more than 15% at ambient temperature when absolute test pressure is equal to 0.5 MPa;
- Relative humidity that is not more than 25% at ambient temperature when absolute test pressure is equal to 0.25 MPa;
- Relative humidity that is less than 30% at ambient temperature when absolute test pressure will be equal to 0.17 MPa;
- Relative humidity up to 40% at ambient temperature when the absolute test pressure is equal to 0.15 MPa;

E.2 Forced air in ALA shall not contain impurities of oil and dust not more than respectively 0.002 g/m^3 and 0.01 g/m^3.

E.3 Measurement system of parameters must automatically provide the measurements with a specified error of local pressure, temperature and humidity in various places of ALA.

E.4 Measurement of pressure shall be provided not less than in 3 different places of ALA, besides these measurements shall be independent from each other. The average value of the pressure in the metering is determined by two of them. And the third dimension is a backup and its value must be displayed on the control console of a compressor station.

E.5 Applicable sensors for measuring the pressure of leakage, regardless of the expected value of the leakage, shall fulfill the following requirements:

- over the range of pressure measurements - (0 -1.15) Cp MPa (Cp - calculated pressure);
- over the range of rarefaction measurements - from 0 to 0.06 MPa;
- Accuracy class - not less than 0.15.

Instruments for measuring barometric pressure must meet the following requirements:

- over the range of measurements - from 0.09 to 0.110 MPa;
- Accuracy class - 0.02.

It allowed as values of barometric pressure to use data of a nearby weather station.

E.6 For representative measurements of bulk temperature, the following requirements must be fulfilled:

- Temperature transmitters are not set in the premises with the indoor temperature less than 200 m^3;
- One temperature transmitter is set in the premises with a capacity from 200 to 700 m^3 inclusive;
- Two temperature transmitters are installed in the premises with the high of more than 5 m on the basis that one transmitter is for every 5 m of height;
- Temperature temperatures are installed in premises of more than 700 m^3 on the basis of one temperature to 700 m^3 volume in increments of 5 m height of the room.

E.7 Sensors for measuring temperatures in ALA when determining the value of leakage depending on the expected values of temperature shall meet the following requirements:

- over the range of measurements - from 0 °C to100 °C;
- by measurement errors - not more than 0.2 °C.

E.8 To determine the average humidity of working substance in the ALA, converters of humidity shall be installed at the points of greatest temperature gradients.

E.9 Converters of humidity must be installed in ALA on the basis of one converter per 1000 m^3 of volume.

E.10 Sensors of humidity measurement that used in determining leakage in ALA must meet the following requirements:

- when measuring dew point - under paragraph E.7 of this appendix;
- measuring range of relative humidity - from 0% to 100%;
- absolute measurement error - no more than 3%.

E.11 To monitor and review tests progress, it shall be held calculation and statistical processing of hourly values of leakage.

E.12 Leakage values shall be calculated in accordance with the methodology instructions on the assessment of the results of integrated tests of HE units of NPP for leaktightness which are developed by the operating organization.

Appendix F

(compulsory)

Passport content of the localizing safety systems and their components

F.1 A name of the localizing safety systems
F.2 Registration number
F.3 The list of documents attached to the passport
F.4 General Information
F.5 Features of the LSS
F.6 Information about the components of the LSS
F.6.1 Information about metal charts
F.6.2 Information about technological penetrations
F.6.3 Information about electrical penetrations
F.6.4 Information about pipelines and insulation fittings
F.6.5 Information about hatches, doors, locks
F.6.6 Information about materials
F.6.7 Information about equipment of the system
F.6.8 Information about the main reinforcement
F.6.9 The list of schemes, drawings and other
F.7 Information about the anti-corrosion coatings
F.8 Summary
F.9 The person responsible for the working order of the LSS
F.10 Information about the repair and reconstruction of the LSS components
F.11 The results of the system inspection
F.12 System registration
F.13 The certificate of the system installation
F.14 The certificate of manufacturing components of the LSS
F.15 Test program of the system
F.16 The list of received executive documentation
F.17 The list of the attached documents, developed and used in the process of installation, commissioning and operation

Note!

- Information that will be included in the passport of the LSS depends on the specific system and its composition.
- 2. The passport shall be subject to compulsory annual updating and supplementing the results of repair of the LSS and its components.

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TCPxxx-2010 / WP_2

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