



On approval of state standards in the field of architecture, town planning and construction of the Republic of Kazakhstan

Invalidated Unofficial translation

Order of the Chairman of the Committee for Construction and Housing and Communal Services of the Ministry for Investment and Development of the Republic of Kazakhstan of December 5, 2018 No. 249-nk Registered in the Ministry of Justice of the Republic of Kazakhstan on December 7, 2018 No. 17888. Abolished by the order of the Acting Chairman of the Committee for Construction and Housing and Communal Services of the Ministry of Industry and Construction of the Republic of Kazakhstan dated 10/18/2023 No. 153-NK

Unofficial translation

Footnote. Abolished by the order of the Acting Chairman of the Committee for Construction and Housing and Communal Services of the Ministry of Industry and Construction of the Republic of Kazakhstan dated 10/18/2023 No. 153-NK (effective ten calendar days after the date of its first official publication).

In accordance with subparagraph 23-16) of Article 20 of the Law of the Republic of Kazakhstan, dated July 16, 2001, "On Architectural, Town Planning and Construction Activity in the Republic of Kazakhstan" and subparagraph 443) of paragraph 17 of the Regulations of the Ministry for Investment and Development of the Republic of Kazakhstan", approved by Resolution № 995 of the Government of the Republic of Kazakhstan dated September 19, 2014, **I hereby ORDER:**

1. To approve:

- 1) construction standards of the Republic of Kazakhstan CS RK 3.04-01-2018 "Bases of Hydraulic Engineering Installations" according to Appendix 1 to this order;
- 2) construction standards of the Republic of Kazakhstan CS RK 3.04-03-2018 "Bases of Hydraulic Engineering Installations " according to Appendix 2 to this order;
- 3) construction standards of the Republic of Kazakhstan CS RK 3.04-09-2018 "Hydraulic Engineering River Installations" according to Appendix 3 to this order;
- 4) construction standards of the Republic of Kazakhstan CS RK 3.04-10-2018 "Hydraulic Engineering Offshore and River Transport Construsctions " according to Appendix 4 to this order.

2. Directorate for Technical Regulation and Control of the Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan shall :

1) ensure the state registration of this order with the Ministry of Justice of the Republic of Kazakhstan;

2) within ten calendar days from the date of the state registration of this order, direct the print and electronic formats of the copy of it both in Kazakh and Russian languages to the Republican State Enterprise on the Right of Economic Management "Republican Center of Legal Information" for official publication and inclusion in the Reference Control Bank of Laws and Regulations of the Republic of Kazakhstan;

3) place this order on the Internet resource of the Committee on Construction, Housing and Utilities Services of the Ministry of Investment and Development of the Republic of Kazakhstan;

4) within ten working days, after the state registration of this order with the Ministry of Justice of the Republic of Kazakhstan, submit the information on the performance of activities to the Judicial Support Department of the Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan according to subparagraphs 1), 2), 3) and 4) of this paragraph.

3. Control over the execution of this order shall be entrusted to the supervising Deputy Chairman of the Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan.

4. This order shall come into effect upon expiry of ten calendar days after the day of its first official publication.

*Chairman of the Committee
on Construction, Housing and Utilities Services
of the Ministry for Investment and Development
of the Republic of Kazakhstan*

M. Zhaymbetov

"AGREED"

with the Ministry of Agriculture
of the Republic of Kazakhstan

"AGREED"

with the Ministry of Energy
of the Republic of Kazakhstan

Appendix 1
to order № 249-nk of the Chairman
of the Committee on Construction,
Housing and Utilities Services
of the Ministry for Investment
and Development
of the Republic of Kazakhstan
dated December 5, 2018

PREFACE

4 DEVELOPED by:	"Kazakh Research and Project Institute of Construction and Architecture" JSC
5 SUBMITTED by:	The Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan
6 APPROVED AND ENACTED:	By order № 249-nk of the Chairman of the Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan dated December 5, 2018

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CONSTRUCTION STANDARDS OF THE REPUBLIC OF KAZAKHSTAN ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ҚҰРЫЛЫС НОРМАЛАРЫ

HYDRO-ENGINEERING INSTALLATIONS ГИДРОТЕХНИКАЛЫҚ ҚҰРЫЛЫСТАР

Date of introduction-2018- XX-XX

Chapter 1. Application

1. These construction standards shall be applicable to the design of newly constructing and reconstructing river and sea hydraulic engineering installations of all kinds and classes.

2. These construction standards determine the minimum necessary requirements to the objects of technical regulation in the design and construction of hydraulic engineering installations at all stages of their creation and commissioning.

Chapter 2. Regulatory references

The following references shall be used to apply these construction standards:

Code of the Republic of Kazakhstan dated January 9, 2007 "Environmental Code of the Republic of Kazakhstan";

Law of the Republic of Kazakhstan dated July 16, 2001 "On Architectural, Town - planning and Construction Activity in the Republic of Kazakhstan" (hereinafter-the Law);

Decree № 1202 of the Government of the Republic of Kazakhstan dated November 17, 2010 "On Approval of Technical Regulations "Safety Requirements of Buildings and Structures, Building Materials and Products" (hereinafter –the Technical Regulations).

Note: When applying them, it is advisable to verify the validity of reference documents pursuant to information catalogues "List of regulatory legal acts and standard technical documents in the sphere of architecture, town planning and construction, operating in the territory of the Republic of Kazakhstan", "The index of regulatory documents on standardization of the Republic of Kazakhstan" and "The index of interstate regulatory documents on standardization of the Republic of Kazakhstan", compiled annually on current year and the corresponding monthly newsletters - journals and information explanatory index published in the current year. In case the reference document is replaced (changed), using this standard shall be guided by the replaced (changed) document. If a reference document is cancelled without replacement, then the regulation, in which the referenc has been made shall be applied in the part that does not affect this reference.

Chapter 3. Terms and definitions

3. The terms with the relevant definitions shall be used in these construction standards:

1) hydro-engineering installations - engineering constructions applied for the management of water resources, water supply to water consumers, water supply and wastewater disposal, prevention of harmful water impact;

2) hydrodynamic accident - an accident at a hydro-technical installation, associated with high speed of water distribution which leads to an emergency situation of technogenic nature;

3) safety of hydro-technical installation - state of hydraulic installation, allowing to ensure life protection, health and legally protected interests of people, environment and household facilities;

4) the declaration of safety of the hydraulic installation – a document in which the safety of the hydraulic engineering installation shall be substantiated, the measures to ensure the safety of the hydraulic engineering installation, taking into account its class and the set of measures shall be determined, undertaken by the economic entity for the purpose of prevention of accidents, as well as readiness for localization, liquidation of accidents and their consequences;

5) acceptable level of accident risk of the hydraulic engineering installation – the value of accident risk of the hydraulic engineering installation, established by regulatory documents;

6) criteria of safety of the hydraulic engineering installation - the rare values of quantitative and qualitative indicators of the state of the hydraulic engineering installation and conditions of its operation, corresponding to the acceptable level of accident risk of the hydraulic engineering installation;

7) ensuring the safety of the hydraulic engineering installation - development and implementation of measures to prevent accidents of hydraulic installations;

8) monitoring of the stress-strain state of a building or a installation - a system of stationary observations and control of changes in strength characteristics and deformations of installations and bases of a building or a installation;

9) engineering protection of territories, buildings and installations - a complex of installations and measures aimed at preventing of dangerous natural influence and natural technogenic conditions and processes on a territory, buildings and constructions, and also protection from their consequences;

10) monitoring of environmental components - a system of stationary observations and control over the state and change of natural and natural technogenic conditions;

11) no-failure operation - property of the facility to keep working continuously for a certain period of time, the parameter of the flow of failures, warranty time;

12) safety of operation - a condition in which there is no acceptable risk associated with causing harm to life or health of citizens, property of individual or juridical citizens, state or municipal property, environment, life or health of animals and plants;

13) operating organization - state enterprise or organization of other organizational and legal form, on the balance of which there shall be a hydraulic engineering installation;

14) technogenic influences - dangerous influences, arising as a result of change of natural conditions in the process of constructing and operating of buildings and installations;

15) endurance capability – the property of the facility to maintain performance until the limit state at the established system of maintenance and repairs, that is, with possible interruptions in operation. The durability indicators shall be the mean life time, operational life, period between repairs;

16) emergency situation - the situation in a certain territory, settled as a result of emergency, fire, harmful impact of hazardous production factors, hazardous natural phenomenon, catastrophe, natural or other disaster, which can cause or inflicted human losses, harm to health of a human or the environment, significant material damage and violation of human life conditions.

Chapter 4. Objectives and functional requirements

Paragraph 1. Objectives of regulatory requirements

4. The objectives of these construction standards shall be:

- 1) ensuring the security of facilities being created;
- 2) protection of people from influence, or occurrence of emergency situations;
- 3) minimization of material and physical damage in case of destruction of the facility.

Paragraph 2. Functional Requirements

5. Design and construction of hydraulic engineering installations shall be carried out by taking into account the following functional requirements:

- 1) ensuring conformity of construction products to its purpose and creation of positive living conditions of the population;
- 2) safety of created construction facilities for life and health of the people, both in the process of construction, and at long-term operation;
- 3) physical integrity and stability of hydraulic engineering installations (including low probability of cracks, deformations, transition to unstable state, loss of equilibrium, or collapse during the whole period of working life;
- 4) safety for the human environment and animal habitat;

- 5) noise protection;
- 6) energy saving and heat conservation;
- 7) protection of construction products and people against adverse impacts taking into account the risk of emergency situations;
- 8) reliability and quality of building constructions and bases, systems of engineering equipment, buildings and constructions;
- 9) compliance with environmental requirements, rational use of natural, physical and labor resources;
- 10) regulation of relations in the process of construction activity, exploitation of water resources and elimination of technical barriers in international cooperation.

Chapter 5. Performance requirements

Paragraph 1. General requirements for the safety of hydraulic installations

6. Development, coordination, approval and composition of project documents for the construction of hydraulic installations shall be performed in accordance with the requirements of the Law and Technical Regulations.

7. Systems of hydraulic installations (hydraulic installations, dams, earth dams, small hydro-power stations, including hydro-accumulating, pumping stations, water-drainage, spillway and water-discharge installations, settling basins, pipelines, daily regulation pools, reservoirs, pressure basins of hydroelectric power stations and others) are designed and constructed taking into account adjacent settlements.

8. Hydraulic installations shall be divided into temporary and permanent. Temporary buildings shall be used only during the construction and repair of permanent installations.

9. Permanent hydro-technical installations, depending on their purpose, shall be subdivided into basic and secondary.

10. The main hydro-technical installations shall include constructions the damage or destruction of which leads to:

- 1) violation and discharge of normal operation of power stations;
- 2) cessation or reduction of water supply for water supply and irrigation;
- 3) flowage and flooding of the protected area;
- 4) cessation or reduction of navigation, activity of river and sea ports, shipbuilding and ship-repairing enterprises;
- 5) production go off or release of oil and gas from shorewells, storages, pipelines, damage to fish stocks.

The secondary hydro-technical installations shall include constructions, destruction or damage of which does not entail failure in operation of the basic hydraulic constructions, but to some extent may negatively affect the work of the basic hydraulic installations.

11. Hydraulic engineering installations shall be designed based on their requirements of integrated use of water resources, on the basis of engineering calculations for the regulation of run off of surface waters, taking into account the schemes of use of watercourses and water consumption on the basis short term and long-term forecasts, data and provisions contained in the programs of improvement of the economic structure, development and placement of production forces and industrial facilities, town planning documentation and other mandatory manual materials.

12. Types of new hydraulic engineering installations, their parameters and layout shall be selected on the basis of a comprehensive comparison of the options of technical and economic indicators and taking into account the following factors:

1) water forecast in changes and fluctuations of the hydrological regime and the surface runoff of the rivers in the upper and lower tail-waters, including the formation of ice composition and temperature regime, the study of the composition of bottom sediments, the possibilities of sediments and re-formation channels and banks of rivers, reservoirs and seas; flood and flooding of territories and engineering protection of buildings and installations located on them;

2) functional purpose of constructions;

3) places of installation of constructions, natural conditions of the area (topographic, hydrological, climatic, engineering-geological, hydrogeological, seismic, biological, etc.);

4) conditions and methods of work production, availability of labour resources;

5) prospective development, change and placement of branches of the national economy, including energy consumption, transport flows and cargo turnover, development of irrigation facilities and drainage, watering, water supply, shipbuilding and ship repair, complex development of offshore coasts, including development of oil and gas fields on the shelf;

6) effects on the environment;

7) influence of construction and operation of the facility on social conditions and public health;

8) changes of conditions and tasks of navigation, fishery, water supply and the regime of work of melioration systems;

9) the established regime of nature management (farmland, nature reserves etc.);

10) welfare and recreation facilities of the population (beaches, resort and sanatorium zones etc.);

11) Measures ensuring quality water conservation: taking into account the preparation of the reservoir bed cleaning, compliance with the proper sanitary regime of the water protection zone, limiting the flow of biogenic elements and pollutants with the provision of their quantity in water not higher than maximum permissible concentrations;

- 12) conditions of permanent and temporary operation of installations;
- 13) requirements of economical expenditure of basic building materials;
- 14) opportunities to use mineral resources development in the perspective and deposits of local building materials;
- 15) technologies of development of oil and gas deposit in the water area of offshore shelves, gathering, storage and transportation of oil and gas;
- 16) technology of dismantling of installations at the end of operation and liquidation of fishing;
- 17) ensuring aesthetic and architectural requirements for constructions located on the banks of water courses, reservoirs and seas;
- 18) ensuring preparation of a bed of reservoirs and adjoining territory;
- 19) organization of fishery conservation measures;
- 20) protection of mineral resources deposits;
- 21) safety of valuable agricultural lands and farmland;
- 22) the necessary conditions of navigation;
- 23) minimum necessary expenses, as well as positive level and speed regimes of waters in the tail water taking into account interests of water consumers and water users, from conditions of preservation of a natural regime of groundwater level for the settled lands;
- 24) fire safety and fire extinguishing equipment during construction and operation.

13. While designing hydraulic engineering installations, it shall be foreseen and provided:

- 1) installation safety at all stages of the construction and operation;
- 2) maximum economic efficiency of construction;
- 3) permanent instrumental and visual control (monitoring) over the state of engineering installations of hydraulic engineering installation and rock mass adjoining to it, as well as natural and technogenic influences on them;
- 4) proper architectural design of the joint unit of hydraulic engineering installations ;
- 5) full use of local building materials;
- 6) standard duration of construction at the highest degree of mechanization of works and the least labour;
- 7) protection of mineral deposits;
- 8) preservation of valuable agricultural lands;
- 9) preparation of a reservoir floor and storages of liquid wastes of industrial enterprises and adjoining territory;
- 10) requirements to create the necessary conditions for navigation;
- 11) preservation of flora and fauna, in particular, fisheries conservation and management measures;

12) The minimum necessary water expenses favorable level and high-speed regimes in pools taking into account interests of water consumers and water users, as well as the favorable regime of groundwater for the settled lands and natural ecosystems.

14. In the design of hydraulic engineering installations the possibility and technical and economic expediency shall be considered:

- 1) the combination of installations performing various operational functions;
- 2) construction of installations and putting them into operation by separate start-up complexes;
- 3) unification of equipment arrangement, constructions and their sizes and methods of producing construction and installation works;
- 4) use of pressure, created on hydroelectric complexes of transport, melioration, fishery and other assignments, for the purposes of energy;
- 5) reconstruction of existing installations.

15. When designing hydraulic engineering installations on rocky soils and inside a rock mass, the installation of earth mass, their watering, gas-bearing capacity and natural tense state, factors influencing constructions reliability: quality and quantity of applied elements, working regime of elements and details, standardization and unification of production; availability of parts, units and blocks shall be taken into account for inspection and repair.

16. The design of hydraulic engineering installations in seismic areas shall be considered in accordance with the requirements of the relevant state standards in the field of architecture, town planning and construction, approved in accordance with subparagraph 23-16) of article 20 of the Law (hereinafter- the State Standards in the field of architecture, town planning and construction).

Paragraph 2. Assigning a class of hydraulic engineering installations

17. Hydraulic engineering installations shall be subdivided into classes depending on their height and soil type of the foundation, socio-economic responsibility and the consequences of possible hydrodynamic changes.

Note: The customer of the hydraulic engineering installation project shall have the right to increase the class of construction by one level.

18. The class of major hydraulic installations (other than those referred to in paragraphs 21, 24 and 25) shall be taken as its highest value.

19. The class of secondary hydraulic installations shall be accepted on the unit below the class of the basic constructions of this hydro units, but not higher than III class.

20. Temporary installations shall belong to class IV. In case if destruction of these installations can cause catastrophic consequences or a significant delay in the

construction of the main installations I and II classes, it shall be acceptable to classify them, in case of proper justification, to the III class. The class of water-retaining hydraulic engineering installations of hydraulic, hydro-accumulating and thermal power stations shall be assigned taking into account their function of protective installations for the territory and facilities located in the lower pool.

Class of the main hydraulic engineering installations of the complex hydroelectric complex, which simultaneously provides the needs of several participants of the water management complex (energy, transport, reclamation, water supply, flood control, etc.) , shall be installed on a installation that is classified as a higher class.

Upon combination in one installation of two or several functions of different assignment (for example, berthing with fencing), the class shall be established pursuant to the installation assigned to a higher class. The class of the main installations, which are part of the water front, shall be established according to the installation assigned to the higher class.

21. Class of the main hydraulic engineering installations of hydraulic or thermal electric power station with installed capacity of less than 1.0 mln. kW shall be increased by one if these electric power stations are isolated from energy systems and serve large settlements, industrial enterprises, transport and other consumers or if these electric power stations provide heat, hot water and steam to large settlements and industrial enterprises.

22. The main hydraulic engineering installations of river ports of the first, second and third categories belong to the 3rd class, the rest installations - to class IV.

Cargo turnover and passenger turnover shall be determined in accordance with the standards of technological design of river ports on inland waterways.

23. In case of crossing or conjugacy of hydraulic engineering installations which can be assigned to different classes, for all constructions the class of more responsible installation shall be accepted.

24. The class of the channel section from the head water intake to the first regulating reservoir, as well as the channel sections between the regulating reservoirs shall decrease by one, if the water supply to the main water consumer during the liquidation of the consequences of the accident on channel is provided by the regulatory capacity of reservoirs or other sources.

25. Coast establishing installations belong to class III. In cases when an accident of a coast establishing installations may lead to consequences of catastrophic character (due to landslide, bank caving and other), the construction belongs to the II class.

26. Offshore oil-gas field hydraulic engineering installations, including oil and gas pipelines and underwater oil tanks, regardless of their design and conditions of operation, shall belong to the I class. Decrease in the class of offshore oil-gas field hydraulic constructions shall be prohibited.

Paragraph 3. Ensuring the safety of hydraulic engineering installations at the designing stage

27. During development of the design of hydraulic engineering installations it is necessary to be guided by regulatory requirements directed on maintenance of safety of hydraulic engineering installations.

28. A special section of the automated system for monitoring the stress and strain state of hydraulic engineering installations in accordance with the requirements of the relevant state standards in the field of architecture, town planning and construction shall be worked out. The system of stationary monitoring and control over the change of strength characteristics and deformations of installations and bases of a hydraulic engineering installation functions in the automated state, both during construction and operation of hydraulic installations and buildings.

29. In order to detect defects and adverse processes in time, to prevent failures and accidents, assignments and to carry out repairs, to improve the operation of the definition and assessment of the level and risk safety, an analysis shall be performed of parametric data taken from control devices-sensors. The source data being read shall include:

- 1) a list of controlled loads and impacts on the installation;
- 2) a list of controlled and diagnostic indicators of the installation condition and its basis, including safety criteria;
- 3) technical conditions and drawings for installation of control and measuring equipment and sensors, specification of measuring instruments and devices;
- 4) structural scheme and technical decisions of the system of monitoring the condition of installations, natural and technogenic influences on them, including its basic hardware and software environment;
- 5) guidance documents and methodical recommendations on carrying out of full-scale observations on work and condition of installations.

30. Criteria for their safety shall be developed as part of the project of hydraulic engineering installation. Before commissioning and during operation of hydraulic engineering installations the safety criteria shall be specified on the basis of the results of full-scale observations on the condition of installations, loads and impacts, as well as changes in the characteristics of installation materials and bases, constructive decisions.

31. Hydraulic engineering installations, their damage can lead to emergency situations, at all stages of their creation and operation, shall be subject to declaration of safety.

32. The declaration on the safety of hydraulic engineering installations is a mandatory part of the project and shall be subject to approval by the supervisory bodies for the safety of hydraulic engineering installations during the project coordination.

33. The declaration on the safety of a hydraulic engineering installation, which function is associated with increased hazard (risk), shall be carried out in order to ensure systematic monitoring of compliance with safety measures, assessment of sufficiency and effectiveness of measures to prevent and eliminate emergency situations at the site.

34. The declaration on the safety of a hydraulic engineering installation shall be subject to alignment:

- 1) before commissioning the facility;
- 2) after the first two years of operation;
- 3) at least once every subsequent five years of operation;
- 4) after reconstruction of hydraulic engineering installations, their major repairs, restoration and change of operating conditions;
- 5) in case of decommissioning and preservation;
- 6) upon changing conditions of regulatory legal acts, rules and standards in the field of safety of hydraulic engineering installations;
- 7) after emergency situations.

35. The projects of hydraulic installations for localization and liquidation of their possible accidents shall envisage the technical decisions on the use of quarries and reserves of soils, production facilities, transport and equipment of the base of construction, bridges and construction railroad in the area and on the territory of the area, autonomous or reserve electrical power and power transmission; other emergency response means of operative action in construction and operational periods.

36. The design of hydraulic installations shall provide constructive-technological decisions to prevent the development of possible dangerous damage and emergency situations that may arise during the construction and operation.

37. The projects of hydraulic engineering installations shall envisage the calculations on estimation of possible material and social damages from potential emergencies of a installation with water front disturbance. Measures shall also be envisaged to reduce the negative effects of possible emergencies of installations on the environment.

38. The projects of head reservoir hydraulic installations shall foresee the local systems of warning of the personnel and population living in the valley of the river in the downstream tail -water of the hydraulic engineering installation, about the threat of breakthroughs of water front.

Paragraph 4. Ensuring the safety of hydraulic engineering installations at the stage of construction

39. The construction of hydraulic engineering installations shall ensure compliance with the requirements of project documentation, technical regulations and safety procedures.

40. When the construction expenses of water are omitted, it shall be inadmissible to create in the downstream pool regimes endangering the safety of the installations under construction, their elements and the adjacent sections of the riverbed.

41. Maintenance of construction of hydraulic engineering installation in winter time shall not lead to decrease of general level of safety of the constructing installation.

42. During the maintenance of works in the winter period the following measures shall be performed on prevention of:

- 1) construction on frost bound basis (if it is not provided by the project);
- 2) freezing of building materials, placed in the body of the installation;
- 3) freezing of the body of concrete installations before the completion of their hardening and obtaining the characteristic strength of concrete;
- 4) freezing of the body of ground installations before the earth compaction or earth consolidation in accordance with the requirements of the project documentation.

Chapter 6. Ensuring the safety of hydraulic engineering installations during operation

Paragraph 1. General provisions

43. The design of hydraulic engineering installations shall provide measures to ensure their safety during operation. Permanent and periodic control (inspection, technical inspection, examinations) of the technical condition of the installation shall be organized at each hydraulic installation, and the authorized persons responsible for their condition and safe operation, technical and technological supervision personnel shall be appointed as well as their scope of employment shall be approved.

44. During operation, the quantitative indicators of the criteria shall be adjusted based on the experience of operation and research. Safety criteria and quantitative indicators shall be reviewed at least once every 5 years.

If there are signs of accident condition and after repair work and (or) change of operation modes of construction, the indicators of safety criteria shall be clarified in an extraordinary order.

45. The results of monitoring shall be reflected in the declaration on safety of hydraulic installations.

46. Operating organization shall provide safety and shall develop the system of control and measuring equipment for carrying out qualitative monitoring of condition of constructions.

The broken down equipment shall be replaced and the newly installed equipment shall issue the necessary information.

47. Hydraulic engineering installations that are in operation for more than 25 (twenty-five) years, regardless of the condition shall be subjected to a comprehensive analysis every five (5) years, with an assessment of their strength, stability and operational reliability.

If situation so requires, the complex analysis of condition of constructions, (if there are signs of a pre-accident condition) shall be made in an extraordinary order on the basis of actual physical and mechanical characteristics of materials of installations and their bases.

48. For each hydraulic engineering installation, based on the analysis of its condition, specific features of the construction and materials, the project solutions shall be developed for prevention and localization of possible accidents, including catastrophic ones, based on the predicted scenarios of their development as part of the project documentation, as well as a result of possible terrorist acts.

49. Operating regimes of hydraulic engineering installations: the order of drawdown (according to paragraphs 44 and 45 of these construction standards) and reservoir storage, releases and maintaining of stable water levels in the tail water shall be based on the existing sanitary standards and rules of use of reservoirs developed by the project organization.

Paragraph 2. Ensuring the safety of river hydraulic engineering installations during the maximum expenses of water pass

50. The passage of water through the spillway installations shall be carried out in accordance with the project documentation and shall not lead to the damage of the installations, as well as the underwater erosion, which could affect the stability of the installations.

51. The mode of the drawdown reservoir before the flood and the subsequent reservoir storage shall provide:

1) the reservoir storage in the period of flood and (or) flooding to the normal retaining level; deviation from this rule is permissible only in case of special requirements of water management complex and for reservoirs of long-continued regulation;

2) positive conditions for discharge through the installations of excess water, pass of sediment, as well as ice, if it is provided by the project documentation;

3) the necessary agreed conditions for normal navigation, fishery, irrigation and water supply, regulation of waste expenses taking into account the requirements of safety and reliability of hydraulic engineering installations and flood protection.

52. At the hydroelectric complexes, where for the pass of estimated maximum water expense of project documentation is foreseen the use of spillover belonging to another owner (for example, a shipping gateway) an instruction shall be drawn up, concerted with the owner, determining the conditions and procedure for inclusion in the work of the installation.

Paragraph 3. Ensuring the safety of mechanical equipment of hydraulic engineering installations

53. Before the spring flood good working condition of gate valves of spillway installations and their gate frame used at spills of a flood shall be ensured. In order to ensure the possibility of maneuvering, gate valves and gate frames are thawed out from ice and ice fringe.

54. The basic gate valves shall be equipped with indicator of opening height.

The individual lifting mechanisms and the gate frames shall be binding to the base bench mark.

55. The complete closure of the gate valves installed on the penstocks shall be carried out only in the good condition of the aerating devices.

56. The connection of the reserve energy supply of the valves, (from the reserve sources of electricity located in flood free zones or in low leakage containment building), and the use of a manual actuator shall be envisaged at the hydroelectric power station, in order to ensure the maneuvering of the gate valves in the case of loss of power supply.

57. The trash collection constructions (lattices, nets, ice booms) shall be regularly cleaned of debris.

The limits on conditions of durability and economy of the value of water level difference on the trash collection lattices shall be established for each construction. Clearing of lattices and spaces before them shall be carried out by the mechanisms provided for this purpose - lattice-cleaning machines, grab buckets or other devices.

58. The gate valves and the trash collection lattices shall not be subjected to vibrations that threaten their durability in all operating modes.

59. Mechanical equipment of hydraulic engineering installations shall be protected from corrosion and algae and shellfish fouling.

Paragraph 4. Ensuring the safety of special hydraulic engineering installations (shipping, port and liquid waste storage)

60. The performance of mechanical equipment (gates, gate valves) and systems of filling and emptying of lock chambers shall be ensured during the operation of the navigable installations (gateways, canals).

The ship's pilotage shall exclude the possibility of their entry into the close gates.

61. During operation of berthing installations the control over their displacements, drawdown of territory and for placing of both general and bulk cargoes shall be organized. Deviations from the rules of cargo placement and erosion of the base of berthing walls reducing the stability of berths shall be prohibited.

62. During the operation of the ash-and slag disposal areas, as well as the disposal area of rocks, control shall be carried out for:

- 1) the levels of water in the disposal areas;
- 2) exceeding the crest of the enclosing dams above the water level;
- 3) the state of beach slopes;
- 4) compliance with washing out of the territory dump to the hydraulic project;
- 5) water system and drainage system;
- 6) dusting of dumps in the dry period of the year;

7) prevention of ingress of aggressive waters into watercourses, drinking water supply systems and groundwater that runs to the dumps of the territory.

63. In case of revealing violations of operation and condition of installations, the measures shall be taken to eliminate them urgently, as well as to prevent and avoid them in the future.

64. During the operation of sedimentation tanks and storage of liquid waste, the following shall be monitored:

- 1) condition of fence, exceeding the crest of fences above the level of liquid;
- 2) the system of interception and drainage of rain and melt waters;
- 3) anti-filtration devices (by screens, walls);

4) operation of the control and measuring equipment, which monitors the possibility of liquid waste penetration beyond the sedimentation and storage areas.

65. In case of revealing violations of operation and condition of installations, the measures shall be taken to eliminate them urgently, as well as to prevent and avoid them in the future.

Paragraph 5. Ensuring the safety of hydraulic installations operated in special natural conditions

66. Ground constructions of the frozen type, their bases and shore interface shall constantly support their freezing condition.

67. The macro fragmental material of training berms in the zones subjected to seasonal freezing and thawing shall correspond to the regulatory (project) indicators for frost resistance. After every 15 (fifteen) years of operation, the stability of the installation shall be checked based on the results of determination of the actual physical and mechanical characteristics of the material of training berms.

68. In the operation of ground installations on everfrozen icy grounds, observations of the temperature regime, as well as the deformations associated with the transition of soils into a thawed state shall be organized.

69. The following types of special observations and tests shall be carried out on hydraulic engineering constructions of the 1st class located in areas with seismicity of 7 points and above, and on constructions of II class in areas with seismicity of 8 points and above:

1) engineering-seismic observations of the construction work and landfalls (seismic monitoring);

2) Engineering-seismological observations in the zone of a reservoir near the location of installations and in adjacent areas (seismological monitoring);

3) tests to determine the dynamic characteristics of hydraulic engineering installations (dynamic testing) with the compilation of dynamic passports.

Paragraph 6. Technical control of the state of hydraulic engineering installations and mechanical equipment

70. Monitoring of the state of hydraulic engineering installations, natural and technogenic impacts shall constantly be carried out. The monitoring results shall be analyzed immediately in the monitoring mode. The data of natural observations shall be analyzed regularly, at least once in 5 (five) years, and the assessment of the state of the hydraulic installation and hydroelectric complex as a whole, included in the declaration of safety of the hydraulic engineering installation shall be made following these results. The control work shall be carried out by the personnel of the operating organization with attraction, if necessary, of the specialized organizations having appropriate authorizations.

71. The volume of observations and the composition of the control and measuring equipment installed on hydraulic engineering installations shall be determined by the project documentation.

72. If necessary, the monitoring shall be organized over vibrations of installations, seismic loads thereon, durability and water resistance of concrete, tense condition and temperature mode of constructions, corrosion of metal and concrete, condition of welded seams of metal installations, allocation of gas on particular areas of hydraulic engineering installations and other. In case of significant changes in the operating conditions of hydraulic engineering installations, the monitoring shall be carried out pursuant to additional programs.

73. Technical examination shall be carried out by the commission of the customer (operating organization) in time in accordance with regulatory documents, but not less than once in 5 (five) years with attraction, if necessary, of the specialists of project and (or) research organizations.

74. The frequency of technical examination of mud and ash disposal areas, enclosing dams of which are increased in the process of operation, shall be determined by the project documentation.

75. According to the results of technical examinations, the survey program shall be scheduled with the involvement of specialized organizations.

Paragraph 7. Ensuring the safety of hydraulic engineering installations during reconstruction and liquidation

76. Reconstruction of permanent hydraulic engineering installations shall be carried out for:

1) strengthening of the main hydraulic engineering installations and their bases at increase of accident risk due to aging of constructions and bases or increase of external influences, and also, in case increase of the economic, environmental and social consequences of a possible accident;

2) providing (improving) the water capacity of the main hydraulic engineering installation;

3) increase of electricity generation;

4) increase of storage capacity of liquid waste;

5) replacement of equipment due to its ageing;

6) increase of water supply of irrigation systems, improvement of the regime of groundwater on irrigated or drained arrays and adjacent areas, along channel routes;

7) increase of goods transit and navigation capacity of ports and navigable installations;

8) intensification of work of the piling and lifting-descent installations;

9) improvement of the environmental conditions of the hydroelectric complex influence zone.

77. Reconstruction of the hydraulic engineering installation shall also be carried out at the change of regulatory requirements, in the case of changes in operating conditions (increasing seismicity of the area, changes in the calculated discharge flow, the installation works in conjunction with newly constructed facilities and so on).

78. The maximal use of existing constructions or elements of constructions which are in normal operating condition shall be envisaged during reconstruction.

79. Reconstruction of the main installations shall be carried out without termination of their basic operational functions; at the same time temporary limitation of design regimes and operating conditions of both reconstructed facilities and water discharge as a whole shall be allowed. These limitations are justified in the project documentation and do not lead to a decrease in the level of allowable accident risk of the reconstructed construction.

80. The reconstruction of the main installations shall ensure maximum protection against possible terrorist acts.

81. Technical condition of reconstructed installations and their elements shall be determined by researches and calculations on the basis of factual characteristics of building materials and bottom soils, accepted at drafting of project documentation on reconstruction.

82. Liquidation of hydraulic engineering installations shall be produced on the basis of project documentation and shall be carried out in the form of:

- 1) complete liquidation;
- 2) partial liquidation.

83. Adverse environmental impact shall not be allowed during the elimination of hydraulic engineering installations .

84. In order to ensure safety before the process of liquidation of the hydraulic engineering installation, the drawdown shall be executed as well as the hydraulic engineering installation and equipment shall be disconnected from any energy sources.

Chapter 7. Environmental protection

85. When developing a draft of the project of hydraulic engineering installations , it shall be necessary to be guided by the Environmental Code of the Republic of Kazakhstan and regulatory documents, establishing requirements for environmental protection in engineering and economic activities. It shall be incumbent to consider and carry out the measures leading to improvement of environmental situation, in the zone of influence of water reservoirs, both top and downstream tail-water: ensuring of complex approach, use of principles of recreation, land recultivation and to involve them in household activity rational use of reservoirs and zones adjoining to hydraulic engineering installations for development of tourism, sports and rest.

86. In connection with the creation of hydraulic engineering installations environmental protection activities shall be developed in a comprehensive manner based on the forecast of its change.

87. When designing hydraulic installations it shall be necessary to provide technical solutions, which provide optimization of ecological interaction of them and natural complex and prevent inadmissible consequences of this interaction.

88. In order to preserve rare species of plants, fish, animals, birds in the areas of direct influence of the main installations, reservoirs, tail-waters, canals biotechnical measures shall be developed and measures like that.

89. The collection of initial data and information on the history of formation and the current state of fauna of the region, the study of the requirements of protection of rare species of animals and plants, which are in the territory under protection shall precede planning and development. The measures shall be based on the materials of

long-term field studies, literary sources, documentary surveys of foresters, hunters and tourists.

Herewith, the requirements for the implementation of biotechnical measures shall be considered both for the period of construction of hydraulic engineering installations and for the prospective period of their operation.

90. Projects of hydraulic engineering installations shall also envisage the impact of household activities and infrastructures associated with their creation on the environment and shall provide measures to neutralize negative factors.

91. The solution to the environmental issues shall begin at the initial stage of the design of a facility and selection of the type of installations and shall be taken into consideration in other technical issues. Development of environmental measures shall include studying the initial state of the natural environment, making forecasts of its changes, establishing an acceptable level of anthropogenic interference, developing measures of protection, as well as the ways to control the state of each element of the environment and possible additional measures to conserve and improve the environmental situation in the operation of installations (according to paragraph 97 of these construction standards).

92. When designing hydraulic installations, special measures shall be provided for the protection of the environment in the implementation of:

1) dredging works, including extraction of soil, its transportation and creation of dumps ;

2) devices of dams, dam, jumpers, stone beds, backfill and the like by means of filling of ground and stone materials into water;

3) construction of enclosing facilities of liquid waste storages of industrial enterprises;

4) sealing of soil bases, including the produced by explosive method;

5) construction of installations using materials that may be a source of environmental pollution;

6) fixing of soils, including those carried out by chemical method or by artificial freezing;

7) underwater concreting and the like.

93. When designing retaining hydraulic installations the following measures shall be provided:

1) on preparation of reservoir bed and liquid waste storage;

2) on elimination of possible sources of pollution of the water environment, dangerous for human health, animal and flora;

3) on elimination of negative impacts on water quality of flooded wood vegetation and overhanging wood;

4) on extraction and disposal of floating wood mass and debris;

5) on localization of possible pockets of pollution and on reduction of concentration of harmful impurities.

94. Provision shall be made to ensure the normative quality of water of reservoir and filtration water from the liquid waste storage facilities:

1) pursuant to hydrochemical indicators (on the content of chemical elements and compounds, on ph indicator);

2) pursuant to hydro-biological indicators (colour, on biological consumption of oxygen);

3) pursuant to sanitary indicators.

95. When increasing the maximum permissible concentrations of pollutants, additional measures to localize possible pockets of pollution and reduce the concentration of harmful impurities shall be organized.

96. In order to meet the requirements of paragraph 92 of these Construction standards, an assessment and prediction shall be made with respect to:

1) changes in geological and hydrogeological conditions- changes in the level of the regime, the conditions of nutrition, the chemism of groundwater, especially mineralised, salinization of soils;

2) filtration losses of water from reservoir and storage of liquid waste;

3) changes in the natural environment resulting from the establishment of the reservoir;

4) changes in the course of the channel process, transformation of the tail-water, silming and processing of the banks of reservoirs;

5) changes in thermal and ice regimes in tail-water, pools of hydro-accumulating and tidal power plants, including the formation of long-term, strengthening of the braking and lighting phenomena;

6) changes in the seismological situation (including those caused by "induced seismicity") -first of all, the frequency and intensity of earthquakes, their distribution and the like;

7) changes in the landscape of the construction area and its restoration;

8) influence of changes of channel, hydraulic, thermal and ice regimes of watercourses and reservoirs on conditions of spawning and reproduction of fishes, nesting of birds, habitat of mammals and so on;

9) Influence of microclimatic changes in the area of reservoir creation and downstream tail-water of hydro-engineering complex – temperature regime and air humidity, quantity and mode of winds and precipitation and similar on engineering-geological processes and properties of rocks of bases , as well as on infrastructures, socio-demographic and natural environment.

97. When designing hydraulic installations changes in natural conditions shall be taken into account, as far as they may lead to the development and intensification of the following negative physical-geological, geodynamic processes in their bases:

- 1) increase of activity nearest seismic-generating faults;
- 2) underflooding and flooding of the territories, the assessment of which must be carried out, guided by the provision of the relevant state regulatory in the field of architecture, town planning and construction;
- 3) processing of banks and sedimentation of reservoirs;
- 4) chemical suffision of soluble rocks carbonate and halogen karst, washed from the soil base and the accumulation of potentially harmful chemical and radioactive substances; compression from deep underground waters of highly mineralized, thermal and radioactive waters and so on;
- 5) chemical suffision of sandy soils, suffision karst;
- 6) occurrence and intensification of landslide phenomena;
- 7) seepage deformations of the bases, folded by forest soils.

98. As environmental measures, in order to manage the development of the processes, specified in paragraph 97 of the Construction Standards , it shall be necessary to consider and develop a set of measures for designing hydraulic engineering installations, including:

- 1) cutting and concreting of large cracks, drainage and anti-filtration devices, sealing, cementing, injection;
- 2) chemical additives and protection (layers, barriers and the like); planning works, replacement of soils, coastal fortifications, fencing and waste water disposal installations (dams, canals, pipelines), regulation of the level of reservoir regime, recultivation of land;
- 3) waste land disposal security and recreational zones (national nature reserves, parks, pastures), special rules of using transport and the like.

99. In the tail water of hydro-engineering complex, in which an extended open water patch is predicted, affecting the microclimate of the area, as well as hydro-engineering complex, which include hydroelectric power, carrying out daily power regulation, it shall be necessary to consider expediency of erection of hydro-engineering complexes -counterregulators, allowing to reduce negative influence of the basic hydro-engineering complexes on natural processes, engineering facilities and social situation in the tail water.

100. Water, terrestrial and air ecosystems shall be monitored during the projection of hydraulic engineering installations, which have a significant impact on the environment in the process of operation, providing an assessment of environmental processes, the effectiveness of the adopted project of environmental measures, check, refinement, correction of estimations and forecasts from the beginning of construction

of the facility, and up to the stage of stabilization of processes of interaction of hydraulic engineering installations with a natural complex.

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Keywords: hydraulic engineering installations, classes, risks of accidents, estimated maximum water expenses, design, construction, operation, reconstruction, liquidation of

Appendix 2
to order № 249-TC of the
Chairman
of the Committee
on Construction,
Housing and Utilities Services
of the Ministry for Investment and
Development
of the Republic of Kazakhstan
dated December 5, 2018

Preface

4 DEVELOPED by:	JSC "Kazakh Research and Design Institute of Construction and Architecture"
5 SUBMITTED by:	The Committee on Construction, Housing and Utility Services of the Ministry for Investment and Development of the Republic of Kazakhstan
6 APPROVED AND ENACTED:	By order № 249-TC of the Chairman of the Committee on Construction, Housing and Utility Services of the Ministry for Investment and Development of the Republic of Kazakhstan dated December 5, 2018

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Construction Standards of the Republic of Kazakhstan

Bases of hydraulic engineering installation

Date of introduction-2018- XX-XX

Chapter 1. Application

1. These construction standards shall impose regulatory requirements for the design of the base of hydraulic installations of all classes, including gravitational, arched and counterforstdams, retaining walls, gateways, offshore and port installations, natural slopes and artificial slope on the sites of the location of hydraulic engineering installations.

2. The requirements of these standards shall not apply to the design of underground hydraulic engineering installations and water installations on reclamation canals with water expenses less than 5 cubic meters per second (hereinafter-m³/s), as well as at depths of water less than 1 meter (hereinafter-m).

Chapter 2. Regulatory references

For the application of these construction standards the following references to regulatory legal acts of the Republic of Kazakhstan shall be necessary:

Code of the Republic of Kazakhstan dated January 9, 2007 "Environmental Code of the Republic of Kazakhstan";

Law of the Republic of Kazakhstan dated July 16, 2001 "On Architectural, Town-Planning and Construction Activity in the Republic of Kazakhstan" (hereinafter-the Law);

Law of the Republic of Kazakhstan of January 13, 2012 "on Energy Saving and Increase of Energy Efficiency";

Decree № 1202 of the Government of the Republic of Kazakhstan dated November 17, 2010 "On Approval of Technical Regulations" Requirements to the Safety of Buildings and Construction Materials and Products";

Order № 439 of the Minister of Internal Affairs of the Republic of Kazakhstan dated June 23, 2017 "On Approval of Technical Regulations" General Fire Safety Requirements" (registered in the Register of State Registration of Regulatory Legal Acts under № 15501 (Hereinafter referred to as the -technical regulations).

Note: When using these construction standards it shall be advisable to verify the validity of reference documents on the information " The list of regulatory legal and regulatory technical acts in the field of architecture, urban planning and construction operating in the territory of the Republic of Kazakhstan", "The index of regulatory documents on standardization in the Republic of Kazakhstan and "The index of Interstate Regulatory Documents", compiled annually as of the current year. If the reference document is replaced (modified), it shall be necessary to be guided by the replaced (modified) document when using these regulations. If a reference document is canceled without replacement, the provision in which the reference is made to it, shall be applied to the part that does not affect the reference.

Chapter Three. Terms and definitions

3. The terms with the corresponding definitions shall be used in these construction standards:

1) Requirements to performance characteristics-regulatory requirements, approved by the authorized body, specifying the technical characteristics of the construction facility acceptable for consumers and providing for their practical implementation the presumption compliance of the normalized facility;

2) load - impact during the entire life cycle, the temporal change of the value of which, compared with the average value, very little, or in which the change before reaching a certain limit value occurs always in one direction (evenly);

3) Base -the area of the ground massif (including coastal contiguity and slope), which interacts with the installation and in which as a result of erection and operation of the installation change the stress-strain state and filtration regime;

4) precipitation-deformations occurring as a result of compaction of soil under the influence of external loads and, in some cases, own weight of soil, not accompanied by fundamental change of its installation;

5) Resistance-the ability of the element or cross-sectional element of the installation to withstand the effects without mechanical damage, for example: ground strength for shear, bending resistance, resistance to buckling in longitudinal bending , tensile resistance.

Chapter Four. Objectives and functional requirements Paragraph 1. Objectives of regulatory requirements

4. The purpose of the regulatory requirements of these construction standards shall be to ensure safety, reliability, durability of the foundation of hydraulic engineering installations at all stages of its lifecycle, subject to the possibility of predicting the nature and quality of deformations of the earth's surface, in order to protect life, health of people and animals, property and environmental protection, to ensure energy efficiency and resource saving, as well as to create conditions for the production process and labor, taking into account its technological and specific features.

Paragraph 2 Functional requirements

5. The bases of hydraulic engineering installations shall be designed according to technical, technological and ecological parameters:

1) Ensuring the safety, reliability and durability of the hydraulic engineering installation, the ability to withstand all types of possible combinations of loads and impacts, which it can be subjected to throughout the life cycle before demolition with reasonable degree of probability;

2) Ensuring the fire safety of the object- the condition of the object, characterized by the possibility of preventing the occurrence and development of fire, as well as the impact on people and material values of dangerous fire factors;

3) compliance with the requirements for sanitary andhygienic conditions;

4) protection against seismic impacts;

5) other requirements determined by a particular project. To ensure mechanical safety of hydraulic engineering installations, the bases are designed using characteristic number meanings of impacts and safety factors. The bases of hydraulic engineering installations shall be erected with observance of technological standards and to operate with observance of preventive and protective measures.

Chapter 5. Performance requirements

Paragraph 1. Basic provisions

6. The bases of hydraulic engineering installations shall be designed on the basis of :

1) results of engineering-geological and hydrogeological researches and researches, containing data on installation, physical-mechanical and filtration characteristics of soil body zones, water levels in the soil, areas of its nutrition and drainage;

2) experience of erection of hydraulic engineering installations in similar engineering-geological conditions and local conditions of construction;

3) data characterizing the constructing of hydro-engineering installation (type, installation, dimensions, construction technology, operating loads, impacts, operating conditions, etc.);

4) data on seismic activity of the construction area;

5) Technical-economic comparison of variants of design decisions and acceptance of the optimum variant, ensuring full use of strength and deformation properties of soil basis and the material of the erecting installation at the least expenses.

7. In order to ensure the operational reliability, durability and safety of hydraulic engineering installations, the project shall provide:

1) an assessment of engineering and geological conditions of the construction site with comparison of the calculation model of the base, bearing ability of the foundation and stability of the installation, stability of natural and artificial slopes, local strength, filtration strength of the base, water back pressure and filtration flow;

2) Determination of the values of movement of the installation due to deformation of the base, stresses on the contact of the building with the basis and development of engineering measures that contribute to increasing the load capacity, reducing displacements and ensuring required security.

Loads and impacts on the base shall be determined based on the joint work of the facility and the foundation in accordance with the requirements of the existing regulatory and technical documents. In the calculation of the base, the reliability coefficients shall be assumed to be the same as for the installations being erected on it.

9. Calculations of the bases of hydraulic engineering installations shall be made for two groups of limiting states. For the first group calculations shall be made of the overall stability of the system of construction-base and filtration strength of the base. For the second group the calculations shall be made of the movements of installations, the local strength of the base and the stability of the slope, causing the collapse of the channel or riverbed, manifestations of creep and cracking of the ground.

Chapter Six. Requirements to ensure the reliability and stableness of base

Paragraph 1. Requirements for soil base

10. It shall be necessary to establish the nomenclature of soil foundation of hydraulic engineering installations and their physical and mechanical characteristics. The values of physical and mechanical characteristics of soils shall be considered as classification.

11. The following physical and mechanical characteristics of soils shall be determined for the design of the foundation of hydraulic engineering installations:

- 1) filtration coefficient;
- 2) specific water absorption;
- 3) indicators of filtration soil strength (local and averaged critical gradients of pressure and critical filtration rates);
- 4) sealing factor;
- 5) content of water-soluble salts;
- 6) creep parameters and; cracking parameters (fracture module, drop and stretch angles, length, opening width);
- 7) parameters of the crack filler (degree of filling, composition, characteristics of properties);
- 8) speed of propagation of longitudinal and transverse waves in the array;
- 9) coefficient of frost heaving;
- 10) specific the normal and tangential force of the swelling and the strength of the separate (elemental rock block) of the rocky ground on a single-axle compression;
- 11) tensile strength of separate rock soil on single-axle stretching;
- 12) the tensile strength of the rock massif on the collapse, on a single-axle compression, on a single-axle stretching;
- 13) coefficient of elastic water return of soil;
- 14) the coefficient of gravitational water return of the soil.

12. When grading of soils the standard values of characteristics shall be applied, in the decision of design tasks-their estimated values. Standard values of soil characteristics shall be established on the basis of results of field and laboratory researches conducted in conditions, approached maximally to conditions of work of a soil in the considered installation system. For standard values of all characteristics shall be taken their average statistical values. Calculated values of soil characteristics shall be determined by the division of standard values of characteristics on the coefficient of reliability on the soil.

13. The method of three-axis compression shall be applied for soils of all types of foundation of river hydraulic engineering installations of I class and –floury-clay soils with plastic and soft-plastic consistence, including for reception of characteristics in unstabilized condition. The method of quick cut (shear) shall be applied upon the justification for the definition of characteristics in the unstabilized state. For soils of all

types of installation foundation of I-III classes, in addition to tests specified by the laboratory methods, field-control testing shall be carried out by a method of stamp shift (for concrete and ferro-concrete installations), a method of shift of bypassed soil (for soil installations), as well as the tests shall be conducted by methods of probing and rotational cut (for all kinds of installations).

14. The calculated values of the local critical pressure gradient shall be determined using the calculation methods of estimation of the suffosion stability of soils by means of tests of soils for the suffosion stability in laboratory or natural conditions.

15. Standard values of coefficients of elastic and gravitational water return shall be determined in natural conditions according to the results of observations of change of heads and water levels in the engineering- and geological element of the foundation at pressure change at a certain point (e.g. in an experimental well).

16. The calculated values of the deformation module, transverse deformation coefficients and seals, filtration, elastic and gravitational water yield, creep parameters shall be equal to the standard values.

17. The standard values of the tensile strength of the rock on single axle compression and single axle stretching, as well as the tensile strength of the rocky ground massif, shall be determined as the average arithmetic mean of the private values of these characteristics obtained in separate tests. Tests for determination of the tensile strength of the rock on single-axle compression shall be carried out by the method of single-axle compression of rock pillar, and on single-axle stretching-by the method of separation of concrete stamps or rock pillars on the contact, as well as the limit of strength an array of rocky soil for the collapse, single-axle stretching and single axle compression shall be determined by taking into account the reliability coefficient on the ground or in accordance with the requirements of one-sided confidence probability.

18. Standard values of characteristics of deformation of arrays of rocky soils (strain module, transverse deformation coefficient, velocity of longitudinal and transverse waves propagation) shall be determined as average arithmetic of private values these characteristics obtained for the given engineering-geological element in separate tests. In this case, the tests for obtaining the private values of the deformation module and the transverse deformation coefficient shall be carried out by methods of static loading of the rock massif, and to obtain the private values of the propagation velocities of longitudinal and transverse waves-by dynamic (seismic acoustic or ultrasonic) methods

19. The standard values of the critical velocity of the water movement in cracks (layers, tectonic zones of crushing) shall be determined by the results of the suffosionic tests of the filler of cracks (layers, crushing zones). The estimated values of the critical velocity of the water flow shall be equaled to standard values.

20. The standard and calculation values of the coefficients of elastic and gravitational water yield shall be determined by the results of tests in natural conditions

21. On deformation and durability in various directions the arrays of rocky soils shall be taken into account isotropic and anisotropic properties. The coefficient of anisotropy shall be referred to the ratio of the greater value of the characteristic to the lesser in the two specified directions.

Paragraph 2. Calculation of stability on non-rocky and rocky bases

22. The criterion for ensuring the stability of the installation, the installation-base and the slopes (arrays) shall be the condition, when the calculated values of the generalized shear forces taking into account the coefficient of load combination are less than or equal to the force of the limit resistance or moments of forces aspiring to turn (overturn) and to keep installation, taking into account coefficients of working conditions and reliability on a degree of responsibility of a installation.

23. Calculations of stability of installations and ground arrays shall be produced by methods satisfying all conditions of equilibrium in the marginal state. It shall be allowed to use other methods of calculation, results of which are tested by experience of design, construction and operation of installations. In calculations of stability it shall be necessary to consider all physically and kinematic possible schemes of buckling of constructions, systems of construction –a basis and slopes (arrays).

24. In calculations of stability of gravitational installations on non-rocky bases shall be considered possibility of stability loss on the schemes of flat, mixed and deep shifts. The choice of the shift scheme shall be carried out depending on the type of a installation, classification characteristics of the base, loading scheme. The enumerated schemes of a shift shall be both at translational form of shift, and at a shift with a turn in the plan. For installations, the basis of which are natural or artificial slopes, or their crests, the scheme of the general collapse of the slope together with the installation located on it shall be considered as well.

25. Calculation of stability of gravitational installations (except port), the bases of which are folded by sandy, coarse-grained, firm and semi-solid dust-clay, tight-and soft-plastic dust-clay soils shall be produced only under the scheme of flat shear. At the same time the calculated thickness of the consolidated layer shall be taken into account , which is accepted for construction with the width of the sole on the part of which the drainage is located, depending on the presence of water and bedding in the base of the drainage layer.

26. When calculating the stability of the installation according to the scheme of flat shear, the calculated surface of shear shall be taken:

1) at a flat sole of a installation-a plane of a building basing on the basis with obligatory check of stability on a horizontal plane of a shift passing through a top edge of a base;

2) in the presence of the installation base of the upper and lower teeth in the sole: at the depth of the laying of the upper tooth, equal or greater than the lower one,-the plane passing through the sole of the teeth, as well as the horizontal plane, passing on the sole of the upper tooth;

3) at depth of laying of a bottom tooth more depth of laying of a top tooth-a horizontal plane passing on a sole of a top tooth (thus all forces should be attributed to the specified plane, except for passive pressure of a ground from the side lower tail-water to be determined throughout the depth of the bottom tooth);

4) at presence at the basis of construction of a stone bed-a plane passing on contact of a installation with bed and a floor with a ground;

5) if the stone bed depth in the ground should be considered also inclined planes or broken surfaces, passing through the bed.

27. The calculated value of the limit resistance and the calculated value of the shear force shall be determined, when calculating the stability of installations according to the scheme of flat shear (without rotation) at the horizontal plane of shear.

28. In case the calculated shear force is applied with eccentricity in the plane of the sole, the calculation of the stability of the installations shall be made according to the scheme of flat shear with the turn in terms of construction.

29. Calculation of stability of installations under the scheme of mixed shift shall be made for constructions on homogeneous bases in all cases. At the same time, the base resistance of the shear shall be equal to the amount of resistance on the flat shear and shear areas. The strength of the limit resistance in calculating the stability of installations according to the scheme of mixed shear in the translational form of shear shall be determined taking into account Mohr-Coulomb law. It shall be allowed not to make calculations of stability under the scheme of mixed shear for port facilities.

30. Calculation of stability of installations under the scheme of deep shift shall be made for all types of constructions bearing only vertical loading, for port constructions-irrespective of a nature of loading, and also for constructions bearing vertical and horizontal loads and located on heterogeneous bases.

31. The calculation of the stability of the port facilities, shall be produced by two methods, based on the progressive movement of the shifted soil, together with the construction of the broken planes shear and from the rotational movement of the round cylindrical surface of the shear. When both methods are used, the results of the stability calculation according to the method by which the condition shows less reliability of the installation shall be decisive.

32. When calculating the stability of installations on the bases, folded water-inundated dust-clay soils, the characteristics of the ground (the angle of internal friction and cohesion), corresponding to its degree of consolidation shall be taken into consideration, or pore pressure (determined experimentally or calculated) shall be entered into the calculation with the characteristics of the soil corresponding to its stabilized state.

33. Calculations of stability of installations on rocky bases, rocky slopes shall be carried out under the scheme of shift on flat or broken calculated surfaces. A scheme of the limiting turn (overturning) with destruction of the basis under a bottom edge of a installation shall be considered for concrete and ferro-concrete installations on rocky bases. At the same time, the calculation results shall be decisive in accordance with the scheme, that pursuant to the condition, shows less reliability of a installation (slope, rock slope). With a flat calculation surface, two possible stability violation schemes shall be taken into account: translational shift and shift with a rotation in the plan. At a broken design surface of a shift, three possible calculation diagrams shall be taken into account: a shift along edges of a broken surface (longitudinal); shift across the edges of the broken surface (transverse) and angle shift to the edges of the broken shear surface (oblique). The choice of a scheme of a destabilization of a installation or a slope (rock slope) and determination of calculation surfaces of shear shall be made using the analysis data of engineering-geological structural models, reflecting the basic elements of fracture of rock array (orientation, length, power, roughness of cracks, their frequency and so on) with weakened layers and areas.

34. When calculating the stability of installations and rocky slopes (slope) according to the scheme of translational and longitudinal shifts, the calculated value of the limit resistance and the calculated value of the shear force shall be determined, which are compared with the value of active shear force (projection of the equivalent design load on the direction of the shift).

35. The calculated value of the resistance force of the thrust array or backfill shall be determined, taking into account the calculated value of passive resistance force. For the thrust array containing the weakening surfaces on which the array can be shifted, the value of the passive resistance force shall be determined without regard to the characteristics of the angle of internal friction and cohesion.

36. The possible reduction of shear resistance against the values of forces set in the assumption of translational motion shall be taken into account when calculating the stability of installations and rocky slopes (slope) according to the scheme of shift with a turn in the plan .

37. Calculations of installation stability of rocky slopes (slopes) according to the scheme of transverse shift shall be made, exploding prism of collapse (shear) on interacting elements. Fragmentation of the prism of collapse (shear) on the elements

shall be made in accordance with the nature of the shear surface, the installation of the rocky massif of the prism and the distribution of forces acting on it. Within each element on the shear surface, the characteristics of the rock strength shall be assumed to be constant. The selection of the directions for the fragmentation of the collapse prism on the elements and the calculation method shall be made taking into account the geological installation of the array. If there are overlapping prism (shear) surfaces of weakening, along with which it is possible to achieve the limit equilibrium of the prism, the plane of the section between the elements shall be placed on these weakening surfaces.

38. The calculations of stability according to the scheme of the cross shift shall be performed in those cases when the direction of displacement of the array does not coincide with the direction of the edge (edges) of the intersection of the shear planes, for example, in calculating the stability of coastal stops of arched dams and similar arrays.

39. In stability calculations of concrete installations under the scheme of limiting turn (overturning) possibility of loss by a concrete installation of stability shall be verified due to infringement of basis durability on a collapse under a bottom edge of a installation at its turn or inclination caused by the effect of tipping forces.

Paragraph 3. Filtration calculation base

40. When designing the base of a hydraulic engineering installation, the filtration strength of soil base shall be provided, allowable pursuant to technical and economic indicators filtration expenses and back pressure of filtered water shall be established on the sole of the installation. At the same time, the following shall be determined:

1) the form of the free surface of the filtration flow (depressive surface) and the location of the sites of its seepage;

2) distribution of pressure of the filtration flow mainly along the underground contour of the installation, at the sites of its unloading and in the places of mating of soils, differing filtration properties and installation of pore space;

3) filtration flow on pattern of place of the base;

4) force impact of filtration flow on the base soil array;

5) general and local filtration strength of soils at the base, and the general filtration strength should be evaluated only for non-rocky soils of the base, and local-for all classes of soils.

41. The characteristics of the filtration flow shall be determined by its modelling pursuant to the physical or mathematical filtration models of the base using, as a rule, of models (diagrams) of the basis, reflecting the geological installation of the soil array with the allocation of the most characteristic of the permeability and suffosion stability of soils areas, that fall into the active area of the filtration flow. The boundaries of

these areas shall be determined by preliminary calculations based on the planned dimensions and configuration of the underground contour of the installation.

42. The criterion of ensuring the general filtration strength of the non-rocky base shall be the condition that the local filtration strength in the considered area of the base is less or equal to the calculated value of the averaged critical gradient of the head-based on the reliability factor. The value of local filtration strength for the bases of installations of I and II classes shall be determined by the method of elongated contour line. In some cases, the values of local filtration strength shall be determined by other approximate methods.

43. The criterion of ensuring the local filtration strength of the non-rocky base shall be the condition that the local pressure gradient in the considered area of the base is less or equal to the local critical pressure gradient taking into account the safety factor. The local filtration strength of the non-rocky base shall be determined in the following areas of the base:

1) in the area of output (discharge) of the filtration flow from the bottom of the base to the lower tail water, drainage device and the like, in layers suffosion-unstable soils;

2) in places with a large drop in the pressure of the filtration flow, for example, when wrapping the underground barriers; on the contact areas of soils with significantly different filtration properties and installation.

44. Criteria of ensuring local filtration strength of rocky bases shall be the condition that the average velocity of water movement in the cracks of the base is less or equal to the critical velocity of water movement in the cracks taking into account the coefficient security.

45. The design of the underground contour of pressure installations shall be performed in accordance with the requirements of the existing regulatory and technical documents. When choosing a drainage system and anti-filtration devices in the basis of the designed installation the conditions of its operation, engineering and geological conditions and requirements for environmental protection in the part of flooding, waterlogging adjacent territory, activation of karst-suffosion processes and the like shall be taken into account

46. When designing the anti-filtration curtain in a non-rocky basis, the critical gradients of the head in the injection curtain in gravel and pebble soils, in the sands of small, large and medium size shall be taken into account separately. In a curtain, which are constructed by a way "a wall in soil" in soils with the consideration of coefficients of filtration.

47. When designing the anti-filtration (grout curtain) curtain in the rocky base, the critical pressure gradient in the curtain shall be taken, depending on the specific water absorption within the curtain. In the case when the curtain (alone or in combination

with other anti-filtration devices) protects the soluble soils contained in the foundation from leaching, the allowable specific water absorption shall be substantiated by calculations and experimental studies.

48. To prevent the excavation of the soil in areas where the underflow with the pressure gradients close to the unit, reaches the surface of the base, the design shall provide for permeable loading or discharge drainage. The surcharge material shall be selected on the principle of the reverse filter to protect the ground base from contact suffosion. For isotropic-free flooding and homogeneous base, the necessary thickness of surcharge shall be determined.

Paragraph 4. Calculation of local strength of rock bases

49. The calculation of local strength of rocky bases of hydraulic engineering installations shall be made to establish the development of measures preventing possible violation of anti-filtration devices, for accounting in the development of measures to improve strength and stability of installations and for achievement consideration of a limit of local strength at calculations of the stress-deformed condition of a installation and a basis. Calculation of local strength shall be made on the limit states of the second group for the bases of constructions of I class at the basic combination of loadings.

50. Local strength test of rock bases shall be made according to the calculation areas :

1) coinciding with the planes, which are on the cracks in the array; coinciding with the plane, timed to the contact installation-base;

2) not coinciding with the planes, timed to cracks and to the contact installation-base.

51. The criteria of ensuring local strength on the sites, shall be the condition of non-exceeding of the operating stresses of the limit internal shear on the calculated area. In cases, where the connection between tangential and normal stresses on the calculated areas, not confined to cracks and contact, in determining the angle of internal friction and adhesion and is described by a single linear dependence with a large error, possible nonlinearity of this connection by means of a piecewise linear approximation or using nonlinear dependences, in the form of quadratic parabola shall be taken into account. If the conditions of local strength are not fulfilled within the limits of the grout curtain, filtration calculations shall be performed taking into account the changes in the filtration regime.

52. In determination of stresses, computational and experimental methods of mechanics of continuous environment and geomechanics shall be applied. It shall be allowed to consider the basis together with the installation as a system of linear-deformed bodies, on contact between which the conditions of equilibrium and

equality of displacements are fulfilled. When justifying, it shall be allowed to schematize a system: installation- basis, allowing to solve a flat problem of elasticity theory in relation to one or to several flat sections. Thus the surface of a basis shall be assumed to be flat, and the body of the basis-homogeneous or consisting of some number homogeneous areas, or having continuously changing characteristics. The natural relief of the base surface, the spatial nature of the system installation-base shall be taken into account as well as the distribution of mechanical characteristics of the base shall be detailed. If in the determination of stresses in some areas of the base one (or more) of the conditions is not fulfilled, then the solution of the problem shall be refined. The refinement shall be performed using a nonlinear constraint between stresses and deformations or by changing the section geometry by excluding the specified areas from consideration.

Paragraph 5. Determination of contact stress for installations on non-caits bases

53. The contact stress (normal and shearing stresses on the contact installation-base) shall be determined for their use in the calculations of the strength of constructions and installations, as well as in the calculation of the bases on the bearing capacity and deformation. When determining contact stresses the design features of the installation, the sequence of erection and the type of base shall be taken into account. In order to reduce the design effort in the construction or elements of the installation, the design shall provide the possibility of creating an optimal distribution of contact stresses, providing the device projections on the contact surface installations, sealing of separate areas of the base and corresponding sequence of erection of the installation.

54. For installations on rocky bases contact stresses shall be determined through the method of out-of-center compression, and in necessary cases for constructions of I and II classes- following the results of calculations of a stressed condition of the installation system-basis with the use of methods of flow mechanics.

55. When determining the contact stress for installations on non-rocky basis the indicator of the flexibility of the installation shall be taken into account.

56. For rigid installations of I and II classes, calculated according to the scheme of flat deformation, normal contact stresses shall be determined by the methods of flow mechanics (linear or nonlinear theory of elasticity, theory of plasticity). For installations of III and IV classes the normal contact stresses shall be determined by the method of non-centered compression or by the method of subgrade resistance coefficient, and for sandy bases with relative density of soil by the method of experimental diagrams.

57. When calculating the strength of hydraulic engineering installations, the diagrams of contact stresses shall be determined by the methods of the continuum mechanics, it shall be necessary to consider the additional and second diagram of the

contact stresses calculated by one of the recommended simplified methods. If the resulting bending moments have different signs, then in the calculations of strength it shall be necessary to use both values, reduced by 10% of the difference of these values, and if the same-only a larger bending moment, also reduced by the specified value.

58. When determining the contact stress with regard to the flexibility of the installations, the method of subgrade resistance coefficient, as well as solutions elastic and elastoplastic tasks shall apply. Thus the installation, depending on its scheme, shall be considered as flat or spatial construction (a beam, a plate, a frame). The flexibility of structural elements shall be determined taking into account the possibility of cracking. When applying the methods of subgrade resistance coefficient and out-of-center compression, shearing stresses shall be taken evenly distributed. The shearing stresses caused by vertical forces shall not be taken into account when calculating the strength of the installations.

59. Normal contact stresses acting on the sole of the installations on heterogeneous bases shall be determined by the same methods as for homogeneous bases. When using the methods of elasticity theory and plasticity theory, the heterogeneity of soils shall be taken into account with the purpose of appropriate calculation characteristics of deformation and durability for different areas of the base. When determining the contact stresses by the method of out-of-center compression, the heterogeneity of the base shall be taken into account or the method of subgrade resistance coefficient or experimental diagrams shall be used.

60. In the case of heterogeneous bases with vertical and steeply- deepening layers in the calculations of contact stresses the methods of the continuum mechanics methods, including numerical methods of solving tasks or approximate methods shall be used, in which the contact stress is taken by proportional modules of deformation of soil of each layer, depending on their sizes and eccentricity of application of loading. Within each layer, the distribution of contact stresses shall be assumed to be linear.

61. If there are layers of variable thickness in the base or inclined seating of layers in the calculations of contact stresses, the methods of continuum mechanics shall be used, including numerical methods or approximate methods based on the conversion of the calculation scheme bases with layers of variable thickness or when the layers are inclined to the schematic base with vertically spaced layers. With a horizontal arrangement of soil layers of constant thickness, the heterogeneity of the base may not be taken into account.

62. When determining the normal contact stress by the methods of experimental diagrams and the coefficient of subgrade resistance, the account of the heterogeneity of the base shall be produced by adding the ordinate of the diagrams, determined in the assumption of homogeneous bases, with the ordinate additional diagrams. The ordinates of an additional epure shall be assumed to be equal to the difference of the

ordinates of the epures, constructed by the method of non-central compression for cases of heterogeneous and homogeneous bases.

Paragraph 6. Calculation on deformations of installation bases and dams from soil materials

63. Calculation of bases of installations and dams from soil materials by deformations shall be made for the purpose of selection of the system of construction: installation- base, displacement of which (precipitation, horizontal displacement, tilts, turns around a horizontal axis, etc.) are unconfined to the limits, guaranteeing normal operation conditions of the construction as a whole or its separate parts and, providing the required durability. Herewith, the strength and fracture resistance of the installation shall be confirmed by the calculation, taking into account the efforts that arise in the interaction of the installation with the base. Calculations on deformations shall be made on the basis of combinations of loadings taking into account the nature of their action in the process of construction and operation of the installation (sequence and speed of erection of the installation, reservoir filling schedule and so on). It shall be allowed to ignore the displacement of the bases of installations occurring in the process of construction, if they do not affect the operational suitability of the installation.

64. The calculation of deformations shall be based on the condition that joint deformation of the base and installation (precipitation, horizontal displacement, tilts, rotations around the vertical axis and other) are less or equal to the limit values of joint deformation base and installations.

65. The limit values of combined deformation of the base and installation shall be established by the corresponding standards of installations design.

66. Calculations of combined deformations shall be made for conditions of a spatial problem. For installations, which length exceeds the width more than three times, it shall be allowed to make calculations for the conditions of flat deformation. In the case , when the width of the installation exceeds the thickness of the compressible thickness twice or more, it shall be allowed to calculate the sediment for the conditions of one-dimensional (compression) problem.

67. When calculating the deformations, final (stabilized) displacements corresponding to the completed process of soils deformation of a base shall be determined for soils of all categories, whereas for clay soils – the values of unstabilized displacement, corresponding to the unfinished process of deformation and displacements caused by the creep soils of the base.

68. In calculating the deformation of the base with the use of calculation schemes that do not take into account the formation and development of plastic deformation, the average pressure under the sole installation shall not exceed the calculated soil resistance.

69. The final setting of the installations located on non-rocky bases, at the average pressure under the sole of installations, less calculated resistance of soil base, shall be determined by the method of layering summation within the compressible layer.

70. At the average pressure under the sole of the installation, the greater calculated resistance of the ground base, the sediment shall be determined by numerical methods, taking into account the elastic plastic nature of soil deformation, the spatial tense state, sequence of erection of construction.

71. Unstabilized setting shall be determined by the moment of time taking into account the degree of primary and secondary soil consolidation and soil creep parameters. Soil creep parameters shall be determined following the results of compression tests of soil on the drained scheme. The degree of primary consolidation shall be determined by decisions of one-dimensional, planar, or spatial consolidation tasks. The degree of secondary consolidation shall be determined by the solutions of one-dimensional, planar or spatial tasks taking into account the properties of soil creep.

72. The tilt (slope) of the installations shall be determined from the eccentric load application within the width of the installation, from the surcharge base outside the sole of the installation and from the compression of the filling ground in the body of the installation (for cellular installations without the bottom) at the eccentric load application.

73. The tilt of installations with rectangular soles, caused by the non-centered application of vertical load within the width of the installation, in the case of homogeneous and horizontal-layered base without taking into account filtration forces, determine in the direction of greater and the lower side sole of the installation.

74. The installation tilt shall be determined from the surcharge base outside the sole of the installation. Surcharging shall be approximated by rectangular, triangular or trapezoidal epure depending on the shape of the pit to be filled.

75. Horizontal displacements of installations and their elements, perceiving a horizontal load (retaining walls, anchoring devices), shall be determined by methods, taking into account the development of areas of plastic deformation (applying the theory of plastic current). It shall be allowed not to verify the horizontal displacement of the base of gravitational and behind the anchoring of the piling retaining walls of the port hydraulic installations.

76. For anchoring devices and other elements of the installation, from the displacement of which its strength and stability depend, calculations of horizontal displacements shall be performed pursuant to the characteristics of soil and loads corresponding to the limit states of the first group.

77. Unstabilized horizontal displacements of installations shall be determined for the moment of time. Horizontal displacement of the installation shall correspond to the achievement of the ultimate equilibrium of the system: installation-base on a flat shift.

Solutions of nonlinear elasticity theory, theory of consolidation or theory of viscoplasticity shall be used in calculations. The dependence of the permeability of the connected soils of the dam cores on compaction in the process of consolidation, water saturation and other factors shall be taken into account.

78. The dam settlement shall be determined as the amount of settlement of its base and body. The settlements of the dam body and the base may be determined by the method of layering by the calculation verticals. The settlements and horizontal displacements of the rocky base shall be neglected.

79. Calculations shall be determined by:

1) construction settlements -vertical displacement of the dam points at the time of completion of its construction;

2) operational settlement-additional vertical displacement of the dam points, occurring from the moment of completion of construction until the completion of consolidation of soil base and body of the dam;

3) The total sediment of the dam body and the base.

80. For the calculation of the precamber, the operating settlement of the dam crest shall be determined. To specify the additional amount of soil to be stacked in the dam, the difference between the total compaction of the soil at the time of completion of consolidation and the operational settlement of the dam contour points shall be determined.

81. Calculation of displacements of constructions erected on rocky bases shall be carried out only for constructions of I class.

82. When calculating displacements, if the ratio of the width of the pressure front of the installation to the pressure on the installation of less than five, the spatial problem shall be considered, if it is more than five – then the flat problem shall be considered as well. In this case, the methods of linear and nonlinear elasticity theory shall be applied to calculate the displacements of installations. The conditional thickness of the base layer in the calculations shall be taken as equal to the width of the sole of the installation. At the stage of feasibility study of construction, it shall be permitted to consider the rock base as a linear-deformed body.

83. The pressure of soil (sediment or backfill) on the bed of the reservoir, volumetric filtration forces at the base, loads from the construction, transferred to the base, and weighing the effect of water in the banks at filling the reservoir shall be taken into account when determining the displacement of installations. The weighting effect of water and filtration forces after filling the reservoir to the design mark shall be taken into account, when calculating the displacement of slopes in narrow canyons.

Paragraph 7. Features of bases design of installations erected in seismic areas

84. The bases of installations erected in areas with a seismicity of 7, 8 and more than 9 points shall be designed to meet the requirements for designing buildings and installations in seismic areas. In areas with a seismicity less than 7 base points, they shall be designed without taking into account seismic effects.

85. The design of the bases taking into account seismic effects shall be carried out on the basis of calculation on the bearing capacity (stability) for a particular combination of loadings determined in accordance with the requirements on loadings and impacts.

86. The calculation of the bases for the bearing capacity (stability) shall be performed on vertical component of the calculated eccentric load in a special combination, transferred by the installation and its comparison with the vertical component of the ultimate resistance of the base during seismic effects, taking into account the seismic coefficient of working conditions and reliability factor for the intended purpose of the construction. The horizontal component of the load shall be taken into account when calculating the installation for shear along the base.

87. Under the action of moment loadings in two directions, the calculation of the base for the bearing capacity (stability) shall be carried out separately for the action of forces and moments in each direction independently from each other.

88. When calculating the bases for a special combination of loads taking into account seismic effects, partial separation of the floor of the installation from the ground shall be allowed when the following conditions are met:

1) eccentricity of the calculation load does not exceed one third of the width of the sole in the plane of the moment;

2) the strength of the ultimate resistance of the base is determined for the conditional installation, the size of the ground of which in the direction of the moment of action is equal to the size of the compressed zone;

3) the maximum boundary pressure under the ground of the installation, calculated taking into account its incomplete footing on the ground, does not exceed the boundary ordinate of the epure of the ultimate resistance of the base.

89. If it is impossible to deepen the ground of an installation or compartment on the same level in non-rocky soils, the calculated value of the angle of internal friction of the soil shall be decreased, depending on the computational seismicity.

Chapter 7. Requirements for ensuring base safety

90. When designing the bases of hydraulic engineering installations, solutions shall be provided to ensure the base safety at all stages of their construction and operation. For this purpose the design shall envisage:

1) an assessment of engineering and geological conditions of the construction site and forecast for their change;

- 2) calculation of the bearing capacity of the base and stability of the installation;
- 3) calculation of the local strength of the base; calculation of the stability of natural and artificial slopes and slope adjacent to the installation;
- 4) calculation of deformations of the system installation-base as a result of the action of the own weight of the installation, water pressure, soil and the like, as well as changes in physical and mechanical (deformation, strength and filtration) properties of soils in the process of construction and operation of the installation, including freezing and thawing;
- 5) determination of stresses in the base and on the contact of the installation with the basis and their changes over time;
- 6) calculation of filtration strength of the base, back pressure of water for installation and filtration flow, as well as, if necessary - volumetric filtration forces and change of filtration regime at the change of the stress state of the base;
- 7) development of engineering measures providing bearing capacity of bases and stability of a installation, required durability of a installation and its base, and also if necessary-reduction of displacements, improvement stress-strain state of the system installation-base, reduction of back pressure and filtration flow.

91. When designing the bases of installations of I-III classes for maintenance of bases safety, it shall be necessary to provide installation of the control-measuring equipment for carrying out of full-scale observations of the condition of installations and their bases, both during construction and during their operation to assess the reliability of the system installation-base, for timely detection of defects, prevention of accidents, improvement of operating conditions, as well as to assess the accuracy of accepted methods of calculation and design solutions. Visual observations shall be provided for installations of IV class and their bases.

92. The composition and scope of the field studies to ensure the safety of the base shall include:

- 1) settlement, tilt and horizontal displacement of the installation and its base;
- 2) soil temperature at the base; hydraulic pressure head of the water at the base of the installation;
- 3) expenses of water filtered through the base of the installation;
- 4) chemical composition, temperature and turbidity of filtered water in drainage, as well as in collectors;
- 5) efficiency of drainage and anti-filtration devices;
- 6) stress and deformation at the base of the installation;
- 7) the pore pressure at the base of the installation; displacement, speed and acceleration of the base in seismic impacts.

93. For installations of IV class, the instrumental studies, if they are foreseen by the project, may be limited to observations of filtration at the base, sediments and displacements of the installation and its base.

Chapter 8. Ensuring the coupling of installations with the base

94. When designing the bases of installations, the measures for the connection of the installation with the base, ensuring the stability of the installation, the strength of the base (including filtration), allowable stress-strain state of the installation and its bases for all calculated combinations of loadings and influences. In all cases, the design of the coupling of the installation with the base shall envisage possible change of filtration characteristics and characteristics of strength and deformation of soils in the process of erection and operation of the installation.

95. When designing the mating of installations with the base, it shall be necessary to remove or replace weak (or weakened in the process of construction) soils from the surface to the depth, below which the characteristics of soils (taking into account their possible improvement) meet the conditions of stability of the installation, the strength of the base and the specified filtration mode. Steepness of slopes of coastal adjacencies of installations shall be selected out of conditions for ensuring stability of both slopes and installations during periods of construction and operation.

96. When designing the coupling of a installation with a rocky base in cases, if the removal of the soil is economically impractical, the following measures shall be considered to reduce the volume of rock removal to ensure the fulfillment of the requirements of the stability of the installation or its coastal stops, strength and deformable base,:

1. reduction of back pressure in the base of pressure installations and coastal arrays of adjacencies;

2) creating a slope towards the upper tail water on the installation contact with the base;

3) creation of a stop at the base from the bottom tail water;

4) application of the constructions providing the most favorable direction of efforts and influences on the basis and coastal adjacencies of the installation;

5) anchoring of sections of installation and coastal adjacencies;

6) Injection strengthening of soil base.

Deepening of the soles of the installation in the more preserved area of rocky soils shall be envisaged in case of insufficient technical and economic efficiency of these measures.

97. In order to ensure the stability of the installations on non-navigational bases, ensure the strength and allowable settlement and displacements in the design of the coupling of the installation with the base, the device of the upper and lower teeth,

drainage of low-permeability base layers, sealing and injection strengthening of soils and other measures shall be provided in applicable cases. When designing the port facilities, the device of a rubble foundation, unloading and anchoring devices, as well as the removal of hydrostatic (filtration) pressure in the ground behind the wall shall be envisaged where it is required. For the installations of meliorative purpose, for which drainage of a watercourse and freezing of the basis are allowed in the process of exploitation, and constructed on dust-clay or small sandy soils, the projects shall provide the corresponding engineering activities (drainage device, anti-migration screens, replacement of a part of the foundation base with soil ground of the required properties and etc.).

98. When designing the foundation of earth dams, erected on a non-lethal basis, the base shall be prepared and leveled, the vegetation layer and the layer, riddled with rhizomes of trees and bushes or with holes of earth-moving animals, as well as the soil containing organic matter or the same amount of salts, freely soluble in water shall be removed .

99. The measures (clearing the surface of the base, deepening the sole of the dam, sealing cracks in the rocky soils, drainage and etc.), aimed at ensuring the stableness of dams, reducing uneven deformation of the base and installation, preventing suffosion and unacceptable reduction of soil strength of the base at its water saturation shall be envisaged, when designing the mating of dams from ground materials with the base. The construction of ground dams on the bases containing water-soluble inclusions and biogenic soils shall be allowed when justifying.

100. When designing the coupling of water-resistant elements of earth dams erected on a rocky basis, the measures shall be taken for the removal of the destroyed rock, including both separate large stones and clusters of stones, cutting and concreting of exploration geological and construction workings, large cracks. If there are water insoluble, poorly permeable rocky soils in the base, only the leveling of the base under the sole of the water-resistant element of the dam shall be provided. In other cases the following measures shall be envisaged: the device of a concrete plate, a covering of a rock by a torcreom, an injection sealing of a part of the base adjoining to a sole of the waterproof element. In the sections of the anti-filtration elements of soil dams with inclined uneven surfaces of rocky shores, the projects shall provide for the gradual adjustment of the slope of the coastal contiguity from the ridge of the dam to the base without abrupt fractures of the profile, with the lowest economically justified general inclination of contiguity. Cutting of protruding areas of slope and filling the recesses with concrete shall be envisaged as well. In the section of connection with the base of the parts of the dam profile, which are made of more permeable materials than the anti-filtration devices, the removal of the collapsible cliff (weathered) shall not be necessary.

101. The measures providing prevention in the process of construction of freezing, weathering, unsealing and liquefaction of soils, and also excluding possibility of filtration of pressure waters through a bottom of a ditch shall be indicated in the project of bases of constructions.

102. The depth of laying the soles of the installations shall be taken as minimal as possible, taking into account the type and structural features of installations, the nature of loads and impacts on the base, geological conditions of the construction site (building properties of soils, installation of the base, presence of weakened surfaces-weak prolayers, zones of tectonic disturbances and others), topographic conditions of the territory of installation; hydrogeological lconditions (water permeability of soils, headwaters, levels and aggressiveness of ground water and others), areas of erosion of soils in the lower beif, depth of seasonal freezing and thawing of soils; navigable water levels and others.

103. When designing the mating of concrete and reinforced concrete installations with a rocky base the following shall be provided:

1) for homogeneous bases- the removal of intensively weathered soils (demountable layer), having low strength and deformation characteristics and weakly amenable to joint grouting due to presence of clay filler in cracks (at justification it shall be allowed to remove weak soils only from the ground side of the installation);

2) for heterogeneous grounds, having large violations and areas of deep selective weathering,-removal of soil, the volume of which should be taken on the basis of the analysis of the stress state and stableness of the installation, taking into account possible strengthening of weakened areas of the base and sealing of cracks.

Chapter 9. Stabilization and compaction of soil bases

104. Stabilization and compaction of soils in the base of installations shall be provided for the change of strength and deformation characteristics of soils in order to increase the bearing capacity of the bases, reduce sediment and displacements, as well as to ensure the required water permeability and filtration strength project. The cementation, chemical methods of stabilization, freezing of soils, mechanical compaction, drainage of an array, a device of the printed piles and so on, shall be necessary by way of measures on changing of strength and deformation properties of soils. Stabilization and compaction of soils in the base of water-retaining installations, foreseen in the project with the purpose of reduction of filtration under construction or by passing it and elimination of hazard effects of filtration, shall include the device of antifiltration barriers (curtains, teeth, sheet piling,"walls in the soil", and others), as well as mechanical and injection compaction of soil.

105. When designing the retaining installations, it shall be primarily intended to consolidate soils in the area adjacent to the downstream side of the structure, as well as

to consolidate and seal the outlets within the structure contour and the base of large cracks, tectonic zones and other faults and layers of weakened soils. Continuous strengthening of the soils shall be justified.

When designing retaining installations of I and II classes, the determination of the method and scope of work to strengthen the base shall be justified by calculations, and for installations of I class, if necessary, by experimental studies of stress-strain condition of the installation and base. For installations of III and IV classes at all stages of designing, and also for constructions of I and II classes at all stages of a technical-economic substantiation, the methods and amount of works for strengthening of a base shall be allowed to be established pursuant to analogues.

106. The design of port facilities on highly deformed and low-strength soils shall envisage the fixation of soils in the area of the back of the front and anchor walls, as well as within the backfill. In this case, the method of stabilization at the stage of feasibility study shall be also established pursuant to analogues. At the stages of the project and working documentation, the method of soil strengthening and the scope of work shall be determined on the basis of calculations and experimental studies.

107. The device of antifiltration curtains (obstacles) shall be obligatory in those cases when the base is folded by filtering weak-water-resistant and fast-soluble soils. With water-resistant soils the device of curtains shall be accepted as reasonable. The depth and width of the anti-filtration veil shall be justified by the calculation or the result of experimental studies. When designing the rocky bases of concrete dams it shall be necessary to consider the possibility of location of the anti-filtration veil outside the zone of cracking under the pressure face, as well as their inclination towards the upper bief.

108. On the section of connection of the curtain with the base of the installation, in order to prevent filtration in the zone of the largest gradients of the pressure, the project shall envisage the local reinforcement of the curtain with additional rows of shallow wells located near the pressure side of the structure parallel to the main row (or rows) of wells, or within the curtain itself. The distance between the additional wells shall be allowed to take more than between the main wells in the veil.

109. In the places of connection of the anti-filtration devices (chisel teeth, diaphragms, dowel and so on) with the base or the banks, a careful laying and compaction of the soil shall be envisaged with the use of plastic soil for this purpose, which is more resistant to suffusion, capable to colmatage cracks in a rocky base.

110. A drainage device shall be provided in the projects of the bases of water-retaining installations as the measure for reduction of back pressure. In rocky bases, drainage shall be mainly located on the side of the pressure face of the installation, and, if necessary, in the middle part of its base.

Chapter 10. Energy conservation and rational use of natural resources

Paragraph 1. Energy reduction requirements

111. The foundation of hydraulic engineering installations shall be designed taking into account the requirements of the Law of the Republic of Kazakhstan "On Energy Saving and Increase of Energy Efficiency" on efficient use of energy for hydraulic engineering installations.

112. During the design process, it shall be necessary to provide solutions and a set of measures to improve the energy efficiency of the facility in accordance with the requirements of existing regulatory and technical documents.

113. The main requirement in the design of the bases of hydraulic engineering installations shall be the environmental safety during operation.

Paragraph 2. Rational use of natural resources

114. When designing the base of hydraulic engineering installations, the maximum allowable loads on the environment shall be taken into account, reliable and effective measures of prevention, elimination of pollution by hazardous wastes, their neutralization and utilization, implementation of resource-saving, low-waste and non-waste technologies and manufactures shall be envisaged as well.

115. The design of the base of hydraulic engineering installations shall include the rational preservation of public resources such as: water, soil, biodiversity, energy resources, air quality and other natural resources for society.

Chapter 11 Environmental protection

116. When designing the bases of hydraulic engineering installations, engineering activities shall be provided for protection of adjoining territories from flooding and waterlogging of land, from pollution of groundwater, as well as for prevention of landslips of waterside slopes.

117. In order to protect the environment when designing hydraulic engineering installations, it shall be necessary to take into account the requirements of the Environmental Code of the Republic of Kazakhstan.

118. The following shall be taken into account during the process of preparation of the base and construction of the buildings:

direct impacts - directly exerted by the main and related types of planned activities in the area of the facility;

2) indirect impacts - to environment which are caused by indirect (secondary) factors arising from the implementation of the project;

3) cumulative impacts - resulting from constantly growing changes caused by past, present or reasonably predictable actions accompanying the implementation of the project.

119. Pursuant to the environmental impact, it shall be necessary to carry out the influence assessment on:

- 1) atmospheric air, except for impact of emissions of greenhouse gases;
- 2) surface and underground water;
- 3) surface of a bottom of reservoirs;
- 4) landscapes;
- 5) land resources and soil cover;
- 6) flora;
- 7) condition of ecological systems.

120. When designing the bases of hydraulic engineering constructions, the degree of radon danger on the site of construction, existence of technogenic radioactive pollution and radioactivity of building constructions shall be taken into account. At the same time, the requirements of radiation safety shall be fulfilled according to hygienic standards.

UDC 624.15 ICS 083.74

Keywords: bases, base, sediments, bearing capacity.

Appendix 3 to order No. 249-nk of the Chairman of the Committee for Construction, Housing and Communal Services of the Ministry for Investment and Development of the Republic of Kazakhstan dated December 5, 2018

АЛҒЫ СӨЗ

1 ӘЗІРЛЕГЕН:	"Қазақ құрылыс және сәулет ғылыми-зерттеу және жобалау институты" АҚ
2 ҰСЫНҒАН:	Қазақстан Республикасының Инвестициялар және даму министрлігінің Құрылыс және тұрғын үй-коммуналдық шаруашылық істері комитеті
3 БЕКІТІЛГЕН ЖӘНЕ ҚОЛДАНЫСҚА ЕНГІЗІЛГЕН:	Қазақстан Республикасының Инвестициялар және даму министрлігінің Құрылыс және тұрғын үй-коммуналдық шаруашылық істері комитетінің төрағанын 2018 жылғы 5 желтоқсандағы № 249-нқ бұйрығымен

PREFACE

4 DEVELOPED BY:	Kazakh Research and Project Institute of Construction and Architecture" JSC
5 SUBMITTED BY:	Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan
6 APPROVED AND ENACTED BY:	By order No. 249-nk of the Chairman of the Committee on Construction, Housing and Utilities Services of the Ministry for Investment and Development of the Republic of Kazakhstan of December 5, 2018

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CONSTRUCTION STANDARDS OF THE REPUBLIC OF KAZAKHSTAN ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ҚҰРЫЛЫС НОРМАЛАРЫ

HYDRAULIC ENGINEERING CONSTRUCTIONS ON RIVER ГИДРОТЕХНИКАЛЫҚ ӨЗЕН ИМАРАТТАРЫ

Date of introduction 2018-XX-XX

Chapter 1. Field of application

1. These construction standards are the part of normative documents of evidential base of technical regulations on safety issues of buildings and constructions and shall be directed to introduction of a parametrical method of rationing in the construction sphere of the Republic of Kazakhstan

2. These construction standards shall apply to new construction, to reconstruction and expansion of the operating river hydraulic engineering constructions:

- 1) dams concrete, reinforced concrete and from soil materials;
- 2) hydroelectric power stations;
- 3) pump stations;
- 4) retaining walls;
- 5) navigable locks;
- 6) fish-passing and fish-protecting constructions;
- 7) constructions on protection against floods, mudflows and gullying.

3. These construction standards shall not apply to hydraulic engineering offshore and river transport constructions as well as to the bases of hydraulic engineering constructions.

Chapter 2. Normative references

For application of these construction standards the following references shall be used:

The law of the Republic of Kazakhstan dated July 16, 2001 "On Architectural, Town-Planning and Construction Activity in the Republic of Kazakhstan" (hereinafter - the Law);

Decree No. 1202 of the Government of the Republic of Kazakhstan dated November 17, 2010 "On Approval of Technical Regulations "Requirement for the Safety of Buildings and Constructions, Construction Materials and Products";

order No. 439 of the Minister of Internal Affairs of the Republic of Kazakhstan dated June 23, 2017 "On Approval of Technical Regulations "General Fire Safety Requirements" (registered in the Register of State Registration of Regulatory Legal Acts under No. 15501), (hereinafter – the technical regulation "General Fire Safety Requirements".

Note - while using it, it shall be advisable to verify the validity of the reference documents according to the information catalogs "The List of Regulations and the Normative Technical Documentation in the Field of Architecture, Town-Planning and Construction Acting within the Territory of the Republic of Kazakhstan", "Index of Regulatory Legal Documents on Standardization of the Republic of Kazakhstan" and "The index of Interstate Normative Documents on Standardization of the Republic of Kazakhstan", developed annually as of the current year and the corresponding with monthly issued newsletters - the magazines and information indexes of standards published in the current year. If the reference document is replaced (modified), then when using of this standard it shall be necessary to be guided by the replaced (modified) document. If the reference document is cancelled without replacement, then the regulation in which the reference to it is given, shall be applied in the part which is not affecting this reference.

Chapter 3. Terms and definitions

4. The following terms with the corresponding definitions shall be applied in these construction standards:

1) coherent soil - the clay soil capable to perceive the stretching tension and to keep slopes without destruction;

2) gabionny constructions - the voluminous constructions of various form made of a wire grid of double torsion with hexagonal cells filled with stone materials, applied to protection of soil against an erosion;

3) geogrid - a flat cellular structural element, composed of set of the composite tapes connected among themselves by polyethylene tapes;

4) hydraulic engineering constructions - the engineering constructions used for water resources management, water supply to water users, water supply and water disposal, prevention of harmful effects of waters;

5) soil material - not rocky (clay, sandy and macrofragmental) soil used for installation of hydraulic engineering constructions and their elements;

6) the map - the site of a reservoir separated by dams of ridging and intended for line performance of work with repeating installation and amount of works on given, and the subsequent to it sites;

7) the construction block - the part of a construction concreted without interruption limited by temporary working seams.

Chapter 4. Objectives and functional requirements

Paragraph 1. Objectives of statutory requirements

6. The purposes of statutory requirements shall be the determination of requirements for the safe organization of works at installation new, reconstruction and expansion of the operating river hydraulic engineering constructions and establishment of technical, technological and environmental requirements for the safety of facilities.

Paragraph 2. Functional requirements

7. Works over installation new, reconstruction and expansion of the operating river hydraulic engineering constructions shall be performed, taking into account the safety requirements, with ensuring mechanical safety, fire safety, observance of requirements of hygiene and protection of human health and environmental protection, safety of people from accidents and other threats, as well as the following shall be prohibited:

- 1) collapses of separate parts or construction as a whole;
- 2) formation of deformations, exceeding the maximum permissible values;
- 3) damages to products and elements used in construction of an installation as a result of considerable deformation of bearing structures of a construction;
- 4) fire and spread of fire and smoke in the construction;
- 5) spread of the fire to neighboring objects;
- 6) pollution or poisonings of water and soil;
- 7) inadequate emission of the fulfilled water.

8. In addition, to achieve the goal of regulatory requirements, the following shall be necessary:

- 1) the establishment of the necessary procedures and conditions for application of soil and construction materials, elements and structures of the construction;
- 2) the use of reliable ways, methods and technologies for the work performance;
- 3) determination of conditions and procedure for fastening of slopes of earthen constructions and performance of shore protection works;
- 4) providing the safe admission of expenses of the river during the construction period;
- 5) the establishment of necessary conditions for riverbed blocking and ensuring appropriate environmental protection.

Chapter 5. Safety requirements at works on river hydraulic engineering constructions

Paragraph 1. Basic provisions

9. When working over the construction, reconstruction and expansion of the operating river hydraulic engineering installations, it shall be necessary, in addition to

the requirements of these construction standards, to fulfill the requirements of other normative and technical documents establishing requirements for the performance of the corresponding works.

10. When performing the works over reconstruction or expansion of the operating river hydraulic engineering installations, it shall be necessary to ensure the safety for the existing constructions and underground services, which are not subject to demolition and are located in a construction zone.

11. The procedure for carrying out work over the navigable rivers shall provide safe passage of vessels and watercrafts with the necessary intensity. The fairway sections of the water area in a zone of construction shall be marked with obstruction beacons.

12. Works on construction, reconstruction and expansion of the operating river hydraulic engineering constructions shall envisage the protection for incomplete and temporary constructions or parts thereof from the damage during floods, motions of ice, storm and squalls, wave influence, piles and blows of vessels, watercrafts and items floating on water.

13. These construction standards shall provide the requirements for construction of dams from soil materials in two ways, namely by dry ground leveling dry and dumping of soil in water. It shall be necessary to be guided by the special technical conditions developed by research organizations, during the installation of dams from ground materials by the method of an alluvium or by the method of mass directed explosions for emission and dumping.

14. Types of dams by the form of material of their bodies and antifiltrational devices, as well as by the methods of their construction shall comply with state standards in the field of architecture, town planning and construction.

15. For each element of the dams, the special technical conditions shall be developed and used for its construction, taking into account materials, method of the work performance, climatic and other local conditions providing also the quality control of works, ensuring reliable functioning of dams. Technical conditions with appropriate justification shall be allowed to be changed and specified in the course of construction.

16. Monitoring of the state of river hydraulic engineering installations during their construction and operation shall be carried out in compliance with the regulatory requirements of the Republic of Kazakhstan. At the same time, it shall be necessary to develop and implement measures for geotechnical monitoring of the bases of river hydraulic engineering constructions and their surrounding soil massifs as a part of the project.

17. When performing the works on construction, reconstruction and expansion of existing river hydraulic engineering constructions, the requirements for ensuring labor

protection and safety measures shall be observed in accordance with the provisions of state standards in the field of architecture, town planning and construction.

18. Fire safety in the operation of river hydraulic engineering constructions shall be ensured by the creation and application of fire prevention systems, fire protection, organizational and technical measures, which comply with the requirements of technical regulations "General Fire Safety Requirements".

19. For the purpose of decrease of the level of risk of real destruction of the facility in the course of construction and the subsequent operation, due to detection of deviations of parameters of building constructions and knots from calculated values at an early stage of their emergence, the facility shall be monitored according to the project documentation and the requirements of the state standards in the field of architecture, town planning and construction.

Paragraph 2. Requirements to the installation of embankments from soil materials dry with consolidation

20. The dry way of embankments installation shall be applied for construction of dams, dikes, antifiltrational elements, water retaining structures in the form of screens, cores, ponurs and leveling of soil constructions with concrete constructions jointly.

21. When constructing embankments from soil materials without mortar, along with requirements of these construction standards it shall be also necessary to fulfill the requirements of the state standards in the field of architecture, town planning and construction.

22. The choice of soil material of an embankment shall be carried out in a complex taking into account its particle size distribution, resistance to crush, compactibility, water permeability, plasticity, ability to change of volume and other factors provided by the requirements of the corresponding state standards in the field of architecture, town planning and construction. At the same time, the choice of soil material shall be made proceeding from the conditions of ensuring necessary durability, rigidity, durability and water permeability of embankments after consolidation.

23. Embankments shall be arranged by layering, alignment and consolidation of soil materials with ensuring their design density. When using coherent soil it shall be necessary to provide reliable contact between the laid and stacked layers.

24. The choice of embankment sealing technology shall be carried out taking into account the requirements to compaction and such factors as origin and properties of material, the dumping method, humidity of laying and its possible variations, initial and final thickness, local climatic conditions, uniformity of compaction, the property of the spreading base, provided by the requirements of the corresponding state standards in the field of architecture, town planning and construction.

25. Layered mechanical consolidation of soil materials in embankments shall be performed conditioned upon their humidity, providing achievement of design density or the required coefficient of consolidation of layers. The thickness of the compacted layers of embankments, shall be specified in the project of works and clarified when carrying out experimental works.

26. When constructing dams and dikes, the installation of embankments shall be carried out taking into account the surface marks of platforms and their placement. Herewith, when layering of embankments from not draining soil it shall be necessary to provide their protection from erosion by an atmospheric precipitation.

27. The embankments within the erected construction or its part (an upper wedge, a core, a transitional zone, the screen and others) shall be performed continuously ensuring the sequenced-flow implementation of the main production operations.

28. When installing embankments for the construction of the non-uniform dams and dikes consisting of several zones of various soil, it shall be necessary to provide measures for prevention of ingress the soil from one zone to another.

29. When constructing embankments on the rocky bases, it shall be necessary to provide reliable contact of the bases with a core and the screen of dams.

30. For the installation of the earthen dams containing inclusions of coarse-grained soil, it shall be necessary to establish the admissible size of large fractions of the specified soil and to define conditions of their laying.

31. For ensuring technological effectiveness of the construction of dams, it shall be necessary to establish the conditions and an order of the installation of ponurs, teeths, the screen and other elements of dams.

32. For construction of stone-earthen and stone-layered dams, the acceptable ways of layering(stone, from mountain weight, pebble soil) and the maximum size limit of the applied stone materials shall be determined. The suitability, installation and physicommechanical characteristics of stone materials for dams shall be established in compliance with the regulatory requirements of the Republic of Kazakhstan.

33. In case of nonrigid fastening of slopes (crops of herbs, stone layering, dumping of gravel and pebble material and others) of embankments shall be arranged without broadening of a design profile. In case of rigid fastening of slopes (concrete monolithic slabs, the reinforced concrete prefabricated and monolithic plates with usual and intense fittings) broadening of their slopes shall be envisaged for ensuring the design density of embankments.

34. Availability of the condensed soil materials at the sections of junction of slopes of embankments with previously erected parts of a construction shall be prohibited. The slope surface located normally to a construction axis shall have a broken outline in the plan.

35. For the installation of embankments in winter, it shall be necessary to establish the maximum permissible negative air temperature at which there is no freezing of soil materials before their laying and consolidation as a part of layers. Assuming the presence of frozen lumps, their admissible limit share shall be determined in the volume of the poured-out soil material.

36. It shall be not permitted to carry out laying of soil materials on the frozen layer without taking measures providing thawing of a contacted surface of the adjusted layer.

37. The installation of antifiltrational elements of dams (ponur, cores, screen, tooth) shall be performed in winter conditions in compliance with the developed technical specifications, which, with appropriate justification, are changed and specified in the course of construction.

38. For elaboration of the technology for the installation of an embankment from soil materials by dry method and establishment of necessary process parameters, it shall be necessary to carry out experimental works on the specified section of the built construction prior to performance of the main works.

Paragraph 3. Requirements to the installation of embankments with dumping of soil materials in water.

39. The method of dumping of soil materials in water (a wet method) shall be applied for the construction of dams, dikes, antifiltrational elements, pressure constructions in the form of screens, cores, ponurs and layerings of earth constructions jointly with concrete constructions.

40. The method of the installation of embankments by dumping of soil materials in water shall be applied, as a rule, to clay and sandy soil. At the same time, the availability of insignificant impurity of macrofragmental soil and rocky breeds shall be allowed therein.

41. The embankment installation with dumping of soil materials in water shall be performed in the pioneer way (by dump trucks) in artificial and natural reservoirs, the dimensions of which in the plan shall correspond to the sizes of the erected constructions. The conditions for the installation of reservoirs shall be provided, ensuring the safety and quality of the work performance.

42. The embankment installation within the erected construction or its part shall be performed continuously, ensuring the technological sequence of the main production operations in maps, into which an artificial or natural reservoir of an embankment have been divided previously.

43. The sizes of reservoirs maps and the sizes of embankment dams shall be specified in the project of works and accepted, taking into account their stability, experience of dumping of soil materials in water and technical capabilities of the used construction equipment.

44. When dumping soil materials into maps of natural reservoirs, with the depth of water up to 4.0 meters, the thickness of the poured-out layer shall be established, taking into account the type of soil material and the need of ensuring safe passage of the construction equipment through it after laying. When the water depth in the maps of natural reservoirs is over 4.0 meters, the possibility of dumping of soil shall be determined by the results of experimental works.

45. Dumping of soil materials in the maps shall be performed with ensuring the constancy of the water level therein.

46. The compaction of the poured-out layer of an embankment shall be made evenly under the influence of the mass of vehicles or other construction equipment used for alignment of a surface of the poured-out soil material with providing requirements of the corresponding state standards in the field of architecture, town planning and construction.

47. When transportating the soil material by scrapers, dropping of soil material by them directly into the water shall not be allowed. In this case, bulldozers shall be used for dropping soil material.

48. For the execution of works in winter conditions, special measures shall be taken for protection of soil materials and water from freezing and conditions for their implementation.

49. For working out of technology of the device of an embankment with dumping of soil materials in the water and establishment of necessary process parameters before performance of the main works, the experimental works shall be carried out on the specified section of the erected construction.

Paragraph 4. Requirements to strengthening of slopes of earth constructions and coast of the rivers

50. Types of fastenings of slopes, their geometrical parameters, materials and conditions of application shall comply with the requirements of the state standards in the field of architecture, town planning and construction.

51. Strengthening of slopes and coast during the installation of river hydraulic engineering constructions shall be carried out without mortar.

52. Slopes and coast in their surface part shall be subject to planning, and shall be pro-trawled, cleaned and, if necessary, planned in the underwater part.

53. In need of the installation of rigid fastening for an exception of germination of herbs and extermination of digging animals and insects, the surface of slopes and coast shall be subject to treatment by chemicals (toxic chemicals, herbicides).

54. In need of rigid fastening of slopes and coast, the bases under them, shall be compacted up to design density, taking into account the requirements of the

corresponding state standards in the field of architecture, town planning and construction.

55. Laying of the filter and the installation of preparation device for rigid fastening of slopes under negative air temperature shall be carried out taking into account the measures which prevent freezing of the used soil materials and do not reduce the quality of laying.

56. The installation of the bases protecting fastening of a slope from slipping shall be carried out prior to the beginning of the works on strengthening of slopes.

57. For installation of fastening of slopes layerings, from a layer of macrofragmental soil or a layer of crushed stone on steep slopes, it shall be necessary to use the corresponding construction equipment. At the same time, the layerings planning conditions should be established.

58. The stability of fastening shall be provided, when fastening the shores under water with the stone layer.

59. Fastening of slopes and coast by paving from a stone shall be allowed to be applied upon the impossibility of use of other types of fastenings. At the same time, the corresponding technical and economical study shall be required.

60. The installation of monolithic concrete and reinforced concrete fastenings of slopes with corners from the horizontal $>45^\circ$ shall be performed through the line (in two turns) with the use of the timbering established on concrete beacons.

61. The order and conditions of works, thickness and need of reinforcing of a covering shall be established for the installation of slopes fastenings and coast from monolithic asphalt concrete coverings.

Paragraph 5. Requirements to drilling-and-blasting works

62. The requirements of this paragraph shall apply to drilling-and-blasting works, when developing inserts, ditches and cleaning of the rocky bases and slopes of river hydraulic engineering constructions.

63. When performing drilling-and-blasting works, in addition to the requirements of these norms, the requirements of the state standards in the field of architecture, town planning and construction, the requirement of industrial safety during the explosive works and the requirements of industrial safety shall be observed, when developing mineral deposits by the open method.

64. Drilling-and-blasting works in the process of installation of river hydraulic engineering constructions shall be carried out in compliance with the developed project of drilling-and-blasting works.

65. In terms of safety of the rocky bases and slopes during performing drilling-and-blasting works, the erected constructions shall be subdivided into two categories.

66. Drilling-and-blasting works at construction are in process of the I category are performed without holding special protective measures, and at construction of buildings of the II category - with holding such activities.

67. The drilling-and-blasting works during the construction of the installations of II category shall be performed in compliance with the developed technical specifications, which specify the key process parameters and factors providing qualitative and safe operation, which, with appropriate justification are changed and specified in the process of construction.

68. The development of rocky soils at the facilities of category II shall be done with ledges, with the formation of a protective layer to protect the base and areas of its interface with the slopes from the development of natural and the formation of new cracks during explosions.

69. Loosening of the rocky soil located directly above the protective layer shall be performed with the use of borehole charges with preliminary establishment of conditions of the device and placement of wells under them.

70. Loosening and cleaning of the rocky soil of a protective layer shall be carried out in the technological sequence, providing rational use of the construction equipment and safety of works.

71. When planning the rocky base of a construction for combined reinforced concrete installations, loosening of a protective layer shall be allowed to be made by charges of explosives.

72. For performance of explosive works at the slopes of ditches at the facilities of group II, it shall be necessary to use planimetric detonation with preliminary establishment of its parameters. For the facilities of group I, the expediency of planimetric detonation shall be established in the project of the organization of construction and shall be specified in the project of production of drilling-and-blasting works.

73. The planimetric detonation shall be carried out with formation of a protective layer under adverse geological conditions, for ensuring safety of a rocky surface behind the planimetric plane and protection of slopes from aeration with prolonged influence of the atmospheric phenomena.

74. Cleaning and processing of slopes after planimetric detonation shall be made without application of explosions.

75. The development of a protective layer after planimetric detonation to prepare the surface for laying of concrete, shall be performed in small sections without the use of explosions. The sizes of sites under laying of concrete are specified in the project of works.

76. Admissible parameters of explosions shall be established in need of carrying out explosive works near the newly-laid (up to 15 days) concrete, as well as the protected land and underground constructions, communications and the equipment.

77. Permissible oscillation speeds shall be established to ensure the safety of the protected facilities and the equipment, located close to the place where drilling-and-blasting works are hold. Permissible oscillation speeds for processing equipment shall be coordinated with manufacturers.

78. For elaboration of the technology and parameters of explosions before performing the main drilling-and-blasting works, it shall be necessary to conduct experimental explosions within the similar sections of the installing construction.

Paragraph 6. Requirements to the installation of underground developments (cameras)

79. Underground developments (rooms) of river hydraulic engineering constructions (machine halls of hydroelectric power stations, hydroheat-sink and nuclear power stations, turbine conduits, locks, transformers, leveling reservoirs, pumping, underground pools, installation camers) shall be arranged taking into account the requirements of this paragraph and the state standards in the field of architecture, town planning and construction.

80. For performing of drilling-and-blasting operations during room drivage, the type and necessity of forming of a protective layer during the explosions shall be established, taking into account the safety of surrounding rocky soil. At the same time, the absence and existence of cracks shall be specified in the project, as well as their development and formation in the rocky soil surrounding the room during the drilling-and-blasting works.

81. During room drivage, the penetration of rocky soil beyond its design circuit shall not exceed the admissible values specified in the project. The search of rocky soil causing reduction of thickness of the bearing elements of the chamber shall be prohibited.

82. In the course of works, the existing developed constructions (outlet, supply and transport tunnels, truck and cargo, installation and ventilation shafts) shall be used as construction approaches to the arranged chambers.

In the absence of such a possibility or the insufficiency of the existing developments with appropriate justification (in the project) the new approaches shall be allowed.

83. The order, conditions and methods of works on installation of chambers shall be accepted depending on the height and span of the chambers, existence of their lining , as well as the durability and cracking of the rocky soil surrounding them.

84. The development process of chambers shall be followed by systematic status monitoring and stability of walls. In case of motions of walls in the chamber, it shall be

necessary to reveal the nature of change of motions in time and if necessary to take measures to gain of a timbering of walls by installation of spreader beams or anchors.

85. Measures for decreasing the impact of deformation of walls on tension of elements of the chamber, the material of spreader beams, length of anchors and other parameters necessary for safe works shall be specified in the project.

86. The type of temporary fastening of chambers during their development shall be taken considering durability, cracking and a status of rocky soil.

Paragraph 7. Requirements to performance of concrete works

87. Concrete works in the process of installation of monolithic and precast-monolithic river hydraulic engineering constructions shall be performed, taking into account the requirements of the state standards in the field of architecture, town planning and construction and the present paragraph.

88. During the preparation, transportation and laying of concrete of constructions the measures shall be taken to ensure the achievement of their design characteristics.

89. Mass transportation of concrete mix in the process of installation of constructions, shall be carried out by special vehicles with concrete mixing transport trucks, or ready-mix trucks. The choice of vehicles for transportation of concrete mix shall be made taking into account the remoteness of a construction facility and terms of mix setting period. The capacity of the vehicles accepted for transportation of concrete mix shall correspond to the capacity of the tubs used for the supply of concrete mix.

90. Laying of concrete mix shall be made on the prepared surfaces of constructions.

91. When installing the constructions, concreting shall be made by separate construction blocks. The order of laying for concrete mix within blocks shall be accepted with regard to the elimination of cracking in the concrete due to temperature effects during the hardening process.

92. For timely overlapping of separate layers or catches in the course of concreting of blocks, the terms of their overlapping shall be established, depending on the type and properties of the concrete mix, as well as the temperature conditions of its laying.

93. Laying of concrete mix in blocks shall be performed with the use of layer-by-layer, step and single-layer technologies the choice of which shall be made depending on possible intensity of concreting, the sizes of blocks in the plan and admissible terms of overlapping of layers or catches.

94. The compaction of concrete mix in blocks shall be carried out taking into account the saturation of the structures of constructions with iron reinforcement.

95. Concreting of massive concrete constructions shall be carried out, providing design temperature mode of hardening of the concrete mix.

96. The cooling of concrete in massive concrete constructions shall be carried out in two stages:

1) the first stage - in the course of laying and hardening of concrete for decrease in temperature of an exothermic warming up in the block;

2) the second stage - cooling of concrete in a construction up to the mean annual temperature of external air, upon which, grouting of construction junctures is possible.

At the same time, the acceptable methods of cooling shall be established for each stage.

97. For the performance of works during the winter period, it shall be necessary to establish the corresponding temperature mode for the concreting of constructions, as well as to provide measures for protection of surfaces of concrete from the influence of negative temperature.

Paragraph 8. Requirements to installation works of technology equipment of constructions

98. Installation of technology equipment of river hydraulic engineering constructions shall be made, taking into account the requirements of the state standards in the field of architecture, town planning and construction and the present section.

99. Prior to the commencement of the installation works for accepting the technology equipment of construction, the bases of installation contractors as well as the installation sites of the operational period shall be prepared.

100. For installation of the technology equipment of constructions, the operational cranes shall be used with a preliminary determination of the type of crane runways. At the same time, it shall be necessary to make the choice of installed cranes taking into account the weight, overall dimensions and install conditions of technology equipment, ensuring their stable and reliable work.

101. In the case of a straightforward method of mounting of layered parts of a mechanical and hydropower equipment of constructions, the preliminary preparation of their bases shall be carried out for their installation.

102. The installation of technology equipment shall be carried out without contamination of grooves and the locks and grids set therein.

103. Assembly of separate aggregates and installation of working mechanisms of hydraulic turbines and hydrogenerators shall be made in the zone protected from an atmospheric precipitation and saved from possible hit of construction waste.

104. Installation of a system of regulation, laying and soldering of windings of the stator, a ration of interpolar connections of a rotor of the generator, installation of the cooling system of conducting parts of the generator, thrust bearing and bearings and also launch, adjustment and testing of the installing hydraulic unit shall be carried out at a temperature not lower than +5 degrees Celsius (further - °C).

Paragraph 9. Requirements to cementation of soil

105. Cementation of soil during the installation, reconstruction and expansion of the existing river hydraulic engineering constructions shall be carried out, taking into account the requirements of the state standards in the field of architecture, town planning and construction and the present section.

106. During the combination of works on cementation of soil with general construction works, the sufficient volume of cementation works shall be provided with consolidation of features of their technologies

107. In the process of cementation of soil, it shall be necessary to consider the existence of backwater, partial or full pressure on the structures.

108. The cementation works in the bases of constructions shall be completed prior to the installation of drainages. The relevant conditions shall be created for the cementation of soils.

109. For performance of the cementation works with an average daily ambient air temperature below + 5 °C, the allowable temperature limits for the cemented soils and the solution pumped into the wells shall be established.

110. After completion of cementation of all zones and carrying out total cementation of wells (if it is provided by the project), the trunks of the well shall be tamponated with solution.

Paragraph 10. Requirements for ensuring the river passage during the construction period and to construction of crossing points

111. The scheme for the river passage (ice) during the construction period through unfinished constant and temporary river hydraulic engineering constructions shall be submitted in the project and specified during the work performance.

112. The scheme for the river passage shall be developed, taking into account the configuration of the main constructions, turn and the sequence of their construction, topographical, geological, hydrogeological conditions of the territory of construction, as well as the requirements of navigation and timber rafting (if necessary).

113. For the development of the scheme the river passage, the project shall specify and approve the method of the river passage, providing safe and convenient works with an exception of danger of flooding of the river banks.

114. The works on installation of crossing points shall be carried out in the periods of the smallest expenses and low water levels in the river.

115. The preparation of the bases of the crossing points located above the level (edge) of the water in the river shall be performed in compliance with the regulatory requirements of the Republic of Kazakhstan. Prior to the installation of crossing points, their bases along the rivers shall be surveyed for the assessment of their condition and necessity of advance preparation.

116. Crossing points from soil materials shall be built from soil of useful excavations (ditches, channels and others). The crossing points, which are the part of the main constructions shall be built from the materials and structures specified in projects of these constructions.

117. During the winter period, the crossing points shall be built from the surface of ice, when the bearing capacity of an ice cover is sufficient for the movement of vehicles and work performance.

Paragraph 11. Requirements for the overlap of the rivers beds

118. The scheme for overlapping of the river bed during installation, reconstruction and expansion of river hydraulic engineering constructions shall be submitted in the project and specified during the work performance.

119. The scheme for overlapping of the river bed shall be developed, taking into account the hydrological and geological conditions of the territory, difference at a banquet, discharge and flow rate of water, discharge capacity of the drainage path, the size of the material for overlapping, transport conditions, the loading capacity of the transport and loading facilities.

120. The order of work and deadlines for overlapping the channel on navigable rivers shall be coordinated:

- 1) with the organizations of the river fleet;
- 2) with operational service which regulates reservoirs if they placed on the top bief.

121. The overlapping of the river bed shall be carried out during the interflood period with the minimum flow of water in the river, and on the navigable rivers - at the end of navigation or during the non-navigable period.

122. For development of the scheme for overlapping of the river bed in the project, the method and parameters for overlapping shall be established and accepted, providing safe and convenient works with an exception of danger of flooding of river banks.

123. The preparatory works shall be performed prior to the commencement of works for overlapping of the river bed.

Chapter 6. Requirements for ensuring quality control and acceptance of work

124. The organization, conduct and documentation support for quality control measures and the acceptance of work shall be carried out within the quality management system operating in the construction organization.

125. When installing new, reconstructing and expanding of the existing river constructions, the quality of works shall be monitored via the operational control. Acceptance of work shall be carried out on the basis of the results of the acceptance

control with observance of the requirements of corresponding state standards in the field of architecture, town planning and construction.

126. Monitoring indicators of the soil characteristics, laid in an embankments construction, shall be carried out by sampling. At the same time, the monitored characteristics of soil shall be determined in compliance with the regulatory requirements of the Republic of Kazakhstan.

127. The quality control of the installation of the side prisms of a dam, which are carried out by sketching stone from tiers, shall be made according to the indicators of density and particle size distribution of stones.

128. Quality control of consolidation of the backfill soil (cavities of the bases of constructions), shall be carried out on the basis of the density of dry soil and humidity. In addition, the samples of the backfill soil shall be selected at distance of 20 centimeters from the bases.

129. When dumping soil into water, the following shall be monitored:

- 1) dumping layer thickness;
- 2) uniformity of consolidation of the surface layer of earth by vehicles and mechanisms;
- 3) water depth in the map;
- 4) temperature of a surface of the base of the map and water in it;
- 5) density of the poured-out underwater layer.

130. During the installation of fastenings of slopes and coast from asphalt concrete coverings, the deviation from the covering thickness from the design size shall not exceed 10%. In addition, the indicators of physicomechanical properties of asphalt concrete shall be subject to control.

131. The need for continuous or periodic seismic control when performing drilling-and-blasting works, as well as the procedure for carrying it out and the controlled parameters, shall be specified in the project of drilling-and-blasting works.

132. Concrete mixes shall comply with the regulatory requirements of the Republic of Kazakhstan, and control of their quality shall be carried out in compliance with the requirements of the corresponding state standards. At the same time, for the same concrete elements and products and, if necessary, mass quality control of their concrete, the nondestructive control methods shall be applied.

133. The control of durability, density, water tightness, frost resistance of concrete of monolithic and combined concrete and reinforced concrete installations of constructions shall be performed in compliance with the regulatory requirements of the Republic of Kazakhstan.

134. In case of antifiltrational purpose of cementation of soil, the quality control of works shall be carried out by drilling, hydraulic approbation and cementation of

control wells. At the same time, the number of control wells shall be accepted, as a rule, ranging from 5 up to 10% of total number of working wells.

135. The quality of cementation works on the section of the antifiltrational veil shall be recognized as sufficient if specific water absorptions in the control wells in terms of size and permissible deviations conform to the project requirements.

136. The method of quality control over the works on consolidation cementation shall be established by the project and provide hydraulic approbation and cementation of control wells or the determination of deformation properties of soil by geophysical methods. The application of the specified measures shall be allowed at the same time.

Chapter 7. Requirements for environmental protection

137. Measures for environmental protection during the installation of new ones, reconstruction and expansion of the existing river hydraulic engineering constructions shall be specified in the project and established in compliance with the current legislation, standards, norms and documents of the legislative bodies regulating the rational use and protection of natural resources.

138. Prior to the commencement of filling of a reservoir, rare and endangered species of flora and fauna shall be gathered and taken out from its zone and necessary conditions for their development and reproduction shall be created, as well as the measures shall be taken for scientific research, engineering protection or transfer of historical and cultural monuments.

139. Prior to overlapping of the river beds, fish passing constructions shall be erected, and prior to filling a reservoir - spawn growing farms and fish farms shall be constructed as well.

140. Pits of soil materials for dumping of earth constructions shall be placed in flooding zones.

141. The territory allocated for temporary use during installation works, warehousing, storage of materials or placement of the equipment shall be recultivated and brought to the conditions suitable for further use upon the termination of installation works.

142. During the installation of antierosion constructions with the use of gabions, it shall be prohibited to apply the construction materials polluting the surrounding environment.

143. It shall be prohibited to develop pits of local stone materials in the water-protection zone of reservoirs.

144. During the installation of gabionny constructions, the methods of works shall be selected, excluding the ingress of pollutants and substances into the water. Warehousing and storage of the contaminating materials shall be prohibited within the water-protection zone.

145. It shall be necessary to arrange the barriers equipped with the frightening-off devices (reflectors, warning lights, sound signals and others) during the installation works on the migration routes of animals.

Appendix 4 to order No. 249-nk of the Chairman of the Committee for Construction, Housing and Utilities Services of the Ministry for Investments and Development of the Republic of Kazakhstan dated December 5, 2018

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Key words: hydraulic engineering constructions; waterways; onshore hydraulic engineering constructions, protective constructions.

АЛҒЫ СӨЗ

1 ӘЗІРЛЕГЕН:	"Қазақ құрылыс және сәулет ғылыми-зерттеу және жобалау институты" АҚ
2 ҰСЫНҒАН:	Қазақстан Республикасының Инвестициялар және даму министрлігінің Құрылыс және тұрғын үй-коммуналдық шаруашылық істері комитеті
3 БЕКІТІЛГЕН ЖӘНЕ ҚОЛДАНЫСҚА ЕНГІЗІЛГЕН:	Қазақстан Республикасының Инвестициялар және даму министрлігінің Құрылыс және тұрғын үй-коммуналдық шаруашылық істері комитетінің төрағанын 2018 жылғы 5 желтоқсандағы № 249-нқ бұйрығымен

PREFACE

4 DEVELOPED BY:	Kazakh research and project Institute of Construction and Architecture JSC
5 SUBMITTED BY:	Committee for Construction, Housing and Utilities Services of the Ministry for Investments and Development of the Republic of Kazakhstan
6 APPROVED AND ENACTED BY:	By order No. 249-nk of the Chairman of the Committee for Construction, Housing and Utilities Services of the Ministry for Investments and Development of the Republic of Kazakhstan as of December 5, 2018

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ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ҚҰРЫЛЫС НОРМАЛАРЫ CONSTRUCTION STANDARDS OF THE REPUBLIC OF KAZAKHSTAN

ГИДРОТЕХНИКАЛЫҚ ТЕҢІЗ ЖӘНЕ ӨЗЕН КӨЛІК ҚҰРЫЛЫСТАРЫ HYDRAULIC ENGINEERING OFFSHORE AND RIVER TRANSPORT CONSTRUCTIONS

Date of introduction - 2018-XX-XX

Chapter 1. Field of application

1. These construction standards shall apply to the works on installation, reconstruction and expansion of the operating hydraulic engineering offshore and river transport constructions, both in protected and open water areas of seas and rivers.

2. The scope of these construction standards shall be the uniform integrated safety requirements for the execution of preparatory and installation works in the production of general construction, dredging and underwater engineering, construction of the bases, dumping, arrays, berms, bases and establishment of shore protection, embankments, berthing, protective facilities during construction, reconstruction and expansion of hydraulic engineering offshore and river transport constructions, as well as during the manufacture of constructions and elements for the installation of these constructions on landfills of the construction organizations.

3. The requirements of construction standards shall not apply to construction and reconstruction of hydrotechnical power plants, dams, ports, navigable and ship-repair enterprises.

Chapter 2. Normative references

For application of these construction standards the following references shall be used:

The Law of the Republic of Kazakhstan dated July 16, 2001 "On Architectural, Town-Planning and Construction Activities in the Republic of Kazakhstan" (hereinafter - the Law);

Decree of the Government of the Republic of Kazakhstan No. 1202 dated November 17, 2010 "On Approval of Technical Regulations "Requirement to Safety of Buildings and Constructions, Construction Materials and Products";

Order of the Minister of investments and development of the Republic of Kazakhstan No. 537 dated April 30, 2015 "On Approval of the Rules for Navigation on Internal Waterways" (registered in the Register of State Registration of Regulatory Legal Acts under No. 11347) (hereinafter referred to as the Rules for Navigation on Internal Waterways);

Order of the Minister of Internal Affairs of the Republic of Kazakhstan No. 439 dated June 23, 2017 "On Approval of Technical Regulations "General Fire Safety Requirements" (registered in the Register of State Registration of Regulatory Legal Acts under No. 15501);

Note: while using them, it shall be advisable to verify the validity of the reference documents according to the information catalogs "List of Regulatory Legal Acts and Regulatory Technical Documentation in the Field of Architecture, Town-Planning and Construction, in Effect Within the Territory of the Republic of Kazakhstan", "Index of Normative Documents on Standardization of the Republic of Kazakhstan" and "Index of Interstate Normative Documents on Standardization of the Republic of Kazakhstan", developed annually as of the current year and the corresponding newsletters, issued on a monthly basis, the magazines and information indexes of standards published in the current year.

Chapter 3. Terms and definitions

4. The following terms shall be used with the corresponding definitions in these construction standards:

1) dam - the retaining hydraulic engineering construction on a waterway for the rise of water level and (or) for creation of a reservoir;

2) bief - the section of the river between two adjacent dams on the river or the section of the canal between two locks where top bief of the dam - the part of the river is higher than a retaining construction (a dam, a lock), and lower bief - the part of the river, which is lower than a retaining construction;

3) hydraulic engineering constructions - the engineering constructions used for water resources management, water supply to water users, water supply and water disposal, prevention of harmful effects of waters;

4) acceptable level of risk of failure of the hydraulic engineering construction - the document, in which safety of the hydraulic engineering construction is proved, measures for safety of the hydraulic engineering construction are determined with its class and a package of measures, accepted by the economic entity for the purpose of accident prevention and ensuring readiness for localization, accident elimination and its consequences;

5) safety of the hydraulic engineering construction - the condition of a hydrotechnical construction allowing to provide protection of life, health and legitimate interests of people, the environment and economic facilities;

6) the declaration of safety of the hydraulic engineering construction - the document in which safety of the hydraulic engineering construction is proved, measures for safety of the hydraulic engineering construction are specified with its class and a package of measures, accepted by the economic entity for the purpose of accident prevention and also ensuring readiness for localization, accident elimination and their consequences;

7) providing of safety of water management systems and constructions - development and implementation of measures for warning of emergence of accidents of water management systems and constructions;

8) integrated hydraulic engineering constructions (water-engineering systems) - group of technologically connected hydraulic engineering constructions with different functions located in one alignment, meliorative hydraulic engineering constructions - trunk and distribution channels, gateways, regulators;

9) hydraulic engineering constructions for the water transport - navigable gateways, logslopping, ports, ship elevators, channels of a dam and also special constructions on ensuring traffic - beacons, rafting canals, and port constructions (piers, breakwaters, piers, moorings, docks, sheds, slips) and others;

10) emergency situation - the situation in a certain territory which developed as a result of accident, the fire, harmful effects of dangerous production factors, a natural hazard, accident, natural or other disaster which can cause or caused, harm to human health or the environment, significant material damage and violation of living conditions of people.

Chapter 4. Objectives and Functional requirements

Paragraph 1. Objectives of Statutory requirements

5. The objectives of the statutory requirements shall be providing of safety for hydraulic engineering offshore and river transport constructions, taking into account the mechanical safety for durability, operational reliability and suitability, efficiency and durability, without allowing emergence of unacceptable risks of infliction of harm to health and life of people and the environment.

Paragraph 2. Functional requirements

6. Pursuant to technical, process and ecological parameters, the hydraulic engineering offshore and river transport constructions shall be designed in such a way to ensure the following functional requirements during their installation and operation:

1) mechanical durability and stability of hydraulic engineering offshore and river transport constructions shall provide, that during operation of a construction, they withstand all types of mechanical and technological impacts foreseen by the project without damages and accidents;

2) fire safety of the facility - fire prevention, restriction of ignition and spread of fire and smoke, the setting of smoke removal and maintaining bearing capacity of a building construction for a period of time, established by applicable regulations;

3) hydraulic engineering offshore and river transport constructions shall be projected and installed in such a way, to provide constructive technology solutions on prevention of the development of potential dangerous damages and emergencies, which can arise during the period of installation and operation, create a safe condition for the movement of vehicles, as well as the safe sanitary and hygienic conditions during the operation of constructions, preventing threat to the health and life of people, animals and the environment as a result of emission of toxic substances and pollution or poisoning of the water environment.

Chapter 5. Specific operational requirement

Paragraph 1. General requirements

7. The requirements of these construction standards shall apply to construction, reconstruction and expansion of the operating hydraulic engineering offshore and river

transport constructions (hereinafter referred to as - hydraulic engineering transport constructions) in compliance with the requirements of technical regulations of the Republic of Kazakhstan "Requirements for the Safety of Buildings and Constructions, Construction Materials and Products", "General Fire Safety Requirements" on safety of hydraulic engineering transport constructions and creating favorable conditions of installation (reconstruction) and operation of hydraulic engineering transport constructions, avoiding unacceptable risks of infliction of harm to the health and life of people and the environment.

8. Hydraulic engineering transport constructions shall comply with the requirements of technical regulations and the state standards in the field of the architecture, town planning and construction, approved according to Subparagraph 23-16) of Article 20 of the Law (hereinafter referred to as - the state standards in the field of architecture, town planning and construction), on ensuring mechanical durability and stability to prevent risks of collapse and damage to building constructions, uninterrupted operation and traffic safety of vehicles, profitability of maintenance of facilities, as well as the requirements for the protection of human health and the creation of safe working conditions for the service personnel and environmental protection.

9. Hydraulic engineering transport constructions shall be divided into permanent and temporary.

The constructions used only during the installation period and repair of constant constructions shall be considered as temporary ones.

10. Permanent hydraulic engineering transport constructions, damage or destruction of which leads to disruption or termination, or reduction of shipping, river and sea ports, ship-building and ship-repair enterprises, may lead to the termination of the movement of sea and river vehicles, shall be projected in compliance with the requirements for the integrated use of water resources, schemes of use of water currents, taking into account the data and provisions, contained in programs for improving the structure of development and production forces and industrial facilities, town-planning documentation and other materials, obligatory for use.

11. The types of hydraulic engineering transport constructions, their parameters and configuration shall be selected on the basis of comparison of technical and economic indicators of options and taking into account:

- 1) functional purpose;
- 2) places of installation, environment of the area (topographical, hydrological, climatic, engineering-geological, hydrogeological, seismic, biological and others);
- 3) conditions and methods of works, existence of human resources;
- 4) development and placements of industries, including changes and development of traffic flows and growth of goods turnover, shipbuilding and ship repair, complex

development of sites of sea coasts, including development of oil and gas fields on the shelf;

5) the water management forecast of change hydrological, including ice and thermal, the mode of the rivers in the top and lower biefs; sludging by alluvium and rearrangements of the course and coast of the rivers, reservoirs and seas; overfloodings and floodings of territories and engineering protection of the buildings and constructions located on them;

6) environmental impact;

7) influence of construction and operation of the facility on social conditions and health of the population;

8) conditions of permanent and temporary operation;

9) requirements for economical consumption of the main construction materials;

10) the possibility of developing minerals, local construction materials and the like;

11) providing esthetic and architectural requirements to the facilities located on coast of water currents, reservoirs and seas.

12. The projects of hydraulic engineering transport constructions shall provide:

1) the reliability of constructions at all stages of their construction and operation;

2) maximum cost efficiency of construction;

3) permanent instrumental and visual monitoring of the state of constructions, as well as the environmental and man-made impacts on them;

4) protection of mineral deposits;

5) necessary shipping conditions;

6) safety of the fauna and flora, in particular, the organization of fish-protective measures.

13. Hydraulic transport facilities include facilities, directly related to water vehicles including ports, navigable gateways, ship elevators, dam channels, as well as special constructions, ensuring the functioning of hydraulic engineering constructions and traffic - port constructions (piers, breakwaters, moorings, docks, sheds, slips), shore protection, embankments, berthing and protective facilities and etc.

14. Reconstruction of permanent hydraulic engineering transport constructions shall be made with the purpose of:

1) improvement of the main hydraulic engineering constructions and their bases with an increased risk of accident due to the aging of constructions and bases or increase in external influences, as well as in case of increase in the economic, environmental and social consequences of possible accident;

2) ensuring (increase) water passes capacity of the main hydraulic engineering constructions;

3) replacements of the equipment due to its wear;

4) increases cargo-and shipping ability of ports and navigable constructions;

5) improvements of environmental conditions of a zone of influence of the water-engineering system and for the purpose of implementation of other economically reasonable measures.

15. During the process of reconstruction it shall be necessary to provide the maximum use of the existing elements of the constructions which are in the normal operational state.

Paragraph 2. Requirements to the safety of hydraulic engineering transport constructions

16. As part of the project of hydraulic engineering transport constructions, the special project shall be developed to monitor their operation and a state, both in the course of construction and in the course of operation for timely detection of defects and adverse processes, assignment of repair measures, prevention of failures and accidents, improvement of the modes of operation and assessment of level of safety and risk of accidents.

17. The project of field observations shall include:

- 1) the list of controlled loadings and impacts on a construction;
- 2) the list of controlled and diagnostic indicators of a condition of a construction and its base, including the safety criteria;
- 3) program and composition of instrumental and visual observations;
- 4) specifications and drawings for installation of the control instrumentation, the specification of measuring instruments and devices;
- 5) the block diagram and technical solutions of a system for monitoring of the state of constructions, environmental and technogenic impacts on them, including the composition of its main hardware and software;
- 6) instructive documents and methodical recommendations for conductive field observations over the work and the state of constructions.

17. Before commissioning and during the operation of hydraulic engineering constructions, the safety criteria shall be specified on the basis of results of field observations of the state of constructions, loadings and influences, as well as the changes in the characteristics of materials of constructions and the bases, constructive decisions.

18. The location of temporary buildings and constructions for installation of facilities of hydraulic engineering transport constructions, as well as the placement of vehicles in premises (garages) or on special platforms in the territory of the building site, shall be carried out with observance of fire-prevention gaps and comply with the construction plan developed as part of the project of the organization of construction, taking into account the requirements of the rules and existing design standards, approved in accordance with the established procedure.

19. The construction site, as well as fire and explosion hazardous and fire-dangerous premises (equipment) shall be provided with safety signs, posters for safe operation and fire safety. Instructions on fire safety measures, lists of voluntary fire teams, procedures for attraction of forces and means for fire extinguishing and other organizational documents, instructions, posters shall be posted in a prominent places.

Chapter 6. Requirements to construction

Paragraph 1. Basic provisions

20. For the installation of new, as well as the reconstruction and expansion of the existing facilities of hydraulic engineering transport constructions, the design and estimate documentation shall be developed in compliance with the requirements of the existing normative and technical documents.

21. The organization of construction activities for hydraulic engineering transport constructions shall be commenced with the development of the project of the organization of installation, in the course of which the following shall be taken into account:

1) difficult engineering-geological and engineering and hydrogeological conditions of installation, caused by their variability including technogenic and also difficult town-planning and planning conditions;

2) application of special methods of works, development of new methods of installation, introduction of highly effective modern mechanisms of domestic and foreign production.

22. When installing the hydraulic engineering transport constructions, it shall be necessary to specify the length of a construction block in the project of the organization of installation from a condition of ensuring the minimum probability of damage by storm and motions of ice of unfinished facilities.

23. The procedure for the work performance on navigable sections of the seas and the rivers shall ensure the safe passage of vessels and watercrafts during construction. Navigable sites of the water area in places of installation and construction works shall be equipped with navigation barriers.

24. Bases of floating construction means shall be located on the coast, having natural or artificial protection from disturbance and influence of moving mass of ice.

25. Storm warnings and other emergency messages shall be transmitted in time to the watercrafts and vessels, used in the course of installation to ensure their safe operation.

26. During the reconstruction of the existing hydraulic engineering transport constructions, as well as during their installation and expansion under the conditions of the operating enterprise or in its immediate vicinity, the installation works shall be

performed in compliance with the instructions of the construction project using the methods, that ensure the safety of the existing buildings and constructions, underwater and underground communications located in the construction zone and which are not subject to demolition, as well as those, which restrict the operational activity of the operating enterprise as minimal as possible.

27. The procedure for the work performance on the navigable rivers shall provide safe, with necessary intensity, passage of vessels and watercrafts during the construction period. Navigable sections of the water area in places of carrying out of installation and construction works shall be equipped with signs of a navigation protection.

28. When installing the river hydraulic engineering transport constructions, incomplete and temporary constructions or their parts shall be protected from damages in the period of floods, motions of ice, storm and squalls, wave influence, piles and blows of vessels, watercrafts and items floating on water.

Paragraph 2. Requirements to carrying out of preparatory works

29. For the performance of installation and construction works on the basis of the project for the organization of construction works, the project shall be developed for the construction of hydraulic engineering transport constructions, comprising:

1) the specified construction master plan of the facility with the location of moorings, permanent and temporary transport routes, ports (places) - shelters, the networks of power supply, crane ways and zones of their action, platforms of enlarging assembly, warehouses and other shoddy constructions and devices necessary for construction;

2) solutions according to the security regulation in compliance with the requirements of building regulations and departmental safety regulations and production sanitation.

30. Prior to the commencement of the main construction works of facilities, the following preparatory work shall be performed:

1) creation by the customer of reference geodetic network (high-rise reference markers, main axes of constructions, supporting construction grid, red lines);

2) fixing the borders of the construction site in nature and determining water areas, establishing of boundary signs, which shall also be carried out at the expense of the customer;

3) construction site development - clearing of the territory of construction, demolition of the buildings, which are not used in the course of construction and other works;

4) creation of warehouse, workshops and subsidiary production, serving the construction industry;

5) setting or mounting of temporary inhabited and production constructions, as well as the installation, in whole or in part, of those permanent port facilities (enterprise), which are provided for use for the construction needs (for example: power network, a water supply system, roads, housing and so forth);

6) engineering preparation of the construction site - first-priority works on the planning of the territory, providing the organization of temporary drains of surface waters, transfer of the existing underground and elevated networks, setting of permanent or temporary access railway tracks and highways, installation of moorings, and in some cases, navigable routes, the setting of temporary or permanent sources and networks of water supply and power supply, the setting of a telephone and radio communication;

7) organization and construction of the polygon for production of reinforced and concrete installations (park of arrays).

31. The water area sections where the movement of construction watercrafts is provided, shall be tralld and, if necessary, inspected by divers. The objects and obstacles found in the course of inspection and creating danger to normal navigation, shall be removed, and in case of impossibility of their removal, - indicated by floating navigation signs.

32. The depths, which ensure the safe operation of constructional watercrafts, shall be created and maintained on these sites during the entire period of construction.

33. For ensuring operational management and control of work of the fleet used in construction, it shall be necessary to organize the round-the-clock radio communication of all watercrafts with the offshore control office for the entire period of their use.

34. Preparatory work shall be conducted with an obligatory accounting of climatic, transportation and economic conditions of the area of construction, as well as with regard to the requirements of environmental protection.

35. Geodetic works during the construction period shall be carried out with a breakdown of the general or main axis of a construction facility, as well as the axes and crucial points of its elements. The newly established planned marking network shall serve as the basis for carrying out of axes of constructions and mass works.

36. The points of a geodetic marking basis shall be fixed with signs in the form of piles or marked massifs for the installations located on the water area, upon the impossibility of the setting of a coastal marking basis.

Paragraph 3. Requirements to carrying out construction and installation works

37. The project for performance of dredging and alluvial works shall contain:

1) justification of the selected method of the works the required composition of vessels and other technical means;

- 2) a list of preparatory and auxiliary works;
- 3) a list of volumes of dredging works and conditions of their production;
- 4) calculation of the key operational performance of the dredge and soil-and-transport fleet;
- 5) calculation of the performance and calendar period;
- 6) the recommended operation modes of vessels of a dredging caravan;
- 7) measures for providing vessels of a dredging caravan with fuel, sweet water, operational materials and navigation repair;
- 8) technical and economic indicators and efficiency of works;
- 9) schedule of execution of dredging works;
- 10) working schedule of the soil-and-transport fleet;
- 11) a complex of measures providing navigation safety of dredges and other vessels, being a part of a dredging caravan;
- 12) technology roadmaps or schemes of works and schemes of arrangement of folding brow marks and strong points;

38. The dredging works shall comply with the International International Regulations for Preventing Collisions at Sea (annex to the Convention on the International Regulations for Preventing Collisions at Sea (London, October 20, 1972), Navigation Rules for Inland Waterways, specifying notices to mariners of the obligatory resolution on port, to which the area of performance of dredging works, departmental instructions for ensuring accident-free operation of vessels of the dredging fleet, the Instruction on Precautionary Measures In the Course of Performance of Dredging Works under the terms of estimated contamination of soil by explosive items, general and provided by the project, or by the specification (detention task) of the requirements for environmental protection.

39. Works on the establishment of the pile bases shall be performed according to working drawings, the construction project, the project of the work performance, compiled with consideration of the local conditions and the requirements of the state standards in the field of architecture, town planning and construction.

40. The construction project for pile installations shall be developed by the organization, which executed the project of a construction taking into account the solutions to the installation of the pile base, the methods of the organization and means of mechanization of the pile works, previously coordinated with the construction organization and shall also include the organizational and technological schemes of construction of pile installations and the description with justification of the accepted methods of production of pile works.

41. The pile works under difficult hydroweather and engineering-geological conditions (the water area opened for over three points disturbance, unstable platforms with possible formation of landslides), as well as under the conditions of high traffic

flow, shall be carried out in accordance with the projects of works, developed as a rule, upon the request of the construction organization, based on the construction project.

42. Prior to layering of a natural stone or crushed stone in water, the underwater base shall be prepared (diving survey and necessary clearing shall be conducted as well). Inspection and, if necessary, the clearing of the base shall be repeated every time after storm or long breaks in work immediately before its resumption.

43. When the top of dumping is located at a depth of 4 meters (hereinafter referred to as - the m) and more from the water level, a stone shall be poured out by means of barges with the drop-down bottom. The specific place of unloading of each arriving vessel shall be specified by measurements and designated by temporary anchor buoys.

44. It shall be allowed to perform dumping of a stone with the bulldozer from the pontoon equipped with the barrier excluding a possibility of falling of the bulldozer from a pontoon.

45. Dumping of stone materials under water into the base of constructions shall be performed with the use of gadgets and devices, preventing dispersion and losses of the material which is poured out under water under the influence of a current and disturbance.

46. Dumping of a stone into the core of a construction shall be made in compliance with the working drawings and the project of works. In working drawings, the dumping of a stone into the core of a construction shall be:

1) the plan with a design axis and also the upper and lower brows tied to the main marking lines of a construction;

2) the cross profiles corresponding to the plan accepted for works with the construction escalations calculated on estimated setting of a construction and also kernel profiles on the project;

3) requirements imposed by the project to quality of a stone (the weight, a form, the mark on durability, the mark on frost resistance and another).

47. Slopes and a crest above the core of a protective construction shall be carried out according to working drawings and the project of works.

48. Working drawings of slopes and a crest shall contain:

1) the plan of a construction with the design lines (axes, the upper and lower brows, borders sketches or calculations of boulders and so on) tied to the main marking lines of a construction;

2) the cross profiles corresponding to the plan accepted for works with the construction rises calculated on estimated setting of a construction and also profiles of slopes and a crest on the project;

3) requirements imposed by the project to a stone (the weight, a form, the mark on durability, the mark on frost resistance and other).

49. The covering of slopes and a crest of a construction from shaped blocks shall be made according to the working drawings of a construction and schedules of works providing timely protection of a core of a construction from damage due to disturbance

50. Immediately before laying the shaped blocks, the condition of stone layering shall be verified.

51. Laying of shaped blocks shall be carried out with the observance of the following requirements:

1) first of all, a number of the curbed and shaped blocks or massifs limiting the laying shall be installed;

2) deviations of extreme ranks of shaped blocks from the design line of laying shall not exceed the admissible sizes;

3) the laying of shaped blocks shall be made, first of all, in an external (sea) part of a construction. The shaped blocks on the slope shall be laid in longitudinal ranks, consistently moving from below to up;

4) the deviation of the actual cross-sectional area (profile) of the laying from design shall not exceed the claying top, admissible at obligatory observance of a design mark;

5) laying shall be made to ensure its design density and the greatest possible adhesion of blocks was provided;

6) works shall be performed under the disturbance within the allowable limits.

Paragraph 4. Requirements to installation of constructions

52. Construction of installations from ordinary massifs shall be performed by separate production of concrete arrays with the laying of them subsequently.

53. Working drawings of arrays laying shall contain:

1) the plan of the first (lower) course of arrays of a construction, tied to the base marking lines of a construction with the indication of the sizes and types of arrays, values of bandaging of seams of a laying and places of sedimentary seams; the first course of arrays edges of a stone bed and border of an alignment by their types are also specified on the plan;

2) the plans of each subsequent course of arrays, tied to the plan of an underlying course, with the indication of the same data as in "a" by the sizes and types of arrays, bandaging of seams and sedimentary seams;

3) the cross-sectional profiles of a wall corresponding to the plans from arrays, cross and longitudinal profiles of a laying of support or the heads, with the indication of the sizes and types of arrays, construction rises and biases, values of bandaging of seams of a laying, profiles of a bed, the bermen and batter arrays set on a bed, marks of ditches of a bed and each course of a laying;

4) the facades of constructions corresponding to plans and profiles of a laying from arrays (for a wall - one facade from the sea side, for support and the heads - facades on all perimeter), with the indication of the sizes and types of arrays, values of bandaging of seams of a laying, places of sedimentary seams, marks of a ditch, bed and each course of a laying;

5) admissible limit deformations and movements of a laying or the requirement for their stabilization in the course of the laying, after its completion, aging and result of loading, for those cases when the latter shall be envisaged by the project and other specialization requirements.

53. Immediately prior to laying the arrays, an underwater survey of a bedding surface shall be made. In case of its violation it shall be necessary to perform the restoration of the bedding surface according to the project.

54. The first array of a support or a head part of a construction shall be laid within on the edge of a support or a tip, perpendicular to the longitudinal axis of a construction. Verification of the provision of the first set array shall be made at the four corners with the use of geodetic tools.

55. Installation of protective and berthing facilities shall be performed from the giant arrays, made of steel concrete in monolithic or in assembly options with the subsequent mounting.

56. Mounting of giant arrays shall be carried out at the specially organized berths.

The girders of the stocks shall be placed on the support by level. The level of the top of girders shall be aligned by laying of linings under them from the sheet steel of different thickness.

57. When installing the elements of giant arrays it shall be necessary to observe the following requirements:

1) installation shall be conducted by means of the mounting mechanism directly on reference sections on axial risks, as close as possible to the designed position;

2) install the elements without pushes, avoiding blows to adjacent elements;

3) not to exempt the installed element from a strapping before the end of adjustment of its position and reliable fixing;

4) to apply mounting arc spot welding for the fixation of elements;

5) to check vertical and horizontal positions of elements on the level and a plumb.

58. When erecting protective and berthing facilities of reinforced concrete cylindrical shells of large diameter, the links of large diameter shells with horizontal segmentation shall be made on specially equipped landfills with the stands for the manufacture of shells located in the area of floating cranes, which is used to assemble and dismantle the formwork, supply reinforcement and concrete mixes.

59. When installing the embankments of angular type (buttress, with internal or external anchors) made of precast concrete elements, depending on local conditions, it

shall be necessary to apply construction methods: "in water" or "dry". In the first case, they shall be assembled from the enlarged blocks previously mounted ashore from separate elements.

When installing constructions by "dry" method on setting soil, the works on replacement of weak soil of the base or on consolidation of them shall be previously performed in compliance with the special project.

60. Works on installation of the upper construction, installation of mooring and fender devices, shall be started after filling of bosoms with soil to the mark provided by the project and stabilization of the underwater part of a construction, determined on the basis of the observation materials. Breakdown of the surface construction shall be made according to the executive working drawings, taking into account the actual position of the installed blocks.

61. Installation of port hydraulic engineering transport constructions from a steel groove shall be carried out in accordance with the working drawings, the project of the organization of construction, the work performance project, developed taking into account the construction conditions on the ground.

62. The project for organizing the construction of a groove construction shall be developed taking into account decisions on the use of construction materials and constructions, methods of organizing the construction and assembly works, previously coordinated with the construction organization, and includes organizational and technological schemes for the construction of groove constructions, the description and justification of methods of production of groove, as well as other complex installation and construction works. In addition, the design organization, which have designed the most complex constructions, shall develop drawings or projects of the corresponding guide templates and other devices for immersion of the groove.

63. Necessity of fixing of the groove subject to influence of waves and ice, shall be determined by the design organization that developed the design project of a construction with possible loads of the groove during the construction period, a profile of the groove, its free length and other conditions of construction. The design organization shall develop the schematic diagrams of protection and working drawings, or the project of fastening of the groove.

64. Installation of berths of the type of single-anchor bolverk and a two-anchor cutting bolverk with an assembled superstructure under the normal and facilitated ice conditions shall be performed with the use of the reinforced concrete groove of rectangular and T-shaped cross-section.

65. Performance of dredging works shall be carried out in accordance with the project requirements of works.

66. The setting of a ditch of a construction shall be conducted according to the project of works, taking into account the peculiarities of the local conditions and

methods of immersion of a groove. With coherent soil and impossibility of bottom erosion during works, the setting of a ditch shall be carried out without the soil shortage. In sandy and incoherent fine-grained soil, in case of immersion of a groove by undermining and having significant flow rates, the setting shall be carried out with a soil shortage from the water area. The value of a shortage shall be determined, depending on the speed of a current, the type of soil of the base and the intensity of operation of washout devices. This value shall be established on a trial basis.

67. Construction of trestle berthing facilities with the combined upper building shall be carried out on previously strained steel concrete piles or hollow piles covers.

Works on storage, transportation and supply of steel concrete piles and piles covers to the place of immersion, as well as their immersion in designed position shall be made in compliance with the project requirements of works.

68. Prior to the installation of elements of the upper structure, the works shall be performed to strengthen the submooring slope, to cut down the heads of piles, piles covers to a design mark, to survey the piles, piles covers, to eliminate the defects noticed on a surface of piles, to establish the heatwaterproofing protection for them in a zone of variable level as well as the preparatory works, according to the project of works, providing the appropriate accuracy of mounting of elements and the reliability of their temporary detachment for the period of grouting, and the set of design concrete strength (installation of collars, ties and others).

69. It shall be necessary to start the setting of a soil submooring slope after the immersion of piles, piles covers and preliminary check with the measurements of the depths of compliance of the slope of soil with the design profile.

70. It shall be necessary to pour out the slope prior to the setting of the upper structure with simultaneous tiered protection of its stone layering.

Paragraph 5. Installation of bank protection constructions

71. The organization of shore protection for the protection of the coast of sea and river port water areas, slopes of earth protective dams, as well as the open coast of the seas, lakes, rivers and reservoirs shall meet the requirements of the state standards in the field of architecture, town planning and construction, and works shall be performed in compliance with the project requirements of works.

In order to avoid washout of the protected coastal slopes with the spring and storm waters, which are flowing down from above, the proper discharge of the surface water shall be performed prior to the commencement of the protective works and in the course of construction.

72. The concealed works (planning of slopes, the setting of the return filters and crushed-stone preparation, bases, fittings of reinforced concrete monolithic plates,

ditches under the bases of sea walls, stone beds and others) shall be accepted and filed under the relevant acts before the subsequent works.

73. Planning of a dry surface of the protected earth slopes and coast shall be allowed to perform depending on applied type of protection by cutting or cutting and laying of soil.

74. If in the course of planning of slopes there are searches, such as, the soil cutting with the depth exceeding the permissible deviations from the design surface of a slope, then they shall be layered with the slope soil with the subsequent consolidation.

75. The nonwoven filtering synthetic materials (dornit, needle punched cloth from short mylar fibers and others) shall be applied as the return filter according to projects in the form of a continuous covering of a slope, separate strips under seams and gaps in coverings, as well as being attached to the covering structural elements along their perimeter.

76. The slope protected by concrete and reinforced concrete slabs shall be planned previously only by soil cutting.

Planning with soil filling shall be allowed if the bedding is compacted to the density of a natural base.

77. The surface slopes protected by gabions, shall be leveled with the filling of holes and hollows with sand or stone chippings.

The materials used for gabions shall meet the requirements of the existing standards and norms.

78. The flooded coastal slopes shall be planned by cutting of soil and adding with incoherent soil.

79. The steel concrete and asphalt concrete coverings applied to protection of underwater parts of coast of the rivers, shall be laid on the flooded slope normally to the line of the coast the whole maps (mats), the lengths of which are assigned by the project, and width of the maps shall be made approximately equal to the length of a drum.

80. Ditches for the bases of sea walls shall be developed with the observance of guidelines for the project of the base for the establishment of shore protection constructions.

81. The sea walls placed on landslide and unstable sections of a coastal ledge, shall be built by separate non-adjacent sections according to the project.

82. Wave canceling covers from shaped arrays and a stone shall be applied to those types and the sizes, that are easy to manufacture, provide reliable protection of the coast, possess a good mutual clinging and necessary stability.

The core of the wave canceling cover shall be made from an unassorted stone. Small fractions of stone material shall be poured into the lower and central part of the core.

83. Breakwaters from concrete gravitational arrays shall be arranged on the prepared bases and the mounting of arrays of a breakwater shall be conducted towards the flow of sediments for the purpose of their accumulation beyond the wave breaking space.

84. Shore protection measures shall be also performed by the setting of artificial shore protection beaches. Installation and replenishment of artificial beaches shall be carried out by transfer of beach material from the places of its accumulation or pits by the land or water transport and also by a refilling.

85. The design of beach dumping shall be made only above the sea front. In the remained part, the washed or poured out sand acquires a natural profile under the influence of waves.

Paragraph 6. Installation of hydraulic engineering transport constructions of the ship-building and ship-repair enterprises

86. The works on installation of berthing, shore protection and protective facilities, lifting and trigger constructions in the form of: dry and bulk docks; loading dock sections; slips; constructions for supporting the floating docks at the ship-building and ship-repair enterprises shall be carried out in compliance with the requirements of separate projects for the organization of construction and the projects of works, developed according to the project for the organization of construction (reconstruction) of the ship-building and ship-repair enterprises.

87. General construction and special construction works during the construction of buildings shall be performed with the observance of the requirements of state regulations in the field of architecture, town planning and construction.

88. The organization of works on installation of hydraulic engineering transport constructions under the conditions of the operating ship-building and ship-repair enterprises shall be coordinated with the plans of production activities of the enterprises.

89. The preparatory works shall be completed prior to the main installation, in compliance with the project of the organization and the calendar schedule of construction.

90. Construction (reconstruction) of lifting and trigger facilities in the form of: dry and bulk docks; loading dock sections; slips; constructions for supporting of the floating docks shall be performed in accordance with the design and estimate documentation of installation (reconstruction) of the ship-building and ship-repair enterprises.

Paragraph 7. Requirements for prevention of emergency situation

91. As part of the design and estimate documentation for installation (reconstruction) of hydraulic engineering transport constructions, the section "Engineering and Technical Measures for Prevention of Emergency Situations" shall be provided along with the measures in the field of protection of people and facilities in emergency situations of natural and technogenic character.

92. Both design and internal (directly inside of the facilities), external accidents at potentially dangerous facilities of offshore and river constructions, on the water area of the seas and the rivers, shall be considered as the sources of emergency situations in compliance with the basic data and the requirements of the relevant regulations and normative and technical documents in this sphere.

93. Hydraulic engineering transport constructions, the damage of which may lead to emergency situations, shall be subject to safety declaration at all stages of their creation and operation.

94. The safety declaration shall be an obligatory part of the project, which shall be subject to the approval by the authorities overseeing the safety of hydraulic engineering constructions when the project is under approval.

95. The safety declaration shall be adjusted:

- 1) before commissioning of the facility;
- 2) after the first two years of operation;
- 3) at least once each next five years of operation;
- 4) after reconstruction of hydraulic engineering constructions, their capital repairs, restoration and change of service conditions;
- 5) when decommissioning and at preservation;
- 6) in the case of amendments of regulations, rules and norms of safety of hydraulic engineering constructions;
- 7) after emergencies.

95. In hydraulic engineering transport constructions for localization and elimination of their possible accidents, technical solutions shall be provided for the use in construction and operational period of pits and reserves of soil, production facilities, transport and the equipment for the base of construction, autonomous or reserve power sources and power lines; other antiemergency means of prompt action.

96. In the course of installation of hydraulic engineering transport constructions, it shall be necessary to carry out field observations of their operation and state, both in the course of installation, and operation, for timely detection of defects and adverse processes, assignment of repair measures, prevention of failures and accidents, improvement of operation conditions and assessment of the level of safety and risk of accidents.

Chapter 7. Requirements for environmental protection

97. In the construction, reconstruction and expansion of the operating hydraulic engineering transport constructions, it shall be necessary to be guided by the legislation of the Republic of Kazakhstan on environmental protection and the normative documents establishing requirements for the protection of the natural environment during engineering activities.

98. When performing these types of works, it shall be necessary to consider changes of an environment, that may lead to the development and strengthening of the negative physic-geological, geodynamic processes in the environment resulting from the operation of constructions.

99. Environment protection measures shall include: studying of an initial condition of the environment, drawing up forecasts of its changes, determination of the acceptable level of anthropogenic intervention, development of measures of protection, as well as the methods to monitor the state of each element of the environment and possible additional measures for preservation and improvement of an environmental situation in the course of operation of constructions.

100. Measures for environmental protection shall include the complex measures providing optimization of their ecological interaction between them and the natural complex and prevention of inadmissible consequences during the installation of hydraulic engineering transport constructions.

101. These measures shall include biotechnical activities for preservation of rare species of plants, fishes, animals, birds at the sections of direct influence of the main constructions, reservoirs, lower biefs, channels and etc. At the same time, both conditions for installation of constructions, and conditions for their operation, as well as the influence of the business environment and the infrastructures accompanying their creation on the environment shall be considered.

102. Special events for environmental protection shall be envisaged when performing:

1) the dredging works, including soil extraction, its transportation and creation of dumps;

2) setting of dams, dikes, crossing points, stone beds, the return fillings, etc., by dumping of soil and stone materials into the water;

3) installation of the protecting constructions for storage of liquid waste of the industrial enterprises;

4) consolidations of soil of the base, including produced by the explosive method;

5) installation of constructions with the use of materials, which are the source of environmental pollution;

6) the consolidation of soil, including those carried out by chemical methods or by artificial freezing;

7) underwater concreting.

Keywords: Hydraulic engineering offshore and river transport constructions, construction norms, safety, installation, engineering and geodetic works, construction, reconstruction, dredging works, dams, dikes, crossing points, ship-building and ship-repair enterprises, shore protection constructions, emergency situations, environmental protection.
