Federal Inspection of Russia for Nuclear and Radiation safety (Gosatomnadzor of Russia)

FEDERAL STANDARDS AND REGULATIONS IN THE NUCLEAR POWER UTILIZATION

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Equipment and Piping of Nuclear Power Installations. Weld Joints and Weld Overlays. Rules of inspection

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The present Inspection Regulations (PK) specify the requirements for the inspection of welded joints and weld coated parts (assembly units and articles) of the equipment and pipelines of nuclear power plants, heating supply stations, power-and-heating stations, experimental and research nuclear reactors and plants that are covered by the "Regulations for (NPP), ПН АЭ Г-7-008-89".

The present Regulations shall serve as a directive to be followed while projecting, designing, producing, and installing the equipment and pipelines; they establish the procedures, types, scopes, and methods for inspection along with the quality standards of welded joints and weld coated parts manufactured in compliance with requirements of the "Equipment and Pipelines of Nuclear Power Plants. Welding and Surfacing. Guidelines. ПН АЭ Г-7-009-89.

The Inspection Regulations are introduced to supersede the Inspection Regulations for Weld Joints and Welding on of the NPP Assemblies and Constructions, Experimental and Research Reactors and Nuclear Plants ПК 1514-72.

The present Regulations are mandatory for all ministries, departments, and organizations engaged in projecting, designing, manufacturing, installation, and maintenance of the equipment and pipelines that are covered by the Regulations for design and safe maintenance of the equipment and pipelines of nuclear power plants.

1. GENERAL

1.1. The methods of inspection stated in the present PK and the scopes of the inspection of welded joints and weld surfaced parts (including instructions as to the zones of welded joints and weld deposits inaccessible for inspection by any method) shall be determined by the designing (projecting) agency which shall specify them in the design documentation agreed upon with the manufacturer plant (erection organization). While developing the design documentation for the equipment and pipelines of individual and pilot projects (first nuclear power plant in a type series), the methods and scope of the inspection of welded joints and weld coated parts should be agreed upon with the leading materials-science organization.

Note. The term "leading materials-science organization" should be understood as the leading departmental materials-science organization, if not otherwise stated in the text.

1.2. The design (project) documentation (engineering project and working documents) for the equipment and pipelines should be prepared taking into account the necessity for the inspection of welded joints and weld coated parts in conformity with the requirements and directions of the present PK, as well as normative and technical documents treating of the inspection methods.

1.3. The arrangement and design of welded joints and weld coated parts should comply with the requirements for the design (project) documentation drawn up in accordance with the ПН АЭ Г-7-008-89 and ПН АЭ Г-7-009-89 and ensure the possibility for the inspection of these parts and joints by the methods and in the scope specified by the present PK during the manufacture, installation, and repair of the equipment and pipelines.

1.4. The inspection by any method should be carried out in compliance with State Standards covering the relevant inspection methods or with departmental methodological standards, which more specifically define methods for the inspection of welded joints and built-up parts. In the absence of these standards, the inspection may be carried out in accordance with the methodological instructions prepared by the leading materials-science organization. The use of standards and instructions should be authorized by the USSR Gosatomenergonadzor.

1.5. All preparatory and inspection procedures should be included into the production control documentation (PKD) (inspection charts, instructions, etc.) and provided with necessary inspection facilities.

The PKD should be agreed upon with the leading materials-science organization.

The PKD may be combined with production-process documentation (PTD).

1.6. All procedures for the inspection of welded joints and weld coated parts covered by the present PK, design documentation, PKD and PTD should be carried out by the manufacturing plant (erection agency) in charge of welding (or personnel of other organizations enlisted by this enterprise) in the sequence established by the PTD of this enterprise, taking into account the requirements of the present PK.

1.7. The results of the inspection of welded joints and weld coated parts should be registered in report documentation.

1.8. If the welded joints and weld coated parts fail to comply with the relevant requirements and standards, they should be either re-welded or rejected.

The decision as to the possibility of accepting the welded joints (weld coated parts) with discontinuity flaws the indices of which exceed the norms specified in the present PK shall be taken in accordance with the procedure specified in Section 14.

1.9. The quality control of welded joints and weld coated parts includes:

- certification of inspectors;
- inspection of the assembly-and-welding and thermal-treatment equipment, apparatus, and appliances;
- incoming control of base materials;
- quality control of welding and surfacing materials;
- process control;
- nondestructive testing;

- destructive inspection;
- inspection of defect correction quality;
- hydraulic (pneumatic) tests.

1.10. Certification of inspectors includes testing of their theoretical knowledge and practical skills.

1.11. Control of the assembly-and-welding equipment, apparatus, and appliances includes checking of their serviceable condition and of the availability of the required measuring and control instruments.

1.12. The incoming control of base materials should be performed in compliance with the instructions of the Section 3 of ПН АЭ Г-7-008-89.

The inspection of cast parts in the zones adjoining the edges prepared for welding should be carried out in compliance with "Regulations for Inspection of Steel Castings for Nuclear Power Plants."

The base materials to be welded should be thermally treated in compliance with the requirements of the standards or specifications for the delivery of materials and, in case of any additional requirements in the drawings or specifications for such part, in compliance with these requirements.

If corrosion-resistant steel of austenitic class is subjected to an additional thermal treatment in the course of the manufacture of a structure, its mechanical properties and resistance to the intercrystalline corrosion should be re-tested.

On agreement with the leading materials-science organization, these tests may be omitted and replaced by the control of the correctness of thermal treatment.

1.13. The quality control of welding and surfacing materials includes control of documents, assessment of the state of the package and the outward appearance, destructive inspection of the weld metal and/or built-up metal made with the use of the materials inspected.

1.14. The process inspection comprises checking the observance of the PTD requirements in the course of preparation and assembly for welding (surfacing), and thermal treatment.

1.15. The nondestructive inspection includes the following methods:

- visual;
- measuring;
- running through with a metal gauge (ball);
- capillary;
- magnetic powder;
- radiographic;
- ultrasonic;
- pressure tightness test.

In addition to the above-listed basic methods, other additional methods (steeloscopic tests, hardness measurement, etching, etc.) may be used, when this is specified in the design or the PKD.

1.16. The destructive inspection includes mechanical tests (tensile test at normal temperature, tensile test at an elevated temperature, static bending test, pipe flattening test), determination of the ferritic phase, intercrystalline corrosion test, metallographic investigation, and chemical composition tests.

1.17. The welded joints in structures or in individual assembly units should be subjected to hydraulic (pneumatic) tests according to instruction provided by the design documentation.

1.18. Definitions of the terms and basic concepts used in the present PK are given in Appendix 1.

2. CATEGORIES OF WELDED JOINTS

2.1. The welded joints for the equipment and pipelines of the NPP with water-moderated and water-graphite reactors fall under the following three categories:

category I - welded joints of the group A equipment and pipelines;

category II - welded joints of the group B equipment and pipelines that continuously or periodically operate in the contact with radioactive heat carrier;

category III - welded joints of the group B equipment and pipelines that operate out of the contact with radioactive heat carrier and welded joints of the group C equipment and pipelines.

Depending on the working pressure, the welded joints of the categories II and III are subdivided into the following sub-categories:

- sub-category IIa - welded joints that operate under a pressure of above 5 MPa (51 kgf/cm^2);
- sub-category IIb - welded joints that operate under a pressure up to 5 MPa (51 kgf/cm2) inclusive;
- subcategory IIIa - welded joints that operating under a pressure of above 5 MPa (51 kgf/cm2);
- subcategory IIIb - welded joints that operate under a pressure of above 1.7 and up to 5 MPa (above 17.3 and up to 51 kgf/cm2) inclusive;
- subcategory IIIc - welded joints that operating under a pressure up to 1.7 MPa (17.3 kgf/cm^2) and below the atmospheric pressure (under a vacuum).

2.2. Welded joints of the equipment and pipelines for the NPP with fast reactors operating with a liquid-metal heat carrier are subdivided into the following categories:

- category Iн - welded joints for the group A equipment and pipelines and welded joints for the group B equipment and pipelines with special requirements for pressure tightness specified in the design documentation;
- category IIн - welded joints of the group B equipment and pipelines that operate in the contact with the liquid-metal heat carrier and gas (except those belonging to the Iн category);
- category II - welded joints of the group B equipment and pipelines that operating out of the contact with the liquid-metal heat carrier and gas.
- category III - welded joints of the group C equipment and pipelines.

Depending on the specific conditions of service, welded joints of the IIн, II, and III categories are subdivided into the following subcategories:

- sub-category IIна - welded joints that operate in the contact with the liquid-metal heat carrier and/or gas at temperatures of above 350°C, regardless of the pressure;
- sub-category IIIнв - welded joints that operate in the contact with the liquid-metal heat carrier and/or gas at temperatures up to 350°C, inclusive, regardless of the pressure;
- sub-category IIIнс - welded joints that operate in the contact with a gas under pressure of 0.07 MPa (0.71 kgf/cm^2) inclusive and at a temperature up to 150°C, inclusive;
- sub-category IIa - welded joints that operate out of the contact with the liquid-metal heat carrier and gas, at a working pressure of above 2 MPa (20.4 kgf/cm^2);
- sub-category IIв - welded joints that operate out of the contact with the liquid-metal heat carrier at a working pressure up to 2 MPa (20.4 kgf/cm^2), inclusive;
- sub-category IIIa - welded joints that operate at a working pressure of above 5 MPa (51 kgf/cm^2);
- sub-category IIIв - welded joints operating at a working pressure of above 1.7 to 5 MPa (above 17.3 up to 51 kgf/cm^2), inclusive;
- sub-category IIIc - welded joints that operate at a working pressure up to 1.7 MPa (17.3 kgf/cm^2) and below the atmospheric pressure (in vacuum).

2.3. Buttering of edges relates to the same category as the respective welded joint.

2.4. Corrosion preventing surfacing should be considered individually, without referring it to any of the categories.

2.5. The categories of welded joints should be determined by the design (project) organization in accordance with the above-defined principles and specified in the design (project) documentation.

2.6. By the decision of the design (project) organization, agreed upon with the manufacturing plant (erection organization), some the most critical welded joints, located at stress concentration points, may be related to a higher category.

3. OBTAINING PERMSSSION FOR THE RIGHT OF WELDING AND SURFACING

3.1. General requirements.

3.1.1. Operations involving the welding and surfacing of the equipment and pipelines should be performed by the manufacturing plants (erection organizations) that are staffed with skilled personnel, technological and quality control services, and all the pertinent technical facilities required for the performance of corresponding operations, and that have the permission to manufacture (erect) the equipment and pipelines of the nuclear power plants, issued by the local authorities of the USSR Gosatomenergonadzor, which shall be issued in the order specified by the USSR Gosatomenergonadzor.

3.1.2. In addition to the general permission, as quoted in item 3.1.1, the manufacturing plant (erection agency) should be granted a permission of the local authorities of the USSR Gosatomenergonadzor to use the required technologies of welding (surfacing) work. This permission is granted on the basis of the industrial certification of the welding (surfacing) production process.

3.1.3. The industrial certification according to item 3.1.2 is undertaken in order to check the possibility of practical execution by the manufacturing plant (erection agency) of the technological processes of welding (surfacing) and inspection in compliance with the requirements of the OP, these PK, design documentation, and the PTD.

3.1.4. The industrial certification should be carried out by the manufacturing plants (erection organizations) dealing with welding (surfacing) of the equipment and pipelines by making control welded joints (surfacing) with subsequent inspection with nondestructive and destructive methods, which should be carried out for each group of single-type the manufactured welded joints (weld coated surfaces) according to the certified technology.

3.2. Certification of welding technology

3.2.1. The industrial certification of the technological methods of making welded joints and weld coated surfaces is subdivided into the following types:

- primary;
- secondary;
- nonscheduled.

3.2.2. The primary certification refers to welded joints (weld coated surfaces) whose technology is not certified at the given manufacturing plant (erection organization).

The technology of the performance of welded joints (weld coated surfaces) that has been used before the introduction of these PK at a given manufacturing plant (erection organization) according to the PTD that complies with the requirements of these PK and OP should be considered to have passed the primary certification.

3.2.3. The secondary certification should be carried out at the following intervals:

- for welded joints of the I and Iн categories - every 18 months;
- for welded joints of the II and IIн categories and for weld coated surfaces - every 24 months;
- for welded joints of the III category - every 36 months.

3.2.4. The nonscheduled certification should be undertaken when the PTD at the manufacturing plant (erection organization) has undergone such changes which may worsen the properties or quality of the manufactured welded joints (weld coated surfaces) performed in accordance with the certified technology and in the case of deteriorated quality of such joints and surfaces made by the manufacturing plant (erection organization). On such an occasion, the decision as to whether there is a need for the nonscheduled certification should be taken by the certification commission of the manufacturing plant (erection organization) with participation of an inspector representing the USSR Gosatomenergonadzor.

3.2.5. If the duration of the manufacture of a particular equipment or erection of the nuclear power plant exceeds that indicated in the item 3.2.3, then the validity of certification may be prolonged by the certification commission to the end of the period by which the particular equipment has to be made or to the completion of the erection of the nuclear power plant, provided that the scheduled certification was carried out immediately before or in the process of the manufacture of the said equipment or erection of the nuclear power plant.

If the welded joints (weld coated surfaces) are made according to the same production process and PTD, then the certification commission may prolong the period to the secondary certification, but not more than twice the period specified in item 3.2.3.

3.2.6. The manufacturing plants (erection organizations) should establish special certifying commissions for certification of the welding (surfacing) process.

3.2.7. The staff of the certifying commissions should include the head of the manufacturing plant (erection organization) or his deputy (chief engineer), the head of the service responsible for welding and surfacing, a representative of the quality control department, an inspector of the USSR Gosatomenergonadzor, as well as other highly skilled experts in welding practice and quality control of welded joints (weld surfacing), and a representative of the design organization at the discretion of the management of the manufacturing plant (erection organization) in charge of the certification.

The members of the certifying commission shall be approved by the order of the manufacturing plant (erection organization).

3.2.8. The manufacturing plant (erection organization) should draw up the certification program, which shall specify the following:

- the name and code of the products (pipeline systems) that comprise welded joints and weld coated surfaces, made according to the production process subject to certification;
- the list of certified groups of welded joints of the same type;
- the list of certified groups of weld coated surfaces of the same type;
- the list of the PTD that pertain to carrying-out and inspecting the welded joints and weld coated surfaces certified;
- methods for nondestructive inspection of the welded joints and weld coated surfaces certified;
- diagrams for cutting specimens out of the control welded joints and weld coated surfaces, which specify the purpose and types of the specimens with reference to the relevant standards or other normative and engineering documents;
- methods for destructive inspection.

3.2.9. The program according to the item 3.2.8 should be agreed upon by the members of the certifying commission and approved by the commission chairman.

3.2.10. The results of the process certification shall be recorded in a statement drawn up according to the form given in Appendix 2.

3.2.11. When any defects will be discovered in the control welded joints (weld coated surfaces) during the nondestructive inspection, the decision as to the possibility of further use of this joint or coated surface for the destructive inspection should be taken by the certifying commission.

3.2.12. In case of unsatisfactory results of destructive inspection, the certifying commission should take appropriate measures for discovering and eliminating the causes of the failure of the control welded joint or weld coated surface to comply with the specified requirements, after which

the rejected control welded joint (weld coated surface) should be replaced with a new control joint or surface, with subsequent inspection of the new control joint or surface.

The measures taken should be recorded in the inspection statement.

3.2.13. In the course of the secondary certification, it is permissible to use the results of the nondestructive and destructive inspection of the control production welded joints carried out as instructed under Section 10.

3.2.14. The inspection statement, drawn up according to item 3.2.10, shall be submitted to the local authority of the USSR Gosatomenergonadzor in the region where the manufacturing plant (erection organization) that carried out the certification is located. The local authority of the USSR Gosatomenergonadzor receives and considers the statement and issues a written permit to the manufacturing plant (erection organization), which authorizes the plant to perform the production welded joints and weld coated surfaces in compliance with the production process certified.

3.2.15. The control welded joints used for certification of the welding process in the course of construction should be specified by the design organization.

The list of welding processes to be certified should be given in the PTD worked out by the leading materials-science organization.

3.3. The scope of the certification

3.3.1. The certification of the production process for the welded joints of the category I (Iн) may be extended to the like welded joints of the II (IIн) and III categories, whereas the technology of the welded joints of the II (IIн) categories may be extended to cover the like welded joints of the III category.

3.3.2. The certification of the production process for the weld coated surfaces with preliminary and concurrent heating may be extended to the like weld coated surfaces produced without heating.

3.3.3. The certification of the production process for arc-welding of the parts having the range of rated thickness from over 10 mm and up to 50 mm may be extended to the welded joints of the parts ranging in thickness from over 3 to 10 mm.

3.3.4. The certification of the production process for the welded joints made by the electroslag welding may be extended to the welded joints of the parts whose minimum thickness differs by no more than 25% from the thickness of the control joint used for certification.

4. CERTIFICATION OF INSPECTORS

4.1. General

4.1.1. The certification of inspectors (experts, flaw-detection operators, quality control inspectors, directly engaged in inspection) should be carried out by testing their theoretical knowledge and practical skills in specific inspection methods.

The certification of the specialists in charge of the inspection should be carried out in compliance with "Model Instructions for Examining Managers and Specialists for the Knowledge of Rules, Norms, and Instructions Pertaining to the Working Safety in Nuclear Power Engineering" issued by the USSR Gosatomenergonadzor.

4.1.2. The list of the inspector staff positions to be certified shall be specified by the certifying enterprise after agreeing upon with the local body of the USSR Gosatomenergonadzor.

4.1.3. The inspectors shall be certified by permanent certifying commissions at the manufacturing plants (erection organizations) and/or special organizations appointed on agreement with the local body of the USSR Gosatomenergonadzor.

4.1.4. The certifying commission shall be appointed by the order of the head of the enterprise and shall comprise of the chairman, deputy chairman, and commission members.

The certifying commissions should consist of highly skilled specialists in the inspection method that will be (or continued to be) practiced by the operators certified.

4.1.5. The members of the commission according to the item 4.1.3 should be periodically certified in the leading materials-science organization according to programs specially developed by this organization and in the order established by the Ministry to which the manufacturing plant (erection organization) is subordinated, but at intervals not less than once in every three years.

In absence of a leading materials-science organization in the Ministry, the commission members may be certified by the leading materials-science organization of another department.

4.1.6. The certifying commissions may be charged with certification of inspectors of other enterprises and organizations that have no their own certifying commissions.

4.2. Certifying procedure

4.2.1. The certification is subdivided into the following types: primary, additional, periodic, and non-scheduled.

4.2.2. The primary certification should by passed by the inspectors that previously had not certificate for the performance of the corresponding type of inspection, who have completed a special theoretical course and whose practical skills have been duly examined.

4.2.3. For being authorized for the work not mentioned in their licenses, on introduction of new inspection instructions, and after a break in the performance of certain inspection operations exceeding six months, an additional certification should be passed by the inspectors who had passed the primary certification.

4.2.4. All inspectors who have to prolong their certificates should pass periodic certification. The periodic certification for checking the theoretical knowledge should be carried out at least once in three years, and the checks of practical skills should be carried at least once a year.

4.2.5. The nonscheduled certification is prescribed to the inspectors before granting them permits for work after temporary suspension from work, as a punishment for violation of the inspection technology or repeated negligence, as well as on the request of a member of the leading materials-science organization, a member of the certifying commission, a representative of the USSR Gosatomenergonadzor, who have checked the proper performance of a certain inspection method and have discovered some violation of the prescribed inspection technology.

4.2.6. Special programs of theoretical training according to item 4.2.2 should be drawn in the scope defined by the duties of the inspectors certified on the basis of relevant methodological documents pertaining to inspection, engineering, and production process documentation for various categories of inspectors.

4.2.7. Specific programs for training of inspectors shall be developed and approved by the enterprises (organizations) in charge of certification on agreement with the leading materials-science organization.

4.2.8. In the case of additional certification, the necessity and scope of theoretical training should be determined by the certifying commission.

4.2.9. The practical skills of inspectors should be tested in presence of at least one member of the certifying commission, who should supervise the proper performance of the inspection operations, as well as the completeness and reliability of the defects discovered in the control or standard specimens with simulated defects; the practical skills may be tested on products that had previously been tested by an already certified inspector.

In case the tests of the practical skills proved to be unsatisfactory, re-tests may be conducted on doubled number of specimens.

4.2.10. Inspectors that failed to pass the theoretical examination must not be allowed to take practical skill examinations.

4.2.11. The inspectors that have failed to pass the certifying examinations are suspended from the work till the repeated certification, which they are allowed to pass after an additional training, but not earlier than after a month and no more than two times.

4.3. Presentation of certification results

4.3.1. The results of testing of the theoretical knowledge and practical skills should be presented in the form of a special statement of tests, quoting the decision on the permission to perform certain types of work.

4.3.2. A group of inspectors of the same inspection category may be included into a single statement of tests containing all the required information and data.

4.3.3. The statements of the certifying commission should be numbered through out and kept at the enterprises (organizations) in charge of certification until the next certification.

4.3.4. Certificates, signed by the commission chairman and authenticated by the stamp of the enterprise (organization) in charge of certification should be issued the inspectors that have passed the theoretical and practical examinations.

4.3.5. The recommended forms of the inspector certificates and forms of the minutes taken at the session of the certifying commission are given in Appendices 3 and 4.

These forms may be changed upon agreement with the USSR Gosatomenergonadzor.

5. REQUIREMENTS FOR INSPECTION FACILITIES

5.1. The inspections should be carried out by means of installations and devices that meet the requirements of the relevant standards and instructions, according to item 1.4.

Installations and devices other than those mentioned in the standards and instructions according to item 1.4 (for example imported ones) may be used, provided that they comply with all requirements of these PK and design documentation for the inspection of welded joints and weld coated parts and that their use is agreed upon with the leading materials-science organization.

5.2. The condition of the installations and apparatuses designed for inspection should be tested periodically on a schedule drawn up in accordance with the operating rules for these installations and apparatuses and manuals appended. After repairs of the installations and apparatuses, they should pass a mandatory testing, regardless of the date of the scheduled testing. The information on periodical tests and parameters inspected should be entered into relevant sections of certificates (log books) for the installations and apparatuses, or should be recorded in a test statement.

5.3. The metrological support of the inspection facilities should comply with the provisions of GOST 8.002-86, and GOST 8.326-78.

5.4. Each consignment of materials for flaw detection (powders, penetrants, films, reagents, etc.) should be inspected:

- for the presence of tags (certificates, etc.) on each shipping piece (package, box, container), for completeness of the data they contain, and for the compliance of these data with the provisions of standards or specifications for the materials inspected (when reagents and penetrants are prepared for local needs, it is enough to check for the presence of the tag and the name of the reagent or penetrant);
- for any damage and deterioration of packing or the materials proper;
- for the term of validity;
- for compliance of the materials with the requirements of methodological papers covering the given type of inspection.

6. QUALITY CONTROL OF WELDING AND SURFACING MATERIALS

6.1. General requirements

6.1.1. All consignments of welding and surfacing materials (wires, strips, fluxes, coated electrodes, and protective gases) destined for welding or surfacing of the equipment and pipelines are subject to inspection.

6.1.2. The quality control of welding and surfacing materials includes:

- checking the shipping papers;
- checking the packing and the condition of the welding (surfacing) materials;
- checking the metal of the weld metal and coating metal.

6.1.3. The quality control of the welding and surfacing materials should be performed by the enterprise that utilizes these materials for welding (surfacing) of the equipment and pipelines.

The inspection of the metal of the weld metal (coating metal) at the enterprise that utilizes the welding materials may be omitted, if this inspection of each consignment or combination of consignments of filler materials and fluxes to be industrially utilized had been performed by another enterprise in full conformity with the requirements of the present PK with the results of the control appropriately presented and handed over to the enterprise which will use the inspected consignments of the welding materials.

6.1.4. The quality of each consignment of welding (surfacing) materials should be controlled before the beginning of their utilization for production.

6.1.5. When the manufacturing plant uses the welding (surfacing) materials of its own production, the acceptance control may be combined with the inspection specified in the present section for the specific consignments of welding (surfacing) materials.

6.2. Checking of the shipping papers

6.2.1. Each consignment of the welding (surfacing) materials should be inspected:

- for the presence of the shipping paper (certificate), with checking of the completeness of the data they contain and of the compliance with the provisions of the standards or specifications covering the welding (surfacing) materials of the grade being checked; for cylinders that contain protective gas this inspection may be confined to checking of the labels attached to the cylinder valves and of distinctive painting of the cylinders;
- for the presence of marking (labels, tags) on each of the shipping piece (case, package, box, coil, cylinder, etc.), with checking of the compliance of the grade, assortment, and lot No. of the material consignment, stated at the label, with the data of the certificate.

6.3. Checking of the packing and of the condition of welding (surfacing) materials

6.3.1. Each consignment of the welding (surfacing) materials should be checked:

- for the absence of a damage (deterioration) in the packing or in materials proper; in case of some damage (defects) of the packing or materials, the possibility of further complete or partial utilization of the welding (surfacing) materials should be decided by the appropriate service of the manufacturing plant (erection organization) responsible for welding (surfacing);
- for the compliance of the welding (surfacing) materials with the data of the certificate and with provisions of the standards or specifications with respect to their size and state.

6.3.2. On inspecting the size and state of the welding (coating) materials, the following points should be checked:

- each consignment of coated electrodes - for the compliance of the rated dimensions of the electrodes with the data of the certificate and of the quality of their packing (absence of damage, overflows, and other visible defects) with the requirements of the standards or specifications covering the electrodes of the grade inspected;

- each consignment of welding (surfacing) wire and strip - for compliance of the rated dimensions and the type of surface with the certificate data and of the condition of the surface (absence of corrosion and other visible flaws) with the provisions of standards or specifications covering the wire or strip of the grade inspected;
- each consignment of flux - for compliance of the color, heterogeneity, and granulometric composition with the provisions of standards or specifications covering the flux of the grade inspected.

6.3.3. In addition to inspections listed under item 6.3.2, each consignment of coated electrodes and fluxes should be checked before utilization for the compliance of the moisture content in the electrode coating and flux with the provisions of standards or specifications covering the materials of the grade inspected or for compliance of the permissible periods of utilization of coated electrodes and fluxes after scheduled calcination with the requirements of the OP, in accordance with the storage conditions.

When a consignment of coated electrodes or flux is used by batches, the moisture content in the coating and flux and the permissible periods of their storage after a scheduled calcination should be checked separately for each part of the consignment.

6.3.4. The scope of the inspection according to items 6.3.2. and 6.3.3 shall be specified by the PKD.

6.3.5. The parameters listed under item 6.3.2 should be checked in accordance with the methodological instructions of standards and specifications which covering the welding (surfacing) materials of the grades inspected, as well as with the PKD.

6.3.6. The moisture content of coated electrodes shall be determined in compliance with the requirements of departmental standards or instructions.

6.3.7. The moisture content of fluxes shall be determined in compliance with the instructions of standards and specifications covering the flux of the grade inspected.

6.4. Inspection of weld metal and built-up metal

6.4.1. Inspection procedure

6.4.1.1. For inspection of each consignment (combination of consignments) of the welding (surfacing) materials, control welded seams (weld surfacing) should be made.

The welding materials destined for the electroslag welding shall be checked only in control welds.

The control welds and weld coatings should be made by welders that have the permit according to "Regulations for Certification of Welders of the Equipment and Pipelines of Nuclear Power Plants (ПН АЭ Г-7-003-87)" (referred to hereunder as "Regulations for Certification of Welders"), which authorizes them for making production welded joints (weld coated parts) with the use of the welding materials inspected.

6.4.1.2. The control welds are to be subjected to 100% visual, measuring, and radiographic or the visual, measuring, and ultrasonic control.

6.4.1.3. The control weld surfacing should be subjected to 100% visual and capillary or visual and magnetic-particle inspection and, in cases specified in the PKD, also to ultrasonic and/or radiographic control.

6.4.1.4. The control welds and weld surfacing should be subjected to destructive inspection whose methods and scope should comply with the requirements of Section 10.

6.4.1.5. The control welds and weld surfacing should be subjected to nondestructive inspection according to items 6.4.1.2 or 6.4.1.3 (after thermal treatment, if it is required) and, in case of positive results, to destructive inspection.

If the total length of the defective regions discovered in the course of the nondestructive inspection does not exceed 5% of the length of the control welded seam, it is permitted to carry out destructive inspection, provided that no specimens will be cut out from the defective spots.

The results of the nondestructive and destructive inspection of the control welds and weld

surfacing should satisfy the requirements of Section 11, taking in account the category of the production welded joints, which are expected to be made with the use of the welding materials of the consignment (or combination of consignments) inspected.

Norms for the assessment of the results of the nondestructive inspection should correspond to the highest category of welds which are expected to be made with the use of the welding materials inspected.

It is allowed not to take in account the defects of the welded seams and weld surfacing that were discovered during measuring control and are not related to the quality of the welding materials used (dimensions of reinforcing beads, grooves between the beads, and ripples do not meet the prescribed requirements).

In case of unsatisfactory results of the nondestructive inspection of control welds and weld surfacing, depending on the nature of discovered defects, a decision should be taken about re-making the control welds or weld surfacing after additional operations aimed at improving the quality of the welding materials (calcination of electrodes or fluxes, dressing of wire or strip, etc.) or the impossibility of using the inspected welding materials for welding the equipment and pipelines of nuclear power plants.

In case of unsatisfactory results of the destructive inspection, the instructions of Section 10 should be followed

6.4.2. The scope of control welds and weld surfacing

6.4.2.1. The control welds should be made in the following scope:

- when inspecting the coated electrodes for manual arc welding intended to be used in the execution of production welded joints - using electrodes of each consignment, except the cases stated in subsection 10.2;
- when inspecting the welding materials intended for the automatic submerged welding and for electroslag welding - using the welding wire of each lot (melt) in combination with the flux of each lot, which are intended for making production welded joints;
- when checking the welding materials for welding in protective gases (a combination of ptrotective gases) - using the welding wire of each lot (melt) in combination with each type of protective gas (combination of gases) which will be used for execution of production welded joints;

Notes:
1. One type of protective gas should be understood as gas of a single grade, quality and application, covered by a single standard or specification.
2. One type of the combination of protective gases should be understood as a mixture of prescribed in PTD.

6.4.2.2. If a consignment (a combination of consignments of filler materials and fluxes) of the welding materials is intended to be used for production welded joints of parts made from carbon steels or steels of the austenitic class with the rated thickness up to 40 mm inclusive or from silico-manganese steel with the rated thickness up to 30 mm inclusive, or from alloyed steels or high-chromium steels with the rated thickness up to 20 mm inclusive, the control welds may be replaced by making control surfacing.

6.4.2.3. If a consignment (a combination of consignments of filler materials and fluxes) is intended to be used both in making production welded joints and weld surfacing, it is permitted to make only a control welded joint, while in cases covered in item 6.4.2.2, only control surfacing may be performed.

6.4.2.4. The welding materials intended for use only in making the root layers of the seam shall be considered as those intended for making production yielded joints of parts with the rated thickness up to 20 mm.

6.4.2.5. While making control welded seams and weld surfacing, it is permitted:

- to combine the inspected consignments of flux into enlarged production lots; one enlarged lot of the flux may include the lots of flux of the same grade produced in accordance with the same standard or specifications; after mixing the entire volume of flux of the enlarged lot; in case of an insufficient volume of mixing devices, the flux may be mixed in several

steps retaining the required mass proportions of the flux of each of the mixed (combined) lots; the maximum mass of the enlarged flux lot should not exceed the value established by standards or specifications for the flux of the grade inspected;

- when using neutral fluxes (type OF-6, OF-10, FTs-18, etc.), only the flux grade should be taken in account (disregarding the lot).

6.4.2.6. The control welded seams (weld surfacing) may not be made, the Section 10 of the design documentation prescribes inspection of production welds by making control production welded joints. In this case, the weld metal, in addition to these welded joints, should be subjected to destructive inspection.

6.4.3. Requirements for making control welds and weld surfacing.

6.4.3.1. When executing control welded seams, the combination of grades of the base metal of the welded plates (parts) and the welding materials inspected should comply with that permissible under the OP.

It is permissible to use plates (parts) made from steels of the same structural class of other grades, provided that the edges of the parts to be welded have previously been buttered with at least three layers of the welding materials of the grade (or combination of grades) inspected. These edges may be buttered with the welding materials of other (non-inspected) lots of welding materials of the some grade, including filler materials of another nomenclature.

When the edges are buttered with no less than five layers, the PTD permits using plates made from steels of other structural classes.

During inspection of the welding materials intended for making production welded joints of steels belonging to different structural classes, the plates made from the material which, according to the OP, do not require preliminary buttering of edges may be used.

6.4.3.2. When making control welds by automatic submerged arc welding or by argon-arc welding, the edges may be buttered (in three layers) by manual arc welding with coated electrodes, which, according to the OP, are permitted for welding steels of the same grade as the welding materials inspected.

6.4.3.3. In making the control welds, the thickness of welded plates (parts) should be established in the PTD, observing the following requirements:

- when using the inspected consignment (combination of consignments) of welding materials for making production welded joints with preliminary and concurrent heating, the thickness of plates (parts) should be no less than the thickness, starting from which, according to the OP, heating is required for making production welded joints;
- when using the inspected consignment (or combination of consignments) of welding materials for making production welded butt joints to be heat treated, the thickness of plates (parts) should be no less than the thickness, starting from which, according to the OP, the heat treatment is required for making production welded joints;
- the thickness of the welded plates (parts) should be no less than 14 mm for arc welding and 30 mm for electroslag welding.

6.4.3.4. The length of welded plates (the total length when several pairs of plates are welded) along the welded seam should be sufficient for taking the required number of specimens for conducting all types of tests prescribed in Section 10, including possible repeated tests on twice the number of initial specimens.

6.4.3.5. The width of each of welded plates (parts) should be no less than 300 mm for electroslag welding, 150 mm for automatic hidden-arc welding, and 80 mm for other kinds of welding.

6.4.3.6. Edges of plates (parts) may be prepared according to any type of welded butt joint used in welding of production articles of the respective thickness using the inspected welding materials, or according to the type of the welded joint specified by the standard or specifications for the welding materials inspected.

6.4.3.7. The control welded joints and weld surfacing should be made with the use of the welding equipment that ensures the observance of all welding parameters specified by the PTD for

making production welded joints and surfacing with the use of the inspected welding (surfacing) materials.

6.4.3.8. The welding conditions should correspond to the conditions under which one of the production welded joints is made with the use of the inspected filler materials of the appropriate nomenclature.

6.4.3.9. The control welded seams should be made in the down-hand position unless otherwise specified in the PKD.

6.4.3.10. The necessity for an regimes of the preliminary and concurrent heating on making the control welds should be decided upon in compliance with the OP taking into account the grade of the base metal of the corresponding production welded joints and the thickness of plates (parts) welded.

If the inspected consignment (combination of consignments of filler materials and fluxes) of the welding materials is intended to be used for making various production welded joints for which the minimum temperatures of preliminary and concurrent heating, as established in the PTD, differ by more than 50°C (including welds where heating is unnecessary), then two control welds should be made.

When making one control welded seam, the minimum heating temperature should correspond to the lowest temperature (including the no-heating cases), and when welding the other control weld, to the highest temperature out of the minimum temperatures prescribed for heating the parts (articles) welded from steels of the corresponding grades and thickness. If individual production articles are to be welded without heating, the first control welded seam should also be made without heating.

6.4.3.11. The necessity, kind (tempering, normalization, or hardening followed by tempering, austenization, etc.) and conditions of thermal treatment of the control welded seams should correspond to those used for making production welded joints which require the use of the inspected welding materials.

6.4.3.12. When tempering the control welded seams, the holding time may be reduced as compared to that prescribed for tempering of production welded joints which are to be made using the welding materials of the inspected consignment (combination of consignments), but no more than by 20%.

6.4.3.13. When the production welded seams are subjected to repeated thermal treatment, the control welded joints should be subjected to the same thermal treatment.

In case of repeated tempering, the control welds may be tempered only once, holding it at each temperature for no less than 80% and no more than 100% of the total duration of the corresponding holding time during thermal treatment of production welded joints. The parts should be tempered first at a low temperature, then at the higher temperature. The transition time from one temperature to the other is not included into the total holding time.

Note. The total duration of holding time should be determined as the sum of rated duration of holding (not counting the tolerances).

6.4.3.14. At various temperatures and/or duration of tempering, the production welded joints which are intended to be made with the inspected consignment (combination of consignments) of welding materials, it is permitted to make two control welded seams, provided that the following requirements are satisfied:

- the first control welded seam should be subjected to the same kind of tempering as the production welded joint which is to be finally tempered at the lowest temperature and the shortest duration (in case of a single production tempering) or the lowest temperatures of the final tempering with the minimum total tempering duration (in case of repeated production tempering); in the cases when the inspected welding materials are intended for use in making production welded joints both subjected and not subjected to tempering, the first control welded seam should not be tempered;
- the second control welded seam should be tempered under the same conditions as the production welded joint which is to be finally tempered at the highest temperature and the

longest duration (in the case of a single production tempering) or at the highest temperature of final tempering with the longest total duration of tempering (in the case of repeated production tempering); when determining the maximum total duration of the tempering, account should be taken also of the probable tempering after correction of the flaws of production welded joints.

When making two control welds in compliance with the above-listed conditions, the results of the inspection of the weld made with the inspected welding materials shall apply to all the intermediate types of repeated tempering of production welded joints.

6.4.3.15. The control surfacing may be made with plates from any grade of steel, unless specific requirements are specified in the PKD.

6.4.3.16. The thickness of plates used in the control surfacing should be no less than 40 mm for anticorrosive surfacing and no less than 20 mm in other cases.

6.4.3.17. The surfacing conditions should correspond to those under which one of the production weld surfacing (or one of the production welded joints) made with the use of inspected filler materials (taking in account their nomenclature).

6.4.3.18. The plates should be welded on in a down-hand position unless otherwise specified in the PKD.

6.4.3.19. The necessity and conditions of the preliminary and concurrent heating in the course of surfacing shall be specified in the PTD.

6.4.3.20. The first step is to overlay two layers on the plate (if the plate is made of steel of the same structural class as the built-up metal) or four layers (if the structural classes of the steel of the plate and of the built-up metal are different) using welding materials of the inspected grade (combination of grades) of any consignment (any combination of consignments). All subsequent (control) layers should be made with the welding materials of the inspected consignment (inspected combination of consignments).

6.4.3.21. The area, number, and the total height of layers in each control surfacing should be sufficient for taking the required number of specimens for all the tests prescribed in Section 10 (including probable re-tests on twice the original number of specimens). In this case, it is permitted to take specimens from the first three layers (if the steel of the plate and of the built-up metal belong to the same structural class) or from the first five layers (if the structural classes of the steel of the plate and of the built-up metal are different).

6.4.3.22. The procedure, kind, and conditions for making the control weld surfacing with austenitic welding (surfacing) materials intended for depositing of anticorrosive coatings shall be specified by the instructions of the leading materials-science organization agreed upon with the leading interdepartmental materials-science organization.

6.4.3.23. The necessity, type, and conditions of the thermal treatment of control weld surfacing should correspond to those used for the production parts (articles) after surfacing them with the inspected welding materials.

The tempering of the control weld surfacing (except anticorrosive types) should be conducted as prescribed in items 6.4.3.12 - 6.4.3.14 related to the tempering of control welds.

Thermal treatment of the control weld surfacing intended for determining of the content of ferrite phase in the built-up metal is impermissible. If the test surfacing is intended for other kinds of tests, the specimens for determining the content of ferrite phase should be cut out before heat treatment of the test coating.

6.4.4. Taking specimens from reference welds and weld surfacing

6.4.4.1. Samples for determining the chemical composition of the welded seam metal should be taken in the zone of the control welded seam separated from the base metal by at least two beads or from two upper layers of the additional four-layer coating carried out on one of the end portions of the surface of the control welded seam.

Samples for determining the chemical composition of the metal of the welded seam produced by electroslag welding should be taken in compliance with the requirements of the PTD.

6.4.4.2. Samples for determining the mechanical properties of the seam metal or built-up should be taken in keeping with the provisions of GOST 6996-66 and the directions of item 6.4.3.21.

6.4.4.3. Samples for determining or confirming the critical temperature of brittleness should be taken in compliance with "Standards for Strength Analysis of the Equipment and Pipelines of Nuclear Power Plants, ПН АЭ Г-7-002-86" (Appendix 2).

6.4.4.4. Samples for determining the ferrite phase in the built-up metal should be taken in compliance with the branch standards or instructions agreed upon with the leading materials-science organization.

6.4.4.5. Samples for testing the resistance against the intercrystalline corrosion should be taken from the upper layers of the control surfacing in compliance with the directions of item 6.4.3.21.

6.4.4.6. Samples from the control anticorrosive weld surfacing should be taken in compliance with the standards or instructions of the leading materials-science organization.

7. INSPECTION OF THE ASSEMBLY-AND-WELDING AND THERMAL-TREATMENT EQUIPMENT AND APPLIANCES

7.1. When inspecting the assembly-and-welding equipment, check the following points:

- operating condition of the equipment and appliances and compliance of their parameters with the prospective operations related to the assembly and welding (surfacing) of particular parts (articles);
- availability and serviceability of the devices for preliminary and concurrent heating on welding and the availability of instruments (or other facilities) checked according to item 5.3 for control of the heating temperature (in case of welding without heating, the inspection according to the present item shall be omitted);
- availability of ammeters and voltmeters, checked according to item 5.3, in the equipment for automatic welding;
- availability of ammeters, checked according to item 5.3, in the manual arc welding stations (erection work may be performed using portable ammeters for periodic control of the welding current);
- observance of the directions of PTD with regard to the kind of current, voltage variations in electric power mains, connection to independent sources of power supply, and washing of torches and hoses;

7.2. Inspection according to item 7.1 should be carried out in accordance with a special schedule.

The results of the inspection should be recorded as prescribed by the manufacturing plant (erection organization) in charge of the inspection.

7.3. When inspecting the heat-treatment equipment, check the following points:

- operation condition of the equipment, tooling, and appliances and correspondence of their parameters with the prospective operations for the heating and heat-treatment of particular welded articles (welds) and weld coated parts;
- availability of the control and measuring instruments and/or other temperature control devices checked according to item 5.3.

7.4. Inspection according to item 7.3 shall be carried out similarly to the inspection of welding equipment according to item 7.2.

8. PROCESS CONTROL

8.1. General.

8.1.1. The process control should be performed in compliance with the PTD and includes the following:

- checking the preparation and assembly of parts for welding and weld surfacing;
- checking the welding and weld surfacing processes;
- checking the thermal-treatment of welded joints and weld coated articles.

8.1.2. Process control should be carried out by production foremen and the quality control service (or other specially assigned specialists) of the manufacturing plant (erection organization) dealing with the checking the equipment and pipelines.

8.1.3. When checking the preparation and assembly of parts for welding, for anticorrosive surfacing, welding, weld surfacing, and heat-treatment, requirements should be observed which are specified in the OP, the present PK, and drawings of parts.

8.1.4. The results of each kind of the process control should be recorded in the corresponding control logs (process certificates, flow route sheets).

8.2. Checking the preparation and assembly of parts for welding and surfacing

8.2.1. When preparing the parts for welding and surfacing, check the following-points:

- availability of markings and/or documents confirming that semi-finished or finished parts have been accepted by the quality control service;
- cleanness (the absence of visible dirt, dust, rust, oil, etc.) of edges and adjoining surfaces to be welded (weld coated) and of the sections of the base metal subject to nondestructive inspection;
- shape and dimensions of edges;
- shape and dimensions of boring or flaring of pipes;
- material, shape, and dimensions of backing rings and consumable inserts.

8.2.2. When assembling parts for welding, check the following points:

- correct installation of backing rings and consumable inserts;
- grades and nomenclature of welding materials intended for making tackings;
- permits authorizing welders to make tackings;
- correct assembly and fastening of parts in assembly jigs;
- cleanness (see item 8.2.1) and the absence of damage of edges and adjoining surfaces;
- heating temperature for making tackings;
- quality, dimensions, and arrangement of tackings;
- joint clearances;
- displacement of edges and the angle of axes or planes of jointed parts;
- dimensions of the unit assembled for welding;
- availability of protective coating;
- correct installation of argon supply devices, availability and regime of gas supply (if such is provided for in the PTD).

8.2.3. The quality of tack welds shall be inspected visually, while their dimensions and layout shall be checked by measurements.

8.2.4. After removal of temporary fastenings from parts made of austenitic and high-chromium alloyed steels and from anticorrosive coating, the welded points should be dressed and checked for cracks by capillary or magnetic powder methods or by pickling followed by examining the dressed points through a 4 - 7x magnifying glass.

8.2.5. An assembly (unit) assembled for welding should be marked (if necessary) and accepted by the quality control service (or by other specialists specially assigned by this service) making a corresponding record in a special log or flow (process) certificate.

8.3. Checking the welding and surfacing processes

8.3.1. Before the beginning of welding (weld surfacing) check the following points:

- availability of the permit for the operator to perform the work in hand (availability of a certificate).
- availability of markings and/or of a record in the weld log or flow (process) certificate, which confirms the compliance of the assembly with established requirements;
- cleanness of edges and surfaces (see item 8.2.1) prepared for welding or surfacing;
- grades and nomenclature of welding materials used;
- availability of documents confirming the positive results of the inspection of welding materials;
- date of calcination of coated electrodes and fluxes or correspondence of the moisture content of fluxes and electrode coating to the established requirements;
- correspondence of the surface of filler materials with the requirements of standards or specifications;
- availability of protecting gas supply (if prescribed in the PTD);
- temperature of preheating (if prescribed in the PTD);

8.3.2. In the process of welding (weld surfacing) check the following points:

- welding (weld surfacing) regimes and the sequence of welding, dressing, and control operations;
- sequence of making the welds and weld coated surfaces;
- ambient temperature (at least 2 m away from the welded or weld coated articles);
- heating temperature;
- sequence of the application of beads and layers;
- temperature of the metal in the zone of welding of parts made from austenitic steels;
- observance of special requirements for welding parts made from heterogeneous and two-layer steels;
- thickness of the first layer and the total thickness of the built-up anticorrosive coating.

8.3.3. The root section of the seam of welded joints of the I and Iн categories of parts made from iron-nickel alloys at the rated wall thickness at the point of welding exceeding 6 mm and from steels at the rated wall thickness at the points of welding exceeding 20 mm should be subjected to radiographic control. The quality assessment norms should be the same as for a completely made welded joint.

In butt welding with one-sided grooving of edges, the radiographic inspection should be carried out after welding-up of the seam root on both sides.

In welded joints subjected to subsequent machining with complete removal of the weld root as well as in the case when there should be no pause and/or a cooling in the process of welding, there is a danger of undue deformation or destruction of the unit conveyed to the place of inspection; if so, this inspection may be omitted.

Note. The term weld root should be understood as the weld zone at the side of blunted edges with a thickness up to 30% of the total thickness of the weld, but not over 20 mm.

8.3.4. The requirements for checking the preliminary and concurrent heating, temperature of metal in the zone of welding of austenitic steels, the points of measurements, and methods of recording of temperature should be specified in the PTD.

8.3.5. Upon completion of the welding (weld surfacing) check the following points:

- presence and correctness of the markings of welds and weld surfacing;
- correspondence of the conditions of stay of the performed welded joints and weld surfacing from completion of welding (weld surfacing) to the beginning of thermal treatment (including conditions of the thermal relief, if it is prescribed).

8.4. Control of thermal treatment

8.4.1. During thermal treatment of the welded joints and weld coated parts, it is necessary to check the observance of requirements of the OP, present PK, PTD and drawings with respect to:

- methods and kinds of thermal treatment;
- the equipment used for thermal-treatment;
- sequence and the order of carrying out the thermal treatment and its individual stages (including preliminary, intermediate, and final tempering);
- regimes of thermal treatment (kiln temperature in the course of charging, heating rate, temperature and duration of holding, conditions, cooling medium, or cooling rate);
- methods and the order of the control of the temperature regime (arrangement of thermocouples or other temperature-measuring devices, their number, etc.);
- temperature in points specified in the OP while checking the required heating zone of the welded joint and adjoining areas;
- conditions that ensure free expansion of welded (weld coated) articles and protect them from plastic deformations under the effect of their own weight;
- other parameters specified in the PTD.

8.4.2. The conditions of thermal treatment should be controlled by thermoelectric converters (thermocouples) with automatic recorders of the regime parameters.

During extra-furnace thermal treatment, it is permissible to resort to other means for the control of the thermal regime of treatment, which ensure the required accuracy of the temperature measurement (radiation pyrometers, etc.).

The thermocouples should be installed in the furnace and directly on the thermally treated welded (weld coated) articles. The number and location of the thermocouples should provide for checking the temperature distribution over the entire volume of the furnace during all-round thermal treatment and checking the heating zones in the case of local thermal treatment.

In case of thermal treatment of the articles with welded joints of the III category, it is permitted, on agreement with the leading materials-science organization, to check the regime of the thermal treatment by a thermocouple installed in the furnace. In this case, the trial heating should be conducted at least once in three months to confirm that the difference of readings of the thermocouples installed in the furnaces and directly on the thermally treated article (in a specific point) does not exceed 15°C, and the results of inspection should be recorded in a special log.

8.4.3. In case of an emergency interruption of the process of thermal treatment, it is necessary to additionally check the rate or conditions of cooling (only in case of local thermal treatment or when unloading the article from the furnace), heating rate after the interruption, and the total duration of holding (before and after the interruption).

8.4.4. On completion of the thermal treatment, the number of the charge and furnace number (in the case of in-furnace thermal treatment), date of thermal treatment, and production code (number) of the welded (weld coated) article or joint should be recorded.

8.4.5. The requirements of the present subsection should also be met during the thermal treatment of control welds and weld surfacing, control welded joints, and control production welded joints.

9.METHODS AND SCOPE OF NONDESTRUCTIVE INSPECTION

9.1. General

9.1.1. The nondestructive inspection of the quality of welded joints and built-up metal (on weld coated parts) should be performed by the methods prescribed in item 1.15.

Specific methods and the scope of nondestructive inspection of welded joints and weld surfacing should be established in the order prescribed in item 1.1.

9.1.2. The quality of welded joints and weld coated parts should be assessed during nondestructive inspection in compliance with the requirements of Section 11, taking in account the category of welded joints specified in Section 2.

9.1.3. The results of the nondestructive inspection of welded joints and weld coated parts should be recorded in keeping with directions of Section 13.

9.1.4. With regard to the scope of inspections, the nondestructive inspection is subdivided into complete control and a random inspection (scope 50, 25, 15, 10, or 5%).

The complete control should be carried over the entire length of each welded joint or over the entire surface of the coated surface of each weld coated part.

Random inspection is prescribed for individual portions of welded joints and weld coated surfaces or individual welded joints (weld coated parts).

9.1.5. Random inspection of individual areas is prescribed for rectilinear and other non-closed welded joints, for circular welded joints of parts with the rated outside diameter over 250 mm, and for weld coated parts. The relation of the total length (area) of the inspected portions to the total length of the welded joint (the area of weld coated surface) should be no less than that prescribed by the scope of random inspection.

9.1.6. During random inspection of circular welded joints of parts with the rated outside diameter up to 250 mm inclusive, it is necessary to examine individual welded joints over their entire length. The number of welded joints examined should be specified by the established scope of random inspection. This scope should be applied to each group of welded joints of the same type made by each welding operator on the manufactured (constructed) object (installation, order).

The belonging of welded joints and weld coated articles to a single type should be determined in compliance with the instructions of Appendix 1.

9.1.7. Selection of the sections inspected according to item 9.1.5 or of welded joints inspected according to item 9.1.6 should be carried out by the quality control service from among the most labor-consuming ones or from those which are doubtful as revealed by the results of preceding tests.

In the absence of such sections, the sections being inspected should be uniformly distributed over the length of the inspected seams.

9.1.8. Irrespective of the scope of random inspection, the areas of intersection and conjugation of welded seams at a distance no less than three times the normal thickness of the welded parts in either direction from the point of intersection (conjugation) of welded seam axes should be tested by all the prescribed methods on each welded joint. The length of these portions should not be included into the scope of the performed random inspection.

9.1.9. If any defects are discovered during the random inspection by any method, additional inspection should be carried out by the same method in doubled scope (in the case of a 50% random inspection it is necessary to carry out the complete control) with mandatory inspection of the areas adjoining the defective ones. If the results of the additional inspection proved to be negative, the welded joint should be subjected to the complete control.

In the case of random inspection of individual welded joints according to item 9.1.6, the directions of the present item should apply to the welded joints of the same type made by the welding operator who is responsible for the defects.

In this case, the following requirement should be complied with.

Additional inspection of the non-inspected sections should be made on twice the original

scope of welded joints of the same type executed by the welding operator in one work shift (during which the defective portion of the welded seam was made) in the case of automatic welding, and in the course of two work shifts during the manual arc welding (the work shift when the defective portion of the weld was made and the preceding work shift). If the additional inspection again reveals some defects, the scope of the inspection of single-type welded joints executed by a particular welding operator within the time should be increased to 100%.

9.1.10. The surface quality of the anticorrosive coating may be assessed by making special reference standards which characterize the permissible appearance of the coated surface. The reference standards should be made with due observance of the requirements laid down in the OP pertaining to weld surfacing with anticorrosive coatings and be accompanied by the manufacturer's certificates approved by the leading materials-science organization.

9.1.11. The sensitivity of the inspection methods used should be sufficient for discovering the discontinuities that should be fixed according to the present PK for each inspection method (in the case of radiographic inspection, the required inspection sensitivity must be ensured).

9.1.12. The inspected zone should include the entire volume of the weld metal and the adjoining areas of the base metal on both sides of the welded seam:

- for butt welds made by arc or electron-beam welding of a width:
  - no less than 5 mm, at a rated thickness of the welded parts up to 5 mm inclusive;
  - no less than the rated thickness of the welded parts, at a rated thickness of the welded parts over 5 to 20 mm inclusive;
  - not less than 20 mm, at a rated thickness of the welded parts above 20 mm;
- for corner, Tee, and edge joints and for welding tubes into tube boards made by arc or electron-beam welding at least 3 mm wide, irrespective of thickness (for the welded joints of tubes welded into the tube boards - as instructed in the design documentation or methodical instructions for inspection).
- for welded joints made by electroslag welding of a width:
  - 50 mm wide, irrespective of their thickness.

The width of the examined portions of the base metal in the welded joints of various rated thickness should be determined separately for each of the welded part depending on its rated thickness.

9.2. Visual and measuring inspection

9.2.1. While conducting visual and measuring inspection, reference should be made to the methodical branch standards or instructions.

9.2.2. If the welded joints are accessible for visual inspection on both sides, these joints should be examined both from the external and internal sides.

9.2.3. During measuring inspection, the preliminary buttered edges and welds should be measured in compliance with the instructions of the PTD, but no less than every other meter and no less than in three points of each seam (edge). The measurements should be made in the first place at the areas whose dimensions have been found doubtful during the visual inspection.

On occasions provided for in the PKD, when the number of the single-type welded joints of pipes with the rated outside diameter up to 90 mm inclusive (including such pipes welded with other parts) exceeds 50, the above-mentioned scope of the measuring inspection may be reduced (selective inspection and/or a smaller number of measurements), but no less than to 10% of the total number of welded joints to be measured and no less than one measurement on each examined welded joint.

9.2.4. When performing measuring inspection of the surfaced anticorrosive coating, its thickness should be measured on cylindrical surfaces no less than every 0.5 m in the axial direction and every 60° around the circumference in the case of manual surfacing and 90° in the case of automatic surfacing.

The flat and spherical surfaces should be measured at least once on each 0.5×0.5 m area in case of manual surfacing and on each portion one meter long (in the direction of surfacing) and 0.5 m wide in case of automatic surfacing.

9.3. Capillary inspection

9.3.1. The capillary inspection should be conducted in compliance with the provisions of GOST 18442-80 and methodical branch standards or instructions.

9.3.2. The required class of sensitivity according to GOST 18442-80 during capillary inspection should be established by the designing organization, but this class should be not less than the second class for the welded joints of the I, Iн, II, and IIн categories and for anticorrosive coatings.

9.3.3. The necessity for inspection on both sides of the welded joints shall be determined in the same way as during visual inspection according to item 9.2.2.

9.3.4. The capillary inspection may be conducted on the welded joints and weld coatings made of any materials.

9.4. Magnetic powder inspection

9.4.1. Magnetic powder inspection should be conducted in accordance with COST 21105-87 and methodical branch standards or instructions.

9.4.2. The sensitivity level according to GOST 21105-87 during magnetic powder inspection should be established by the designing organization, in which case it should be not lower than the B level for the I, Iн, II, IIн categories.

9.4.3. The necessity for inspection on both sides of the welded joint should be determined in the same way as during visual inspection according to 9.2.2.

9.4.4. The magnetic powder inspection should be conducted only on the welded joints of parts made from steels of pearlitic class and/or from high-chromium steels and their edges buttered in advance with high-chromium filler materials.

9.5. Radiographic inspection

9.5.1. Radiographic inspection should be carried out in compliance with GOST 7512-82 (except the sensitivity tables of radiographic inspection) and methodical branch standards and instructions.

9.5.2. The inspection sensitivity should be established by the radiation thickness as specified in the documents listed under item 9.5.1.

When exposing the parts to radiation through two or more walls, the sensitivity of inspection should be established by the total rated thickness of these walls.

9.5.3. The particular methods of radiographic inspection of welded joints should be determined in conformity with the provisions of methodological standards or instructions and taking in account the requirements laid down in item 9.1.12.

9.5.4. It is permitted to use X-ray-television and radiometric installations and fixing the results of inspection, provided that the required inspection sensitivity is ensured.

9.5.5. The welded joints should be subjected to radiographic inspection through one wall, except when it is technically impossible. The technical impossibility should be agreed upon with the leading branch materials-science organization and the regional agency of the USSR Gosatomenergonadzor.

9.5.6. Radiography of welded joints should be conducted by X-ray installations or braking X-ray radiation (linear accelerators, microtrons, betatrons). Gamma-raying is resorted to when X-raying is technically impossible and in the case of technical difficulties in the course of X-raying, e.g, during assembly.

9.6. Ultrasonic inspection

9.6.1. Ultrasonic inspection should be carried out in compliance with the provisions of GOST 14782-86 and methodological branch standards and instructions.

9.6.2. While inspecting anticorrosive coatings it is necessary to examine the zone of fusion of the coated metal with the base metal.

When inspecting the welded joints of weld coated steels it is necessary to examine the metal of a weld seam made with pearlitic filler materials and the zone of fusion of the coated metal and the base metal.

9.7. Inspection by running through a metal gage (ball)

9.7.1. This inspection is prescribed for pipes with a rated inside diameter not over 70 mm in cases specially stipulated in the design (project) documentation.

9.7.2. The diameter of the test gage (ball) should be as prescribed in the design (project) documentation pertaining to the welded joints being inspected.

9.8. Pressure tightness inspection

9.8.1. This inspection should be carried out when so prescribed in the design (project) documentation and conducted in compliance with the methodical branch standards or instructions.

9.8.2. Depending on the characteristics of discovered penetrating defects, five classes of pressure tightness are established (Table 1).

9.8.3. The class of pressure tightness is established by the designing (projecting) organization and is indicated in the drawings or inspection tables.

Depending on the prescribed class of pressure tightness, the manufacturing plant determines a particular method of inspection and indicates it in the PTD.

9.8.4. The pressure tightness inspection is prescribed for welded joints which must meet the requirements of gas or vacuum tightness at the rated thickness of the part with the thinnest walls out of the welded parts up to 8 mm inclusive.

Table 1. **Characteristics of Pressure Tightness Classes**

Pressure tightness class	Minimum values of summary characteristics of discovered penetrating defects	
	m^3, Pa/s	L·mm Hg/s
I	From 6.7 10^{-11} to 6.7 10^{-10}	From 5 10^{-7} to 5 10^{-6}
II	Over 6.7-10^{-10} to 6.7 10^{-9}	Over 5 10^{-6} to 5 10^{-5}
III	Over 6.7 10^{-9} to 6.7 l^{-7}	Over 5 10^{-5} to 5 10^{-3}
IV	Over 6.7 10^{-7} to 6.7 10^{-6}	Over 5 10^{-3} to 5 10^{-2}
V	Over 6.7 10^{-6} to 6.7 10^{-4}	Over 5 10^{-2} to 5.0

9.9. Hydraulic (pneumatic) tests

9.9.1. The welded joints should be subjected to these tests as a part of assembly units or articles. Luminescent-hydraulic inspection is also allowable.

9.9.2. Hydraulic (pneumatic) tests should be carried out as prescribed in the design (project) and production process documents prepared in compliance with the requirements of ПН АЭГ-7-008-89.

9.10. Inspection procedure

9.10.1. The nondestructive acceptance inspection of welded joints and weld coated parts (articles) should be carried out after their thermal treatment (if prescribed).

If a welded joint or a weld coated part (article) must be repeatedly tempered, this inspection should be performed after any tempering.

9.10.2. If a welded article must be subjected to a complete thermal treatment (normalization or hardening followed by tempering) the nondestructive inspection of welded joints should be performed after this thermal treatment, regardless of the preliminary tempering.

9.10.3. If a welded joint (weld coated part) is subject to mandatory radiographic and ultrasonic inspection, the radiographic inspection may be performed before thermal treatment (including the complete thermal treatment) with mandatory 100% ultrasonic inspection after the thermal treatment.

9.10.4. If a welded joint is subject to machining with removal of a part of a weld seam or to deformation, the nondestructive acceptance inspection should be carried out after these operations.

The radiographic inspection may be carried out before the final machining of the welded joint, if the summary allowance for this machining is not over 20% of the rated thickness of the welded parts on each side; the required inspection sensitivity should be selected on the basis of the radiation thickness of the wall after machining.

9.10.5. The sequence of the nondestructive inspection carried out by various methods should be as prescribed in the PTD, however, the visual and measuring inspection should precede all other inspection methods.

9.10.6. The visual and measuring inspection should be carried out both before and after thermal treatment of the welded joints and weld coated parts.

It is permitted to carry out measuring inspection after thermal treatment only for the position of axes of the welded parts (the absence of undue deformations).

9.10.7. The pressure tightness inspection should be carried out after the hydraulic tests. In case the liquid methods are used, the pressure tightness inspection may be combined with the hydraulic tests. On the decision of the designing organization agreed upon with the manufacturing plant and the leading materials-science organization, the pressure tightness inspection may be carried out before hydraulic tests.

9.11. Scope of the inspection

9.11.1. The particular methods and scope of nondestructive inspection of welded joints and weld coated parts (depending on their type and category) should be established in accordance with Tables 2 through 6 taking in account the additional directions of the PK and should be specified in the design documentation.

For welded joints of parts with different rated thickness, the scopes of the inspection indicated in Table 2 should be set on the basis of the rated thickness of the most thin-walled part at the point of welding (or the thinnest portion in the case of a welded joint having a variable section).

9.11.2. The methods and scope of nondestructive inspection established for each welded joint (weld coated part), with account taken of the approved deviations which are presented in the order specified in Section 14, should be given in the inspection tables.

9.11.3. The 100% capillary inspection is prescribed for all the welded joints of the parts from steels of austenitic class made with niobium-containing filler materials and the welded joints between the parts from austenitic steels and the niobium-containing anticorrosive surfacing.

In other cases, the necessity for and the scope of capillary inspection of welded joints of the parts made from steels of austenitic class should be specified in inspection tables.

9.11.4. The parts made from alloyed steels, buttered with pearlitic or high-chromium filler materials, should be subjected to 100% capillary or magnetic powder inspection regardless of the category of the welded joint (including the fusion zone between the coated and base metal).

The welded joints of the above-specified parts with the parts made from steels of austenitic class should be subjected to repeated capillary inspection of the zone of fusion between the buttering and the base metal.

9.11.5. The scope of capillary or magnetic powder inspection prescribed in Tables 2 through 6 and in item 9.11.3 may be reduced, if the inspection of the first twenty single-type welded joints of the manufactured or erected object (installation, order) with a total length of inspected joints no less than ten meters reveals no cracks. This principle does not apply to the welded joints of categories I, Iн, II, IIн of parts made from steels of pearlitic class alloyed with vanadium or niobium and of parts made from steels of austenitic class welded with niobium-containing filler materials and to the welded joints of all categories of parts made from steels of various structural classes.

9.11.6. The scope of the capillary or magnetic-powder inspection reduced in accordance with item 9.11.5 should be no less than 2% for welded joints of parts made from carbon and/or silico-manganese steels and for welded joints of parts made from steels of austenitic class with niobium-free filler materials and no less than 15% in other cases.

If the random inspection according to the present item reveals even only one crack, all the welded joints carried out with the use of the same consignment of filler materials as the defective welds have to be subjected to complete control.

9.11.7. If radiographic and/or ultrasonic inspection of welded joints proves to be impossible, these methods of inspection may be replaced by layer-by-layer visual inspection in the course of welding, with recording the inspection results in a special log followed by capillary or magnetic powder inspection of the welded joints in accessible places.

This replacement should be agreed upon with the manufacturing plant (erection organization) and the leading materials-science organization.

9.11.8. The radiographic inspection according to Tables 2 through 4 of the welded joints of the IIв and IIIс categories intended for operating under a pressure of up to 0.07 MPa may be omitted, which fact should be duly recorded in the design documentation.

9.11.9. The scope of the radiographic inspection of welded joints of the pipelines of the IIв and III categories, which are out of contact with a radioactive heat carrier, with the rated outside diameter up to 200 mm, inclusive, and at the rated thickness of the wall less than 15 mm, may be reduced by the decision of the designing (projecting) agency, but no more than twice.

9.11.10. The ultrasonic inspection of welded joint not subject to radiographic inspection may be replaced by the radiographic inspection in the same scope.

Should it be impossible to carry out radiographic inspection of welded joints of the IIIв and IIIс categories, the designing (projecting) organization may decide, subject to approval by the manufacturing plant (erection organization) and the leading materials-science organization, to replace the said kind of inspection by the same scope of ultrasonic inspection.

9.11.11. If the welded joint has to be subjected to random radiographic and ultrasonic inspection, but the latter is technically impossible, the scope of radiographic inspection should be doubled.

9.11.12. The radiographic inspection of corner, Tee, edge, and overlap welded joints should be undertaken only in the case when the total radiation thickness of the X-rayed metal (weld metal plus base metal) does not exceed 100 mm; in this case, the design height of the corner joint or the weld seam thickness in the X-raying direction should be no less than 0.2 of the total radiation thickness.

9.11.13. The inaccessibility of particular welded joints to inspection by one or another method should be stipulated in the design documentation.

9.11.14. The corner, Tee, edge, and overlap wedge joints with a structural clearance, as well as corner and Tee joints of pipes with the rated diameter of the welded up pipe (union) under 100 mm are not to be subjected to ultrasonic inspection.

9.11.15. The welded joints securing the branch pipes (unions) and pipes up to 15 mm to pipelines and equipment as well as those securing the tubes into tube plates at the rated diameter of branch pipes (unions) and pipes up to 15 mm are not to be subjected to radiographic inspection, if not otherwise instructed in the design documentation.

The welded joints securing the branch pipes (unions), and pipes with an inside diameter up to 30 mm, inclusive, should be subjected to radiographic inspection in the scope of at least 50% of the length of the corresponding weld; in thus case, a mandatory operation is layer-by-layer visual inspection in the process of welding. The reduction of the scope of the weld seam inspection should not be taken in account when determining the total scope of random inspection.

Table 2. **Methods and Scope of Nondestructive Inspection of Welds of Parts Made of Steels of Pearlitic Class and/or High-Chromium Steels (except welded joints of tubes in tube plates and welded joints of auxiliary parts)**

Rated thickness of welded parts, mm	Category of welded joints	Scope of inspection, %								
		visual and measuring	by running through of a metal ball	capillary or magnetic powder	radiographic			ultrasonic		Pressure tightness control
					on equipment	on pipelines		on equipment	on pipelines	
						up to $D_н$ = 325 mm, inclusive	over $D_н$=325 mm			
Up to 5.5 inclusively.	I, Iн, IIa, Iна,	100	See subsection 9.7.1	100	100	100	100	-	-	
	IIв, IIнв	100		50	100	50	100	-	-	
	IIнс	100		50	25	10	10	-	-	
	IIIa	100		-	50	25	50	-	-	
	IIIв	100		-	50	25	50	-	-	
	IIIс	100		-	25	5	10	-	-	
Over 5.5	I, Iн	100		100	100	100	100	100	100	See subsection 9.8.
	IIa, IIна	100		100	100	50	100	100	100	
	IIв, IIнв	100		50	50	25	50	100	100	
	IIнс	100		25	25	10	10	25	25	
	IIIa	100		-	50	25	50	100	100	
	IIIв	100		-	25	-	25	25	25	
	IIIс	100		-	10	-	10	10	10	

Note. The term "auxiliary parts" should be understood as parts that are not subjected to pressure which are welded to the casings of the equipment and pipelines (supports, backings, separating devices, suspensions, etc.).

Table 3. **Methods and Scope of Nondestructive Inspection of Welded Joints of Parts Made of Steels of Austenitic Class and Iron-Nickel Alloys with Parts Made of Steels of Pearlitic Class or of High-Chromium Steels (except welded joints of tubes in tube plates and welded joints of auxiliary, parts)**

Welded joints	Category of welded joint	visual and measuring	Scope of inspection, %					
			by running through a metal ball	capillary	radiographic			
					on equipment	on pipelines		Pressure tightness
						up to $D_н$=325 mm inclusive	over $D_н$=325 mm	
Parts made from austenitic steels or iron-nickel alloys	I, Iн, IIа, Iна,	100	See item 9.7.1	As instructed in present Inspection Regulations	100	100	100	See subsection 9.8.
	IIв, IIнв	100			100	50	100	
	IIнс	100			25	10	10	
	IIIа	100			50	25	50	
	IIIв	100			50	25	50	
	IIIс	100			25	10	25	
Parts made from austenitic steels or iron-nickel alloys with parts made from pearlitic or high-chromium steels	I, Iн, Iна IIа	100		100	100	100	100	
	IIв, IIнв, IIнс IIIа IIIв	100		50	100	100	100	
	IIIс	100		10	100	100	100	

Table 4. **Methods and Scope of Nondestructive Inspection of Buttering of Parts from Steel of Pearlitic Class and from High-Chromium Steels and of Nondestructive Inspection of Coated Anticorrosive Coating on Parts (Articles) from Steels of Pearlitic Class**

Type of welding	Category of welded joint	Scope of inspection, %				
		visual and measuring	capillary or magnetic powder	radiographic		Ultrasonic
				up to $D_н$ = 325 mm, inclusive	over $D_н$ = 325 mm	
Preliminary buttering with austenitic filler materials	I, Iн, IIa, IIна	100	100	100	100	100
	IIв, IIнв, IIIa	100	100	100	100	50
	IIIв	100	100	100	100	25
	IIIс	100	100	100	100	10
Preliminary buttering with high-chromium or pearlitic filler materials	I, Iн	100	100	100	100	100
	IIa, IIн	100	50	50	100	100
	IIв, IIIнв	100	25	25	50	100
	Ila	100	25	10	25	100
	IIIв, IIIс	100	-	-	-	100
Built-up anticorrosive coating	-	100	-	-	-	100
Reinforcing surfacing	Methods and scope of inspection should be established by designing organization on agreement with manufacturing plant, leading materials-science organization and the USSR Gosatomenergonadzor					

Table 5. **Methods and Scope of Nondestructive Inspection of Welded Joints of Tubes in Tube Plates and Headers**

Category of welded joint	Scope of inspection			
	visual and measuring	capillary and magnetic powder	Radio-graphic	Pressure-tightness
I, Iн, IIна	100	100	100	100
IIа, IIнв	100	50	50	See subsection 9.8
IIв, IIIа	100	-	25	
IIIв	100	-	10	
IIIс	100	-	-	

Note. If the welded joints of tubes in tube plates and headers are inaccessible to radiographic inspection or there are no methods ensuring the required authenticity of inspection results the radiographic inspection may be re-plated by capillary of magnetic powder inspection in the same scope while in the joints of tubes welded into tube plates and headers on special automatic welders followed by 100% inspection of performed welds for pressure-tightness by a helium lead detector - a metallographic inspection of control welds performed on each welding set at the beginning of each work shift (not less than two welded joints examined in at least four sections of each joint). This decision should be taken by the designing agency jointly with the manufacturing plant constructing organization) and with the leading materials-science organization on approval by the local agency of the USSR Gosatomenergonadzor and should be recorded in the production-process documentation.

Table 6. **Methods and Scope of Nondestructive Inspection of Corner and Overlap Welded Joints Used in Welding Auxiliary parts to Parts Operating under Pressure**

Category of welded joint	Scope of inspection. %	
	visual and measuring	capillary or magnetic powder
I, Iн, Iна	100	100
IIа, IIнв, IIв, IIIа	100	25
IIIв, IIIс	100	10

Note. The categories of welded joints are established in accordance with the groups of equipment and pipelines to which auxiliary parts are welded.

10. DESTRUCTIVE INSPECTION

10.1. General requirements

10.1.1. The destructive inspection should be carried out in the following cases:

- when checking the quality of the welding (surfacing) materials by testing the specimens cut out of the control welded seams (weld deposits);
- when certifying the production technology of welded joints and weld coated surfaces by testing the specimens cut from the control welded joints (weld deposits);
- when checking the characteristics of the metal of production welded joints for compliance with the established norms by testing the specimens cut from the control production welded joints (when specially specified in the designing documentation for the articles being inspected).

10.1.2. The destructive inspection should be carried out in compliance with the requirements of relevant normative-and-engineering documents:

- checking the chemical composition according to GOST 12344-88, GOST 12352-81, GOST 12353-78, GOST 12354-81, GOST 12356-81, GOST 12357-84, GOST 12361-82, GOST 12365-84, GOST 22536.1-88, GOST 22536.5-87, GOST 22536.7-88, GOST 22536.0-87, GOST 27809-88 or in compliance with methodological branch documents;
- determination of mechanical properties (ultimate strength, yield point, relative elongation, reduction of area), static bend test, flattening, and impact bending, according to GOST 6996-66;
- bending tests of weld coated parts according to Norms for Strength Analysis of Equipment and Pipelines of Nuclear Power Plants (ПН АЭ Г-7-002-86) (Appendix 2);
- determination or confirmation of the critical temperature of brittleness, according to ПН АЭ Г-7-002-86 (Appendix 2);
- tests for the resistance to intercrystalline corrosion, according to GOST 6032-84 (AM or AMU methods);
- determining the ferrite phase content in the coated metal, according to branch standards or instructions;
- metallographic tests, according to branch standards or instructions.

10.1.3. The types of specimens for determining the mechanical properties of metal of the weld seam, coated metal, and welded joints should be selected from COST 6996-66 and be specified in design documentation or the PTD (stating the order number of relevant drawing, when necessary).

The impact bending tests for determining or confirming the critical temperature of brittleness should be made on type IX specimens according to the above mentioned standard.

Note. When testing for impact bending the weld metal or coated metal, made with austenitic filler materials, it is permitted, in cases stipulated in the design documentation, to use type VI specimens according to GOST 6996-66. In this case, the quality assessment norms are established by the relevant technical standard or design documentation.

10.1.4. The number of specimens for the mechanical tests should be at least two for tests at each temperature. The number of specimens for metallographic tests should be at least two from each control welded joint.

For other types of tests, the number of specimens should not be less than that specified in the relevant technical paper according to item 10.1.2.

10.1.5. The checked surfaces of micro-sections for metallographic test should include:

- when controlling the welded joints on transverse micro-sections - the section of the weld and buttered edges with adjoining areas of the base metal to permit checking the thermal influence zone;
- when controlling the weld surfacing - the deposited layer with an adjoining part of this metal which permits checking the thermal influence zone.

10.1.6. When testing the welded joints of steels of austenitic class for static bending, in the cases specified in the PKD, it is permitted to use mandrels whose diameter is equal to two to four thickness of the specimens being tested.

10.1.7. The results of the destructive inspection should satisfy the requirements of Section 11.

In the case of unsatisfactory results of any type of mechanical tests, re-tests may be made of twice the original number of specimens. The results of re-tests should be considered final.

In the case of unsatisfactory results of tests for determining the ferrite phase or of metallographic tests, a new control coating (weld seam, welded joint) should be made and the tests should be repeated in the same scope. The results of the tests should be considered final.

10.1.8. In the case of unsatisfactory results of the tests for resistance to intercrystalline corrosion, re-tests should be made on twice the original number of specimens; the results of the re-tests should be considered final.

10.1.9. The results of the destructive inspection should be recorded as prescribed in the relevant technical standard documentation listed in item 10.1.2 and in Section 13.

10.1.10. The results of the checks of chemical composition, critical brittleness temperatures, as determined according to item 10.1.2, should be entered in the certificates of the equipment and pipelines.

10.2. Quality control of welding (weld surfacing) materials

10.2.1. The destructive inspection during quality checks of welding (weld surfacing) materials, before their utilization in actual production, should be carried out by testing the specimens cut out from the control welds and weld surfacing performed in compliance with the requirements of subsection 6.4.

10.2.2. The inspection of the built-up metal or weld seam metal according to item 10.2.1. is aimed at determining:

- chemical composition;
- mechanical properties (ultimate strength, yield point, relative elongation, reduction of area) at standard temperature;
- mechanical properties at elevated temperatures, in cases specified in design documentation;
- critical brittleness temperature (or its confirmation), in cases specified in design documentation;
- content of ferritic phase in austenitic built-up metal;
- resistance to intercrystalline corrosion of the austenitic metal.

10.2.3. During the inspection of coated electrodes or wire for argon-arc welding in argon and in argon-helium mixture (in the absence of titanium and niobium in the wire), it is permitted not to determine the chemical composition of the coated metal or weld metal (the certificate data may be taken in account).

10.2.4 When inspecting the coated electrodes, the following tests may be omitted:

- mechanical properties of weld metal or coating metal at standard and/or elevated temperatures, if the certificate of the electrode consignment being inspected contains the appropriate characteristics of the welded seam metal (built-up metal) without thermal treatment, and the electrodes of the consignment being inspected are intended for making welded joints (weld surfacing) not subjected to thermal treatment;
- mechanical properties of the weld metal or built-up metal at standard and/or elevated temperatures provided the certificate of the electrode consignment being inspected contains the appropriate characteristics of weld seam metal (built-up metal) after the thermal treatment whose conditions correspond to the conditions of thermal treatment of production welded joints (coating) which will be made by the electrodes of the consignment being inspected.

10.2.5. The critical brittleness temperature should not be determined (confirmed) in the following cases:

- when the certificate of the electrode consignment being inspected contains the results of determination or confirmation of the critical brittleness temperature of the weld metal or coating metal;
- when the welding materials are intended for welding (weld surfacing) of articles not expected to be analyzed for the resistance to brittle rupture according to the norms of ПН АЭ Г-7-002-86 (Section 5.8).

10.2.6. When inspecting the filler materials for argon-arc welding, intended for welding the root of the seam (except butt welds of the I and Iн categories) and for making welded joints with a minimum thickness up to 16 mm inclusive (counting by the smaller thickness), the

determination of the mechanical properties and critical brittleness temperature of the weld metal or coated metal may be omitted.

10.2.7. When inspecting the welding (surfacing) materials intended only for making the first layer (adjoining the base metal) of the surfacing of any type, the mechanical properties of the coating metal and determination (confirmation) of the critical brittleness temperature of weld metal or coating metal may be omitted.

10.2.8. The mechanical properties of the weld metal (coating metal) made from austenitic welding materials should be determined only in the cases when the structure for which they are intended will be thermally treated after welding or heated for bending, stamping, etc. or in the case of special requirements in the design documentation.

10.2.9. The content of the ferritic phase should be determined in the metal fused with austenitic filler materials (electrodes, wire, strip) if this content is specified in standards or specifications covering the corresponding filler material.

10.2.10. The resistance to the intercrystalline corrosion should be checked during the inspection of the filler materials intended to be used for welding (weld surfacing) of articles made from steels of austenitic class and operating in water, water-steam, and steam media or for surfacing the upper layer of the anticorrosive coating.

In this case, the control weld seams (weld surfacing), from which the test specimens are cut, should be subjected to thermal treatment, if this is prescribed for the production welded joints (weld surfacing). If the production welded joints (weld surfacing) are thermally treated under different conditions, the control specimens should be thermally treated under one set of these conditions, which is the most unfavorable from the viewpoint of resistance of the weld seam metal (built-up metal) to intercrystalline corrosion. The thermal treatment conditions should be agreed upon with the leading materials-science organization and specified in the PKD.

The tests for the resistance to intercrystalline corrosion during inspection of the welding (surfacing) materials intended for making a single-layer anticorrosive coating should be carried out in compliance with the instructions of the leading materials-science organization.

10.2.11. The destructive inspection of surfacing materials intended for making anticorrosive coatings should be carried out in compliance with the standards or instructions of the leading materials-science organization approved by the leading interdepartmental materials-science organization.

10.3. Production certification of the technology of welded joints and weld surfacing

10.3.1. The destructive inspection during production certification of the technology of welded joints and weld surfacing should be carried out by testing the specimens cut from the control welded joints and weld surfacing performed in keeping with the requirements specified hereunder.

10.3.2. Each group of single-type production welded joints (weld surfacing) performed in accordance with the technology being certified should be provided with at least one control welded joint (weld surfacing).

10.3.3. The control welded joints (weld surfacing) should be executed in compliance with the requirements of the PTD for the technology being certified.

10.3.4. When the control welded joints or weld surfacing are made with heating, the heating temperature should be set in compliance with the requirements of OP for the maximum rated thickness of the production welded joints (weld coated parts) of the certified group, similar from the viewpoint of the base metal grade to the control welded joint (surfacing). The thickness of the parts of the control welded joint should be not smaller than the thickness beginning from which, according to the Guidelines, welding should be accompanied by heating.

10.3.5. When making control welded joints or weld surfacing subject to thermal treatment, the holding temperature should be established in accordance with the OP. In this case, the thickness of the parts of the control welded joint should be not smaller than the thickness

which is the starting point, according to this document, after which thermal treatment is mandatory.

10.3.6. The thickness of the base metal of the control coating should correspond to the maximum rated thickness of the base metal of the parts with coated surfaces in each certified group. The control weld surfacing for the production weld coated parts with the rated thickness of the base metal exceeding 50 mm may be made with the base metal of a smaller thickness, but no less than 50 mm.

10.3.7. The control welded joints and weld surfacing should be subjected to 100% nondestructive inspection by the methods prescribed for the corresponding certified production welded joints and weld coated surfaces and should meet the norms established in Section 11. In this case, the norms should be determined by the rated thickness of the control welded joints and weld coated parts.

10.3.8. A consignment (combinations of consignments) of welding (weld surfacing) materials used for making control welded joints (weld surfacing) according to item 10.3.1 should be checked in accordance with the requirements of Section 6 of the present PK.

10.3.9. When inspecting the butt welded joints, the following tests should be made:

- test for the ultimate strength at standard temperature;
- test for the ultimate strength at an elevated temperature;
- determining the angle of bend or flattening at standard temperature.

10.3.10. The tests of ultimate strength at elevated temperature should be carried out only if so prescribed in the design documentation covering the articles welded according to the technology being certified. In this case, the test temperature should be the highest out of those specified in these documents.

10.3.11. When inspecting the corner, Tee, and overlap welds, only metallographic tests are prescribed.

10.3.12. Inspection of the weld coated surfaces should be accompanied by bending angle and metallographic tests.

10.4. Inspection of production welded joints

10.4.1. The production welded joints are inspected in the following cases:

- for casings of the group A equipment;
- for casings of the group B equipment in cases prescribed by the designing organization on agreement with the manufacturing plant.

10.4.2. During inspection according to item 10.4.1, control production welded joint should be made. In this case, the control production welded joint should be similar to one of the inspected production circular or longitudinal welded joints of the central shells of the equipment casings with regard to the grade and lot (melt) of the base metal, consignment (combination of consignments) of welding materials, type of the welded joint, rated thickness, and outside diameters of welded parts, method and conditions of welding, as well as with regard to conditions of the preliminary and concurrent heating and thermal treatment.

If two casing shells welded to each other are made from metal of different lots (melts), the control production welded joint may be similar to the inspected production welded joints with respect to the lot (melt) of the base metal of only one of the shells.

The control production welded joints may be made with dimensions differing from the dimensions of the corresponding production welded joints, provided that the relation of the maximum and minimum thickness and outside diameters of the parts of the production and control welded joints does not exceed 1.25 for the group A equipment and 2.0 for the group B equipment.

This relation for the welded joints, executed by the electroslag welding, should not exceed 1.25, regardless of the group of equipment.

For the longitudinal welded joints the relation of diameters may be disregarded.

On occasions specified in the design documentation, when the rated outside diameter of the production welded joints exceeds 50 mm, it is permitted to make flat control production welded joints.

10.4.3. The necessity for making control production welded joints should be stipulated in the design documentation for the inspected equipment, which shall prescribe the execution of special parts taking into account the requirements of item 10.4.2, or a corresponding increase in the length of the blanks of production parts, which ensures the possibility of making a control production welded joint of requisite dimensions.

10.4.4. When one enterprise turns out several units of the group B equipment within a year according to the same drawings and PTD, it is permitted to make one control welded joint per group (order) of casings of these units, the number of which does not exceed six.

10.4.5. If the production welded joint is subjected to repeated thermal treatment under tempering conditions, the control welded joint may be subjected to a single tempering with a duration of 80 - 100% of the total duration of all production tempering operations. If the temperatures of production tempering are different, the holding time at each temperature should be no less than 80% and no more than 100% of the total duration of the holding time of corresponding production tempering operations. The time of transition from one temperature to another is not taken in account and the sequence of the holding at various temperatures shall depend on the sequence of performing the corresponding production tempering operations.

10.4.6. During inspection according to item 10.4.1, it is necessary to determine the following characteristics of the welded joint:

- ultimate strength and bending angle at standard temperature;
- ultimate strength at an elevated temperature;
- resistance to intercrystalline corrosion.

10.4.7. The ultimate strength of a welded joint at an elevated temperature should be determined only if so prescribed in the design documentation covering the article being inspected.

10.4.8. The ultimate strength and bending angle of the welded joints of parts made from steels of austenitic class should be determined only in cases when the inspected production article is subjected to thermal treatment, heating for bending, stamping, or other thermal-treatment operations or when so prescribed in the relevant directions of the design documentation covering the article in question.

10.4.9. The ultimate strength of the welded joints of parts from steels of different structural classes (e.g., pearlitic and austenitic) should be determined only when appropriate instructions directives are specified and quality assessment standards are established in the design documentation for the article in question. .

10.4.10.The tests for resistance to intercrystalline corrosion should be performed only for the welded joints of the parts made from corrosion-resistant steels of austenitic class (if design documentation contains requirements as to resistance to intercrystalline corrosion).

10.4.11. The critical brittleness temperature of the weld seam metal and fusion zone or weld zone of the control production welded joint should be determined when so prescribed in the design documentation.

11. QUALITY ASSESSMENT NORMS

11.1. General

11.1.1. The quality of welded joints and built-up metal should be assessed on the basis of the inspection results of particular welded joints and weld coated articles in keeping with the requirements of Sections 9 and 10.

11.1.2. The quality assessment norms should be based on the following factors:

- when inspecting the butt welded joints of various thickness - on the rated thickness of the thinnest part;
- when inspecting the corner and Tee welded joints - on the design height of the comer weld;
- when inspecting the end welded joints - on twice the rated thickness of the thinner welded part;
- when inspecting the welding in of tubes into tube plates - on the rated thickness of tube walls;
- during the radiographic inspection of welded joints of tubes of other cylindrical parts through two walls - on the rated thickness of one wall;
- during inspection of welded joints with a boring - on the rated thickness of the wall (at the point of boring) which should be specified in the design documentation or in the PKD. The results of inspection should meet the norms of the present PK.

11.1.3. The length of welded joints should be determined over their external surface (for circular, corner, and Tee welded joints, over the external surface of the welded-on part at the edge of the corner joint).

11.1.4. In cases indicated in the drawings of articles, during inspection of welded joints of the IIIв and IIIс categories (accessible to welding from one side and having no backing rings) of the pipelines and pipe systems of equipment, the weld root may have incomplete penetrations with a depth (height) up to 10% of the rated thickness of welded pipes, but not over 2 mm with a total length not over 20% of the inside perimeter of the joint.

11.1.5. The quality assessment norms of the reinforcing weld surfacing should be established by the designing organization on agreement with the manufacturing plant, leading materials-science organization, and the USSR Gosatomenergonadzor.

11.2. Visual and measuring inspection

11.2.1. Cracks, peeling, burns, blowholes, overflows, shrinkage pits, undercuts, metal splashes, incomplete penetrations, clusters, and non-individual inclusions revealed by visual inspection are impermissible.

11.2.2. The norms of permissible individual surface inclusions and pores for the welded joints and buttered edges are given in Table 7.

11.2.3. The norms of permissible height (depth) of the depression between the beads and of ripples on the surface of welded joints are given in Table 8.

11.2.4. The surface of the anticorrosive coating may have individual inclusions not over 1 mm in size, if their number in any area of 100×100 mm in size is not over four.

The surface of reinforcing weld surfacing may have individual inclusions with a maximum size not over 1 mm, if their number on any 25 cm^2 area does not exceed five.

Visual inspection of these surfaces should comply with the instructions of Notes 1 and 2 of Table 7.

The height (depth) of the hollow between the beads on these surfaces should not exceed 1 mm and that of ripples, not over 0.5 mm.

During automatic arc weld surfacing with a strip electrode, the levels of the surfaces of two adjacent beads may be misaligned at points of their conjugation by no more than 2 mm.

Table 7. **Norms of Permissible Surface Inclusions in Welded Joint and Buttered Edges**

Rated thickness of welded (weld coated) parts, mm	Permissible maximum size of inclusion in welded joints (weld surfacing) of categories, mm					Maximum permissible number of inclusions on any 100 mm of the length of welded joint (coating) of categories:				
	Iн	IIн	I	II	III	Iн	IIн	I	II	III
Up to 2 inclusive	-	-	-		0.3	-	-	-	-	2
Over 2 to 3 inclusive	-	-	-	0.3	0.4	-	-	-	2	3
Over 3 to 4 – inclusive	-	-	0.3	0.4	0.5	-	-	2	3	4
Over 4 to 5 inclusive	-	0.3	0.4	0.5	0.6	-	2	2	3	4
Over 5 to 6 inclusive	0.3	0.4	0.5	0.6	0.8	2	2	2	3	4
Over 6 to 8 inclusive	0.4	0.6	0.8	0.8	1.0	2	2	3	4	5
Over 8 to 10 inclusive	0.5	0.6	0.8	1.0	1.2	2	3	3	4	5
Over 10 to 15 inclusive	0.6	0.8	1.0	1.2	1.5	3	3	3	4	5
Over 15 to 20 inclusive	0.8	1.0	1.2	1.5	2.0	3	3	4	5	6
Over 20 to 40 inclusive	1.0	1.2	1.5	2.0	2.0	3	4	4	5	6
Over 40 to 100 inclusive	1.2	1.5	1.5	2.0	2.5	4	4	5	6	7
Over 100 to 200 inclusive	1.5	1.5	1.5	2.0	2.5	4	5	6	7	8
Over 200	1.5	1.5	1.5	2.0	2.5	5	6	7	8	9

Notes. 1. Inclusions of a maximum actual size up to 0.2 mm are disregarded irrespective of the rated thickness of welded (weld coated) parts both when counting the number of individual inclusions and when considering the distance between inclusions.

2. Any combination of inclusions (individual clusters, groups of inclusions) which may be inscribed into a square with a side size not exceeding the maximum permissible size of an individual inclusion may be considered as a single solid inclusion.

Table 8. **Norms of Permissible Height (depth) of Hollows between Beads and Ripples on their Surfaces**

Rated thickness of welded (weld coated) parts, mm	Maximum linear size for categories of welded joints, mm		
	I, Iн, IIн	II	III
Up to 2 inclusive	0.3	0.4	0.6
Over 2 to 4 inclusive	0.4	0.6	0.8
Over 4 to 6 inclusive	0.6	0.8	1.0
Over 6 to 10 inclusive	0.8	1.0	1.2
Over 10 to 15 inclusive	1.0	1.2	1.5
Over 15	1.2	1.5	2.0

11.2.5. The shape and dimensions of the structural elements of welded seams (width and height of reinforcement, concavity and excessive weld root penetration, displacement of edges, minimum distance from the edge of weld reinforcement to the line of fusion of the preliminary buttering with the base metal) and geometric position of the axes of welded parts (displacement, angle of axes, and perpendicularity) should meet the requirements of the present PK and design documentation.

11.2.6. When inspecting the joints assembled for arc welding, take care to observe the following requirements.

11.2.6.1. The displacement of faces of the parts assembled for arc welding with two side preparation of edges should not exceed 0.5 mm at their rated section up to 1 mm, inclusive, half the rated size of faces at its value above 1 up to 4 mm inclusive and 2 mm at a rated size of faces exceeding 4 mm.

11.2.6.2. The permissible displacement (misalignment) of the internal edges in the butt welded joints with one-sided preparation is established by drawings, specifications covering the article, or by the PTD. In the absence of such stipulations in these documentation, this displacement may attain 12% of the rated wall thickness of the welded parts, but not over 0.5 mm.

11.2.6.3. In the butt welded joints assembled for electroslag welding, the displacement of edges of the parts to be welded should not exceed 2 mm.

11.2.6.4. In the butt welded joints of the parts of identical rated thickness assembled for the arc welding and not subjected to machining after welding in the zone of the weld seams, the displacement of edges (misalignment of surfaces of joined parts) at the side (sides) of the welding should not exceed the norms given in Table 9.

Table 9. **Norms of Permissible Displacements of Edges in Butt Joints**

Rated thickness of joined parts, mm	Maximum permissible displacement of edges in butt joints, mm		
	Longitudinal, meridianal, chord, and circular during welding of any parts and circular for welding end plates	transverse circular	
		when welding pipes and tapered parts	when welding up cylindrical casing parts from plates or forgings
Up to 5 inclusive	0.20S	0.20S	0.20S
Over 5 to 10 inclusive	0.10S+0.5	0.10S+0.5	0.25S
Over 10 to 25 inclusive	0.10S+0.5	6.10S+6.5	0.10S+1.5
Over 25 to 50 inclusive	0.04S+2.0	0.06S+1.5	0.06S+2.5
Over 50 to 100 inclusive	0,02S+3.0	0.03S+3.0	0.045+3.5
Over 100	0.01S+4.0 but not over 6.0	0.015S+4.5, but not over 7.5	0.025S+5.0, but not over 10.0

11.2.7. When inspecting the executed welded joints, the following requirements should be

observed.

11.2.7.1. When welding the swivelling butts of piping parts without backing rings, it is permitted to have a continuous or intermittent concavity of the weld root on the internal side not exceeding that specified in Table 10.

When welding the non-swivelling butts of pipes without backing rings, the permissible concavity of the weld root at the internal side should not exceed that indicated in Table 11.

Table 10. **Norms of Permissible Concavity on Internal Side of Weld Root**

Rated thickness of wall of welded pipes (parts), mm	Permissible maximum height (depth) of concavity of weld root, mm
From 1.0 to 1.8 inclusive	0.2
Over 1.8 to 2.8 inclusive	0.4
Over 2.8 to 4.0 inclusive	0.6
Over 4.0 to 6.0 inclusive	0.8
Over 6.0 to 8.0 inclusive	1.0
Over 8.0 to 12 inclusive	1.2
Over 12	1.5
Note. For welded joints of IIIb and IIIc categories the height (depth) of concavity may be increased in 1.5 times.	

11.2.7.2. The dimensions of continuous or intermittent convexity of the weld root during one sided welding of pipes without backing rings and the fusion of the edges and backing ring in the course of welding with blowing should meet the requirements specified for the corresponding types of welded joints in the OP. In cases not covered in the OP, this convexity should meet the requirements of Table 12.

11.2.8. The thickness of reinforcing weld surfacing should meet the requirements of the designing documentation and PTD.

Table 11. **Norms of Concavity on Internal Side of Weld Boot**

Rated thickness of wall of welded pipes (parts), mm	Permissible maximum height (depth) of concavity of weld root, mm
From 1.0 to 1.8 inclusive	0.4
Over 1.8 to 2.8 inclusive	0.6
Over 2.8 to 4.0 inclusive	0.8
Over 4.0 to 6.0 inclusive	1.0
Over 6.0 to 8.0 inclusive	1.2
Over 8	0.15S but not over 1.6 mm, provided rated size of weld reinforcement is increased by 1 mm
Note. For welded joints of IIIв and IIIc categories the height (depth) of concavity may be increased 1.5 times.	

Table 12. **Norms of Weld Convexity for One-sided Welding**

Rated inside diameter of pipe, mm	Size of convexity, mm, max
Up to 25 inclusive	1.5
Over 25 to 150 inclusive	2.0
Over 150	2.5

11.2.9. The thickness of the anticorrosive weld coating and the thickness of the preliminary buttering of edges of parts should meet the requirements of the OP and design documentation. During thickness measurements, the permissible sinking between the beads should be disregarded.

11.2.10. Any defects discovered during the visual and measuring inspection should be corrected before the inspection by any other methods.

11.3. Inspection by running through a metal gage (ball)

The results of the inspection should be considered satisfactory if the gage (ball) of the diameter specified in the drawing passes through the welded joint being inspected.

11.4. Pressure tightness inspection

The quality of the welded joint should be considered satisfactory if the inspection by the method corresponding to the preset class of pressure tightness does not reveal any impermissible leaks.

11.5. Capillary inspection

11.5.1. The quality of welded joints and weld coated surfaces should be assessed during the capillary inspection both by the indicator traces and by the actual characteristics of discovered discontinuities after removal of the developer in the zone of registered indicator traces.

11.5.2. During the inspection by indicator traces, the quality of a welded joint or coating surface should be considered satisfactory when the following conditions are concurrently satisfied:

- indicator traces are rounded (linear traces are absent);
- the maximum size of each indicator trace does not exceed three times the norms specified in items 11.2.2 and 11.2.4 for individual inclusions;
- the number of indicator traces does not exceed the norms specified in items 11.2.2 and 11.2.4 for individual inclusions;
- indicator traces are of the individual type.

Rounded indicator traces with the maximum size up to 0.6 mm inclusive should not be taken into account regardless of the rated thickness of the welded (weld surfaced) parts.

11.5.3. During the inspection by the actual characteristics of discovered discontinuities, reference should be made to items 11.2.1, 11.2.2, and 11.2.4.

11.5.4. The discontinuities that fail to satisfy the norms of item 11.5.2 with regard to indicator traces, may be subjected to inspection by the actual characteristics, the results of this inspection being final.

11.6. Magnetic powder inspection

The norms of the quality assessment during magnetic powder inspection are similar to those used in visual inspection as defined in items 11.2.1, 11.2.2, and 11.2.4. The discovered discontinuities coming up to the surface may be assessed by their actual characteristics after removal of the emulsion or powder.

In case of impermissible defects, the capillary inspection may be made on the corresponding areas and, if it produces satisfactory results, the metal should be ground up to 1 mm deep (provided the minimum permissible thickness of metal is ensured) and, then, the magnetic powder inspection should be repeated. The results of the repeated inspection should be considered final.

11.7. Radiographic inspection

11.7.1 The quality of welded joint or weld coated part should be considered satisfactory if the photographs do not show any cracks and impermissible incomplete fusion, inclusions, concavity, or excessive weld root fusion.

If the concavity or excessive weld root fusion have been checked by measuring inspection, their assessment during radiographic inspection may be omitted.

11.7.2. The norms of permissible individual inclusions and their clusters for welded joints of the I, II, and III categories, including buttered edges, are specified in Table 13 and those for the welded joints of the Iн and IIн categories are specified in Table 14. The discovered inclusions whose maximum size is smaller than those indicated in the column "Required sensitivity of inspection" (Tables 13 and 14) should not be considered during assessment of the quality of welded joints, both when counting the number of inclusions and their total reduced area and when considering the distances between the inclusions (clusters).

When determining a cluster, all inclusions whose maximum size exceeds 0.2 mm should be counted.

At the rated wall thickness of the welded parts below 1 mm, the norms should be defined by the designing (projecting) organization subject to approval by the leading materials-science organization.

The norms should not exceed the values established in Tables 13 and 14 for the thickness of 1 mm.

11.7.3. Any combination of individual and clustered inclusions which may be inscribed into a rectangle with the dimensions of sides not exceeding the values of permissible maximum size and permissible maximum width of an individual large inclusion should be considered as one solid large inclusion.

Table 13. **Norms of Individual and Clustered Inclusions Permissible in Welded Joints during Radiographic Inspection**

Rated thickness of welded parts in point of welding, mm	Required sensitivity of inspection, mm.	Individual and clustered inclusions				Individual large inclusions		
		Permissible maximum size		Permissible number of Inclusions, and clusters in any section of welded joint 100 mm long	Permissible total reduced area of individual or cluster inclusions in any sections of welded joint 100 mm	Permissible		Permissible number in any section of welded joint 100 mm long
		inclusion, mm	cluster, mm			maximum size, mm	maximum width, mm	
1	2	3	4	5	6	7	8	9
Welded joints of the I category								
Over 1.0 to 1.5 inclusive	0.1	0.2	0.3	10	0.15	3.0	0.2	1
Over 1.5 to 2.0 inclusive	0.1	0.3	0.4	10	0.3	3.0	0.3	1
Over 2.0 to 2.5 inclusive	0.1	0.4	0.6	10	0.6	3.0	0.4	1
Over 2.5 to 3.0 inclusive	0.1	0.5	0.8	10	1.0	3.0	0.5	1
Over 3.0 to 4.5 inclusive	0.1	0.6	1.0	10	1.4	3.0	0.6	1
Over 4.5 to 6.0 inclusive	0.2	0.8	1.2	11	2.5	3.0	0.8	1
Over 6.0 to 7.5 inclusive	0.2	1.0	1.5	11	4.0	3.0	1.0	1
Over 7.5 to 10.0 inclusive	0.2	1.2	2.0	12	5.5	3.5	1.2	1
Over 10.0 to 12.0 inclusive	0.2	1.5	2.5	12	7.5	3.5	1.5	1
Over 12.0 to 14.0 inclusive	0.3	1.5	2.5	13	9.0	4.0	1.5	1
Over 14.0 to 18.0 inclusive	0.3	2.0	3.0	13	11.0	4.0	2.0.	1
Over 18.0 to 21.0 inclusive	0.3	2.0	3.0	14	14.0	4,0	2,0	1
Over 21.0 to 24.0 inclusive	0.4	2.0	3.0	14	17.5	5.0	2.0	1
Over 24.0 to 27.0 inclusive	0.4	2.5	3.5	15	20.0	5.0	2.5	2
Over 27.0 to 30.0 inclusive	0.4	2.5	3.5	15	23.0	6.0	2.5	2
Over 30.0 to 35.0 inclusive	0.5	2.5	4.0	16	26.0	6,0	2.5	2
Over 35.0 to 40.0 inclusive	0.5	3.0	4.5	17	30.0	7.0	3.0	2
Over 40.0 to 45.0 inclusive	0.6	3.0	4.5	18	34.0	8.0	3.0	2
Over 45.0 to 50.0 inclusive	0.6	3.0	4.5	19	38.0	9.0	3.0	2
Over 50.0 to 55.0 inclusive	0.6	3.0	4.5	20	42.0	10.0	3.0	2

Table 13 (continued)

1	2	3	4	5	6	7	8	9
Over 55.0 to 65,0 inclusive	0.75	3.5	5.0	21	48.0	10.0	3.5	2
Over 65.0 to 75,0 inclusive	0.75	3.5	5.0	22	56.0	10.0	3.5	2
Over 75.0 to 85.0 inclusive	1.0	4.0	6.0	23	64.0	10.0	4.0	2
Over 85.0 to 100.0 inclusive	1.0	4.0	6.0	24	72.0	10.0	4.0	2
Over 100.0 to 115.0 inclusive	1.25	4.0	6.0	25	85.0	10.0	4.0	2
Over 115.0 to 125.0 inclusive	1.25	5.0	7.0	25	100.0	10.0	5.0	2
Over 125.0 to 135.0 inclusive	1.5	5.0	7.0	24	100.0	11.0	5.0	2
Over 135,0 to 150.0 inclusive	1.5	5.0	7.0	7.0	115.0	11.0	5.0	2
Over 150.0 to 175.0 inclusive	2.0	5.0	7.0	23	130.0	11.0	5.0	2
Over 175.0 to 200.0 inclusive	2.0	5.0	8.0	23	150.0	11.0	5.0	2
Over 200.0 to 250.0 inclusive	2.5	5.0	8.0	22	180.0	12.0	5.0	2
Over 250.0 to 300.0 inclusive	3.0	6.0	9.0	21	220.0	12.0	6.0	2
Over 300.0 to 350.0 inclusive	3.5	7.0	10.0	20	260.0	13.0	7.0	2
Over 350.0 to 400.0 inclusive	4.0	8.0	12.0	19	300.0	13.0	8.0	2
Over 400.0 to 450.0 inclusive	4.5	9.0	14.0	18	340.0	13.0	9.0	2
Over 450.0 to 500.0 inclusive	5.0	10.0	15.0	17	380.0	14.0	10.0	2
Over 500.0 to 550.0 inclusive	5.5	11.0	16.0	16	420.0	14.0	11.0	2
Over 550.0	6.0	12.0	18.0	15	460.0	14.0	12.0	2
Welded joints of the II category								
Over 1.0 to 1.5 inclusive	0.1	0.3	0.4	11	0.4	4.0	0.3	1
Over 1.5 to 2.0 inclusive	0.1	0.4	0.6	11	0.6	4.0	0.4	1
Over 2.0 to 2,5 inclusive	0.1	0.5	0.8	11	1.2	4.0	0.5	1
Over 2.5 to 3,5 inclusive	0.1	0.6	1.0	11	1.7	4.0	0.6	1
Over 3.5 to 5.0 inclusive	0.2	0.8	1.2	11	3.0	4.0	0.8	1

Table 13 (continued)

1	2	3	4	5	6	7	8	9
Over 5.0 to 6.5 inclusive	0.2	1.0	1.5	12	4.5	4.0	1.0	2
Over 6.5 to 8.5 inclusive	0.2	1.2	2.0	12	6.5	4.0	1.2	2
Over 8.5 to 10.0 inclusive	0.2	1.5	2.5	13	8.5	4.0	1.5	2
Over 10.0 to 12.0 inclusive	0.3	1.5	2.5	13	10.0	5.0	1.5	2
Over 12.0 to 15.0 inclusive	0.3	2.0	3.0	14	12.0	5.0	2.0	2
Over 15.0 to 18.0 inclusive	0.3	2.0	3.0	14	15.0	5.0	2.0	2
Over 18.0 to 21.0 inclusive	0.4	2.5	3.5	15	18.0	6.0	2.5	2
Over 21.0 to 24.0 inclusive	0.4	2.5	4.0	15	21.0	6.0	2.5	2
Over 24.0 to 28.0 inclusive	0.5	3.0	4.5	16	24.0	7.0	3.0	2
Over 28.0 to 32.0 inclusive	0.5	3.0	4.5	16	28.0	7.0	3.0	2
Over 32.0 to 38.0 inclusive	0.6	3.0	4.5	18	32.0	8.0	3.0	2
Over 38.0 to 44.0 inclusive	0.6	3.5	5.0	20	37.0	9.0	3.5	2
Over 44.0 to 52.0 inclusive	0.75	3.5	5.0	21	43.0	10.0	3.5	2
Over 52.0 to 60.0 inclusive	0.75	4.0	6.0	22	50.0	12.0	4.0	3
Over 60.0 to 70.0 inclusive	1.0	4.0	6.0	23	58.0	12.0	4.0	3
Over 70.0 to 80.0 inclusive	1.0	4.0	6.9	24	67.0	12.0	4.0	3
Over 80 to 100.0 inclusive	1.25	4.0	6.0	25	81.0	12.0	4.0	3
Over 100.0 to 120 inclusive	1.5	5.0	7.0	26	100.0	12.0	5.0	3
Over 120.0 to 140 inclusive	1.75	5.0	7.0	25	115.0	12.0	5.0	3
Over 140.0 to 160.0 inclusive	2.0	5.0	8.0	24	135.0	13.0	5.0	3
Over 160.0 to 200.0 inclusive	2.5	6.0	9.0	24	160.0	13.0	6.0	3
Over 200.0 to 240.0 inclusive	3.0	6.0	9.0	23	200.0	14.0	6.0	3
Over 240.0 to 280.0 inclusive	3.5	7.0	10.0	22	235.0	14.0	7.0	3
Over 280.0 inclusive	4.0	8.0	12.0	22	250.0	14.0	8.0	3

Table 13 (continued)

1	2	3	4	5	6	7	8	9
Welded joints of the III category								
Over 1.0 to 2.0 inclusive	0.1	0.4	0.6	12	0.8	5.0	0.5	2
Over 2.0 to 3.0 inclusive	0.1	0.6	1.0	12	2.0	5.0	0.6	2
Over 3.0 to 4.0 inclusive	0.2	0.8	1.2	12	3.5	5.0	0.8	2
Over 4.0 to 5.0 inclusive	0.2	1.0	1.5	13	5.0	5.0	1.0	2
Over 5.0 to 6.5 inclusive	0.2	1.2	2.0	13	6.0	5.0	1.2	3
Over 6.5 to 8.0 inclusive	0.2	1.5	2.5	13	8.0	5.0	1.5	3
Over 8.0 to 10.0 inclusive	0.3	1.5	2.5	14	10.0	5.0	1.5	3
Over 10.0 to 12.0 inclusive	0.3	2.0	3.0	14	12.0	6.0	2.0	3
Over 12.0 to 14.0 inclusive	0.4	2.0	3.0	15	14.0	6.0	2.0	3
Over 14.0 to 18.0 inclusive	0.4	2.5	3.5	15	16.0	6.0	2.5	3
Over 18.0 to 22.0 inclusive	0.5	3.0	4.0	16	20.0	7.0	3.0	3
Over 22.0 to 24.0 inclusive	0.5	3.0	4.5	16	25.0	7.0	3.0	3
Over 24.0 to 28.0 inclusive	0.6	3.0	4.5	18	25.0	8.0	3.0	3
Over 28.0 to 32.0 inclusive	0.6	3.5	5.0	18	31.0	8.0	3.5	3
Over 32.0 to 35.0 inclusive	0.6	3.5	5.0	20	35.0	9.0	3.5	3
Over 35.0 to 38.0 inclusive	0.75	3.5	5.0	20	35.0	9.0	3.5	3
Over 38.0 to 44.0 inclusive	0.75	4.0	6.0	21	41.0	10.0	4.0	3
Over 44.0 to 50.0 inclusive	0.75	4.0	6.0	22	47.0	12.0	4.0	3
Over 50.0 to 60.0 inclusive	1.0	4.0	6.0	23	55.0	14.0	4.0	4
Over 60.0 to 70.0 inclusive	1.0	4.0	6.0	24	65.0	14.0	4.0	4

Table 13 (continued)

1	2	3	4	5	6	7	8	9
Over 70.0 to 85.0 inclusive	1.25	5.0	7.0	25	78.0	14.0	5.0	4
Over 85.0 to 100.0 inclusive	1.50	5.0	7.0	26	92.0	14.0	5.0	4
Over 100.0 to 130.0 inclusive	2.0	5.0	8.0	27	115.0	14.0	5.0	4
Over 130.0 to 165.0 inclusive	2.5	6.0	9.0	26	145.0	15.0	6.0	4
Over 165.0 to 200.0 inclusive	3.0	6.0	9.0	25	160.0	15.0	6.0	4
Over 200.0 to 225.0 inclusive	3.5	7.0	10.0	25	210.0	15.0	7.0	4
Over 225.0	4.0	8.0	12.0	24	230.0	16.0	8.0	4
Note. The required sensitivity is given with reference to groove standards. When wire standards are used, the values of required sensitivity 0.30, 0.60, 0.75, and 1.5 mm may be replaced by 0.32; 0.63; 0.80 and 1.6 mm, respectively.								

Table 14. **Norms of Individual and Clustered Inclusions Permissible in Welded Joints of the Iн and IIн Categories**

Rated thickness of welded parts at point of welding, mm	Required sensitivity, mm	Permissible maximum size of inclusion or cluster, mm	Permissible number of individual or clustered inclusions in any section of welded joint 100 mm, long	Permissible total reduced area of individual or clustered inclusions in any section of welded joint 100 mm, mm^2
1	2	3	4	5
Welded joints of the Iн category				
Up to 2 inclusive	0.1	Impermissible	Impermissible	Impermissible
Over 2 to 3 inclusive	0.1	Same	Same	Same
Over 3 to 5 inclusive	0.1	0.4	3	0.5
Over 5 to 8 inclusive	0.2	0.5	3	1.0
Over 8 to 11 inclusive	0.3	0.6	4	1.5
Over 11 to 14 inclusive	0.3	0.8	4	2.0
Over 14 to 20 inclusive	0.3	1.0	4	3.0
Over 20 to 26 inclusive	0.4	1.2	4	4.5
Over-26 to 34 inclusive	0.4	1.6	4	7.0
Over 34 to 45 inclusive	0.5	2.0	5	12.0
Over 45 to 67 inclusive	0.6	2.5	5	20.0
Over 67 to 90 inclusive	1.0	3.0	5	27.0
Over 90 to 120 inclusive	1.25	4.0	5	45.0
Over 120 to 200 inclusive	1.5	5.0	5	75.0
Over 200	2.0	5.0	7	125.0
Welded joints of the IIн category				
Up to 2 inclusive	0.1	Impermissible	Impermissible	Impermissible
Over 2 to 3 inclusive	0.1	0.4	5	0.6
Over 3 to 5 inclusive	0.2	0.5	5	1.0
Over 5 to 8 inclusive	0.2	0.6	5	1.5
Over 8 to 11 inclusive	0.2	0.8	5	2.5
Over 11 to 14 inclusive	0.3	1.0	6	4.0
Over 14 to 20 inclusive	0.3	1.2	6	6.0
Over 20 to 26 inclusive	0.4	1.5	6	9.0
Over 26 to 34 inclusive	0.5	2.0	6	16.0
Over 34 to 45 inclusive	0.6	2.5	7	25.0
Over 45 to 67 inclusive	0.75	3.0	7	36.0
Over 67 to 90 inclusive	1.00	4.0	7	64.0
Over 90 to 120 inclusive	1.25	5.0	7	100.0
Over 120 to 200 inclusive	1.5	5.0	8	125.0
Over 200	2.0	5.0	10	175.0

11.7.4. Any combination of individual or clustered inclusions which may be inscribed into a square with the dimension of a side not exceeding the maximum size of an individual inclusion may be considered as one solid inclusion.

11.7.5. In the absence of individual large inclusions (including those taken for the inclusions specified in item 11.7.3) or when their number is smaller than that permissible according to the norms of Table 13, they may be replaced by the corresponding number of individual inclusions and/or individual clusters of permissible dimensions without taking them into account when calculating the total area of individual inclusions and individual clusters.

11.7.6. For welded joints (buttered edges) that are shorter than 100 mm, the norms of Tables 13 and 14 with respect to the total area and number of inclusions (clusters) should be proportionately reduced. If the obtained number of permissible inclusions (clusters) is fractional, this number should be rounded off to the nearest whole number.

11.7.7. During the inspection of buttered edges, the required inspection sensitivity, permissible maximum size of individual small inclusions and individual clusters, as well as the permissible maximum size and maximum width of individual large inclusions should comply with the norms of Tables 13 and 14, whereas the permissible number and summary reduced area of individual small inclusions and individual clusters as well as the permissible number of individual large inclusions should be established by the PKD (if the edges are buttered and the welded joint is made at the same enterprise) or by the duly approved technical papers for a particular article (in the case the edges are buttered at one enterprise and their welded joint at the other). In any case, the permissible number and the summary reduced area of individual inclusions and clusters registered during inspection of buttered edges should not exceed 50% of the respective norms of Tables 13 and 14.

11.7.8. The norms for the height (depth) of weld root concavity or fusion should comply with the instructions of subsection 11.2 (see Tables 10 - 12).

11.7.9. While inspecting welded joints with incomplete fusion or with backing rings (or mitre joint), the structural clearances visible on the radiogram (including those filled with slag or metal) should not be a cause for rejection.

11.8. Ultrasonic inspection

11.8.1. The permissible norms of individual discontinuities, depending on their equivalent area and number (or the total equivalent area) for welded joints, for edges buttered with austenitic filler materials, and anticorrosive weld coating are summarized in Tables 15 - 17.

The edges buttered with the high-chromium filler materials should be inspected as a part of the finished welded joint according to norms of Table 15, without dividing them into buttered edges and weld metal. The necessity for and the scope of the in process control of buttered edges and the permissible number of individual discontinuities discovered during this inspection should be established in the PKD.

When inspecting welded joints of pipes with the rated wall thickness up to 50 mm it is permitted to use check notches and norms of permissibility of individual discontinuities specified in Table 15.

11.8.2. The quality of the welded joint, buttering of edges, and anticorrosive weld coating should be considered satisfactory when the following conditions are concurrently satisfied:

- characteristics and number of discontinuities meet the norms of Tables 15 - 17;
- the discontinuity is not excessively extended;
- the distance over the scanned surface between two adjacent discontinuities is not less than the length of the discontinuity with the larger value of this parameter;
- there are no transverse cracks.

11.9. Hydraulic (pneumatic) tests

The welded joints are considered to have passed the hydraulic (pneumatic) tests if all the requirements of satisfactory test results given in the APP Regulations (ПН АЭ Г 7-008-89) have been observed.

11.10. Mechanical tests

11.10.1. The mechanical properties of the weld metal (built-up metal) and characteristics of welded joints should be not worse than those specified in Appendix 5.

If there are no relevant data in Appendix 5, the corresponding specific values should be provided in the design documentation or taken from the relevant technical standard documentation.

11.10.2. The quality of the welded joint should be considered satisfactory if the values obtained during mechanical tests are not lower than those specified in item 11.10.1.

Table 15. **Norms of Permissible Individual Discontinuities during Ultrasonic Inspection of Welded Joints of Steels of Pearlitic Class and/or High-Chromium Steels**

Rated thickness of welded parts, mm	Equivalent area of individual discontinuity, mm^2						Permissible number of registered individual discontinuities per any 100 mm of welded joint length		
	Minimum registered			Maximum permissible					
	Category of welded joint			Category of welded joint			Category of welded joint		
	I, Iн, IIн	II	III, IIIн	I, Iн, IIн	II	III, IIIн	I, Iн, IIн	II	III, IIIн
From 5.5 to 10, inclusive	2.0	2.5	3.5	4	5	7	4	5	7
Over 10 to 20, inclusive	2.0	2.5	3.5	4	5	7	5	6	8
Over 20 to 40, inclusive	2.0	2.5	3.5	4	5	7	6	7	9
Over 40 to 60, inclusive	2.5	3.5	5.0	5	7	10	7	8	10
Over 60 to 80 , inclusive	3.5	5.0	7.5	7	10	15	7	9	11
Over 80 to 100, inclusive	5.0	7.5	10.0	10	15	20	7	9	11
Over 100 to 120, inclusive	5.0	7.5	10.0	10	15	20	8	10	12
Over 120 to 200, inclusive	7.5	10.0	15.0	15	20	30	8	10	12
Over 200 to 300, inclusive	15.0	20.0	25.0	30	40	50	9	11	13
Over 300 to 400, inclusive	25.0			50			10		
Over 400 to 600, inclusive	35.0			60			10		

Note. The norms of the equivalent area in the table are given with reference to inspection with the use of a standard flat-bottom reflector. It is permitted to use other kinds of reflectors provided the provisions of COST 14782-86 with respect to the identity of inspection results are duly observed.

Table 16. **Norms of Permissible Individual Discontinuities in the Zone of Fusion between Coated Metal and Base Metal during Inspection of Edges of Parts of Pearlitic Steel Class of from High-Chromium Steel Buttered with Austenitic Filler Materials**

Rated thickness of buttered edge, mm	Equivalent area of individual discontinuities, mm^2		Permissible number of registered individual discontinuities per any 100 mm of the length of buttered edge, pcs.		
	Minimum registered	Maximum permissible	Category of welded joint		
			I, Iн, IIн	II	III, IIIн
Over 10 to 40, inclusive	3.5	7	3	4	5
Over 40 to 60, inclusive	3.5	7	4	5	6
Over 60	3.5	5	5	6	7

Table 17. **Norms of Permissible Individual Discontinuities in the Zone of Fusion of the Built-up Metal with Base Metal during Inspection of Anticorrosive Weld Coating**

Rated thickness of weld coated part (article) without account of coating, mm	Equivalent area of individual discontinuities, mm^2		Permissible summary equivalent area of individual discontinuities on any section 200x200 mm, mm^2 in size
	Minimum registered	Maximum permissible	
Up to 100, inclusive	10	20	75
Over 100 to 300, inclusive	15	30	100
Over 300	20	40	125

11.10.3. The values of ultimate strength, yield point, relative elongation, and reduction of area should be determined as the arithmetic mean of the results of testing of individual specimens. The results of tests of individual specimens should be not lower than 95% of the established norms.

11.10.4. The procedure for assessing the results of impact bending tests and determining or confirming the critical brittleness temperature should correspond to that specified in the norms of ПН АЭ Г-7-002-86.

11.10.5. The norms of assessment of static bending tests (bending to the preset level) are given in Table 18.

For instances not covered in Table 18, the norms of assessment of test results should be established by the design documentation covering the materials of equipment and pipelines.

11.10.6. When testing welded joints of pipes for flattening, there should be a gap between the pipe walls not exceeding the norms established by the design documentation for the materials and, in absence of such norms, not exceeding twice the wall thickness of the welded pipes.

11.10.7. The results of static bending and flattening tests should be considered satisfactory if, on reaching the preset bending angle according to item 11.10.5 during the static bending test or of the gap according to item 11.10.6 during the flattening test, the stretched side and edges of the specimen do not show cracks longer than 20% of the specimen width in the case of specimens up to 25 mm wide and not more than 5 mm if the specimen width exceeds 25 mm.

Table 18. **Norms for Assessment of Quality during Static Bending Tests of Arc-welded Joints**

Material of welded parts	Thickness of welding joint, mm	Preset bending angle, deg.
Carbon steels	Up to 20 inclusive	100
	Over 20	60
Silicon manganese steels	Up to 20 inclusive	80
	over 20	60
Alloy steels	Up to 20 inclusive	50
	Over 20	40
Steels of austenitic class	Up to 20 inclusive	160
	Over 20	120

11.11. Metallographic analyses

11.11.1. The quality of welded joints subjected to metallographic analyses should be considered satisfactory if the following conditions are concurrently satisfied:

- the macrosection has no cracks and incomplete penetrations (except incomplete penetrations according to item 11.1.4);
- the maximum dimensions of any inclusions and clusters do not exceed the maximum permissible size specified in Table 19;
- the distance between any two inclusions and clusters is at least three times the maximum size of any one of two considered inclusions or clusters;
- the sum of the maximum sizes of inclusions and clusters discovered on the macrosection does not exceed three times the largest permissible size of an individual inclusion specified in Table 19 for the corresponding rated thickness of the welded parts; the inclusions and clusters with the maximum size up to 0.2 mm should be disregarded.

11.11.2. During metallographic analysis of butt joints of pipes made from steels of austenitic class and iron-nickel alloys with remaining backing rings (or on mitre joints) or of welded joints of tubes in tube plates, there may be discontinuities up to 0.4 mm long extending from the end of the structural clearance, provided the actual thickness of the weld exceeds the rated thickness of the wall at the point of pipe welding by no less than 0.5 mm.

Table 19. **Norms of Individual Inclusions and Clusters Permissible in Welded Joints during Metallographic Analyses**

Rated thickness of welded parts, mm	Permissible maximum size of individual inclusions and clusters, mm		
	Category of welded joint		
	I, Iн, IIн	II	III, IIIн
Up to 1.5, inclusive	0.2	0.2	0.3
Over 1.5 to 2.5, inclusive	0.2	0.3	0.4
Over 2.5 to 3.5, inclusive	0.3	0.4	0.5
Over 3.5 to 5.0, inclusive	0.4	0.5	0.6
Over 5.0 to 6.5, inclusive	0.5	0.5	0.8
Over 6.5 to 8.5, inclusive	0.6	0.8	1.0
Over 8.5 to 12, inclusive	0.8	1.0	1.5
Over 12 to 20, inclusive	1.0	1.5	2.0
Over 20 to 35, inclusive	1.5	2.0	2.5
Over 35 to 50, inclusive	2.0	2.5	3.0
Over 50 to 100, inclusive	2.5	3.0	3.5
Over 100 to 160, inclusive	3.0	3.5	4.0
Over 160 to 240, inclusive	3.5	4.0	5.0
Over 240 to 280, inclusive	4.0	5.0	6.0
Over 280	5.0	6.0	6.0

Note. The inclusions (clusters) with the maximum size up to 0.2 mm, inclusive, should be disregarded irrespective of the thickness of the welded parts both when considering the distances between inclusions (clusters) and when calculating the sum of maximum dimensions of discovered inclusions and clusters.

11.12. Tests for resistance against intercrystalline corrosion

11.12.1. The quality of the welded joint or built-up metal should be considered satisfactory if the results of tests by the AM and AMU methods correspond to requirements of GOST 6032-84 with respect to resistance against intercrystalline corrosion.

11.13. Determination of the content of ferrite phase in built-up metal

11.13.1. The content of ferritic phase in the built-up metal should be within 2 to 8% in the welded joints of structures that operate at temperatures up to 350°C and 2 to 5% for structures operating at temperatures above 350°C, but in all cases, it should not exceed the upper limit established in the standards or specifications covering the corresponding filler materials.

11.14. Analysis of chemical composition

11.14.1. The norms of chemical composition of the built-up metal and weld seam metal are given in Appendix 6. For the cases not specified in Appendix 6, the norms should be established in compliance with departmental standards or relevant specifications of welding materials.

11.14.2. The results of analysis of the chemical composition of the built metal (weld metal) should be considered satisfactory if the parameters of the chemical composition satisfy the requirements of item 11.14.1, relevant standards, or specifications.

12. CHECKING OF DEFECTS CORRECTION

12.1. All defects discovered in the course of the nondestructive inspection should be corrected.

12.2. When correcting the defects of welded joints and weld coated parts, check the observance of requirements formulated in the OP, PTD and PKD with respect to:

- methods and completeness of defects correction;
- smoothness of transitions at the points of removed metal;
- thickness of the wall at the point of the maximum depth of removed metal (when correcting defects without the use of welding);
- high-temperature tempering of welded joints before correction of defects (if necessary);
- shape, dimensions, and the quality of the surface with removed metal prepared for welding;
- welding methods and welding materials used for welding-up the places with removed metal;
- welding regimes and the necessity and temperature of heating when welding-up the surfaces with removed metal;
- procedures and possibility of defect correction after repeated correction of defects in one and the same welded joint (weld coated part).

12.3. The surfaces with removed metal should be subjected to visual inspection. The removed metal in the welded joints of the categories I and In, in all cases, and of other categories, when correcting defects like cracks and poor fusion, and also defects revealed during capillary or magnetic powder inspection should be subjected to capillary or magnetic powder inspection (pickling test is also permissible).

The necessity for the radiographic and ultrasonic inspection of the zone of removed metal should be prescribed by the enterprise in charge of correction of defects.

12.4. The quality (roughness) of the surface of removed metal should meet the requirements of the methodical branch standards or instructions dealing with the respective method of inspection.

12.5. All areas of the welded joints or weld coated parts corrected by welding (if it is required after correction of defects) should be subjected (if necessary) to 100% inspection by all methods (except destructive inspection) prescribed in the present PK and PKD for the welded joint (weld coated part) being corrected,

12.6. Inspection according to item 12.5 should be carried out over the entire welded-up area of removed metal and in the adjoining portions of the welded joints throughout their width, extending in each direction along the longitudinal axis of the welded joint to no less than 2.5 of the maximum depth of the welded up hollow, but no less than 20 mm and no more than 100 mm, and sections of the base metal of a width indicated in item 9.11.2 adjoining the inspected portion of the

weld and the edges of the welded hollow.

In the case of weld coated parts the above-mentioned inspection should be carried out on the correction area and adjoining areas at least 20 mm wide in each direction.

The quality assessment standards should be governed by the thickness of the welded joint being corrected.

13. REQUIREMENTS TO ACCOUNTING DOCUMENTATION

13.1. General

13.1.1. The accounting documentation pertaining to quality inspection of welded joints and weld coated parts during the production and erection of equipment and pipelines are subdivided into four groups:

group 1, accounting documentation related to certification of personnel;

group 2, accounting documentation related to inspection of materials;

group 3, accounting documentation related to process control;

group 4, accounting documentation related to acceptance control.

13.1.2. The accounting documentation of the groups listed in item 13.1.1 should be prepared by the corresponding services of the manufacturing plant (erection organization) responsible for the performance and authenticity of the types of inspection they are in charge of.

13.1.3.The specific forms of accounting documentation in each group should be established by the manufacturing plant (erection organization) taking into account the requirements of the present PK.

13.1.4. The accounting documentation of the first, second, and third groups should be kept at the manufacturing plant (erection organization) and should not be turned over to other organization, including the customer.

The term of keeping of the above-mentioned documents after the date of their execution should be as follows:

for accounting documentation of the group 1, no less than 5 years;

for accounting documentation of the groups 2 and 3, at least 3 years.

13.1.5. The accounting documentation of the group 4 should be kept at the manufacturing plant (erection organization) throughout the designed service period of the manufactured (erected) equipment of pipeline.

The above-listed accounting documentation should be used for making out certificates for the equipment and pipelines in accordance with the APP Regulations (ПН АЭ Г-7-008-89).

In the cases provided for in the designing (projecting) documentation for an article, the originals or copies of the accounting documentation, group 4, should be turned over to the owner of the equipment and pipelines.

The radiographic films should be kept for five years at the manufacturing plant (erection organization) or with the owner of the equipment and pipelines.

13.2. Accounting documentation related to personnel qualification control

13.2.1. The accounting documentation related to personnel certification should be drawn up on the basis of the certification of the following categories of personnel:

- welding operators;
- inspectors.

13.2.2. The results of personnel certification should be presented in the reports of the corresponding certification commissions.

13.2.3. The form of the report used during certification of welding operators should comply with the Regulations for Certification of Welding Operators.

13.2.4. The report made up during certification of inspectors should comply with the form given in Appendix 4.

13.3. Accounting documentation related to inspection of materials

13.3.1. The accounting documentation should include the results of the following types of inspection:

- base materials to be welded or surfaced;
- welding materials;
- flaw-detection materials.

13.3.2. The results of the inspection of materials listed in item 13.3.1 should be recorded in special logs.

In addition to the welding materials inspection log, there should be a log for entering the results of calcination of coated electrodes and welding fluxes to enable the checking of their serviceability life.

13.3.3. Each materials inspection log according to item 13.3.1 should contain at least the following data:

- name and grade of the materials;
- No. of standard or specifications for the material;
- lot No. of the material (or melt No. in absence of lot No. for the melted materials);
- No. and date of the material lot certificate;
- compliance of the certificate data with the provisions of the standard or specifications for the material;
- mass of the lot of materials less packing (or another parameter that characterizes the volume of the lot accepted);
- condition of packing (only for the materials which might be destroyed due to damaged packing);
- results of tests during incoming control;
- decision as to clearing the materials for use.

13.4. Accounting documentation related to process control

13.4.1. The accounting documentation related to the process control should cover the types of inspection prescribed in the present PK.

13.4.2. The results of each type of process control should be recorded in the corresponding inspection logs (route certificates).

13.4.2.1. The inspection logs (route certificates, charts) of the assembly-welding and thermal treatment equipment, apparatuses, and appliances should contain at least the following data:

- name of equipment, apparatus, and appliance;
- serial and inventory Nos;
- scope of performed inspection;
- date of check (inspection);
- decision as to the condition of the inspected equipment, apparatuses, and appliances;
- the next check due.

13.4.2.2. The inspection-logs (route certificates, charts) covering the preparation and assembly of parts for welding and surfacing should contain the following data:

- name of the inspecting agency (stating the shop and bay Nos.);
- name, code, or designation of parts, assembly units, and the article;
- drawing Nos.;
- grade of base material of welded (weld coated) parts;
- Nos. of welded joints and weld surfacing to be made;
- type and scope of inspection;
- inspectors’ name and initials;
- date of inspection;

- decision on the results of inspection.

13.4.2.3. The inspection logs (route certificates, charts) related to the welding and surfacing methods should contain at least the following data:

- name of the enterprise in charge of welding work, stating the shop and bay Nos.;
- name, code, or designation of parts, assembly units, and articles;
- drawing Nos.;
- Nos. of performed welded joints or weld surfacing;
- categories of welded joints;
- types, nomenclature, grades and lot No. of welding materials used;
- surnames and initials of welding operators who have executed the welded joints and weld surfacing, stating the Nos. of their certificates or personal stamps;
- data on the registered violations of the requirements, the ensuing defects, and their correction;
- data on the execution of control welded joints (if any);
- date of inspection;
- official posts, names, and initials of the persons in charge of inspection;
- decision on the results of inspection.

13.4.2.4. The inspection logs (route certificates, charts) related to the thermal treatment of welded joints and weld coated articles should contain at least the following data:

- name of the enterprise in charge of thermal treatment of the article, stating the shop and bay Nos.;
- name, code, or designation of assembly units and the article;
- grades of the base material of the article;
- data on the number and location of thermocouples;
- actual conditions of the performed thermal treatment;
- names and initials of thermal treaters and inspectors;
- date of inspection;
- decision on the results of inspection.

13.5. Accounting documentation related to acceptance inspection

13.5.1. The accounting documentation related to acceptance inspection should cover the following inspection methods:

- visual and measuring;
- radiographic;
- ultrasonic;
- capillary and magnetic powder;
- mechanical tests;
- resistance against intercrystalline corrosion;
- metallographic analyses;
- determination of the content of ferrite phase;
- pressure tightness test;
- hydraulic (pneumatic) tests;
- additional inspection methods (running through a metal ball, steeloscopy, pickling, etc.).

13.5.2. The results of the inspection by each method according to item 13.5.1 should be presented in reports, statements, decisions, or notifications which should state at least the following data:

- name of enterprise which executed the inspected welded joints (weld coated parts);
- name, code, or designation (No.) of the article;
- drawing No.;

- Nos. of inspected welded joints and weld coated parts;
- categories of welded joints and weld surfacing;
- information on thermal treatment performed;
- method and scope of inspection;
- date of inspection;
- name and initials (or personal stamp) of inspectors;
- information on discovered defects and their location;
- information on results of inspection after correction of defects;
- final decision on the results of inspection.

14. DEVIATIONS PROM ESTABLISHED REQUIREMENTS

In some cases, when the inspection by one of the above-listed methods or in the prescribed scope is technically impossible or when the correction of the defective welded joint (weld coated part) can impair its operational reliability, one may resort to well-motivated deviations from established norms, formalized by a joint decision of the designing (projecting) organization, manufacturing plant (erection organization) agreed upon with the leading materials-science organization (of branch subordination or, in cases defined by the USSR Gosatomenergonadzor, interdepartmental), with the customer, and the USSR Gosatomenergonadzor.

If deviations from the norms of the assessment of the quality of welded joints of the categories I, Iн, II, IIн, do not go beyond the limits established for welded joints of III category, the decision may be taken without participation of the customer.

APPENDIX 1

TERMS AND BASIC DEFINITIONS

Given below are the terms and basic definitions used in the present PK.

1. General terms and definitions

1.1. Defect – an impermissible deviation from the requirements of specified in the present document.

1.2. Cracks – a defect in the form of a rupture of the metal of the welded joint or weld coated part (article).

1.3. Exfoliation - defect in the form of a discontinuity of fusion between the built-up and base metal on parts (articles) with the anticorrosive weld coating or with buttered edges and on other weld coated parts.

1.4. Burn – a defect in the form of a through hole in the weld, caused by flowing out of some metal from the welding bath in the course of welding.

1.5. Blowhole – a defect in the form of a funnel-shaped or tubular hollow in the welded seam.

1.6. Overflow – a defect in the form of metal over flown in the course of welding (weld surfacing) on the surface of welded (weld coated) parts or beads and not fused to the latter.

1.7. Shrinkage hole – a defect in the form of a cavity or depression caused by the shrinkage of molten metal during solidification (usually located at the points of interrupted or finished welding).

1.8. Undercut – a sharp depression on the border between the surface of the weld and the base metal or on the border between two adjacent beads.

1.9. Metal splashes – a defect in the form of solidified drops of metal on the surface of welded or weld coated parts.

1.10. Poor penetration – the absence of penetration of a welded joint or weld coated part between the base metal and the weld metal (coating metal) or between individual beads.

1.11. Hollow between beads - a longitudinal depression between two adjacent beads (assessed by the maximum depth).

1.12. Ripple - transverse or rounded (or elongated and rounded in case of automatic submerged arc welding) depressions on the surface of the bead formed due to non-uniform solidification of metal in the welding bath (assessed by maximum depth).

1.13. Convexity of butt weld – a part of butt weld protruding above the level of the welded parts (assessed by the maximum height of the weld above this level).

1.14. Convexity of corner weld – a part of the corner weld protruding above the line connecting the edges of its surfaces in a single cross-section (assessed by the maximum height of the surface above this line).

1.15. Concavity of corner weld - the maximum distance from the surface of the weld to the line connecting the edges of its surface in a single transverse section (assessed by the maximum depth of the weld surface under this line).

1.16. Width of weld – the distance between the edges of weld surface in a single transverse section.

1.17. Convexity (excessive fusion) of the weld root – a part of the one-sided weld at the side of its root, protruding above the level of the surface of welded parts (assessed by the maximum height of the weld root surface above this level).

1.18. Concavity of weld root – a depression on the surface of the welded joint with one-sided weld at the location of its root (assessed by the maximum depth of weld root surface above the level of the surfaces of welded parts).

1.19. Edge of weld – the face surface of a part after machining to the weld dimensions

specified in the drawing.

1.20. Displacement of edges – a misalignment of levels of welded parts in butt welds.

1.21. Inclusion - a cavity in the weld metal or coating metal filled with gas, slag, or foreign metal (a pore, slag, or tungsten inclusion).

1.22. Pore – a rounded cavity filled with gas in the weld metal or in coating metal.

1.23. Slag inclusion – a slag-filled cavity in the weld metal or in coating metal.

1.24. Tungsten inclusion – a non-melted particle (splinter) of a tungsten electrode penetrated into weld metal or into coating metal.

1.25. Discontinuity - generalized name of cracks, exfoliations, burns, blowholes, pores, poor fusion, and inclusions.

2. Standard terms and definitions

2.1. Rated thickness of welded parts – the thickness specified in the drawing (without regard to tolerances) of the base metal of parts in the zone adjoining the weld.

2.2. Rated thickness of base metal of weld coated part (article) – the thickness of the base metal of a part (article) specified in the drawing (without regard to tolerances).

2.3. Design height of the corner weld (Fig. П1.1) – the dimension in the drawing of a perpendicular dropped from the point of conjunction of welded parts (point 0) on the straight line that connects the edges of its surface in a single transverse section (in the case of a convex corner weld) or on the tangent to the surface of the weld, parallel to this line (in the case of a concave corner weld).

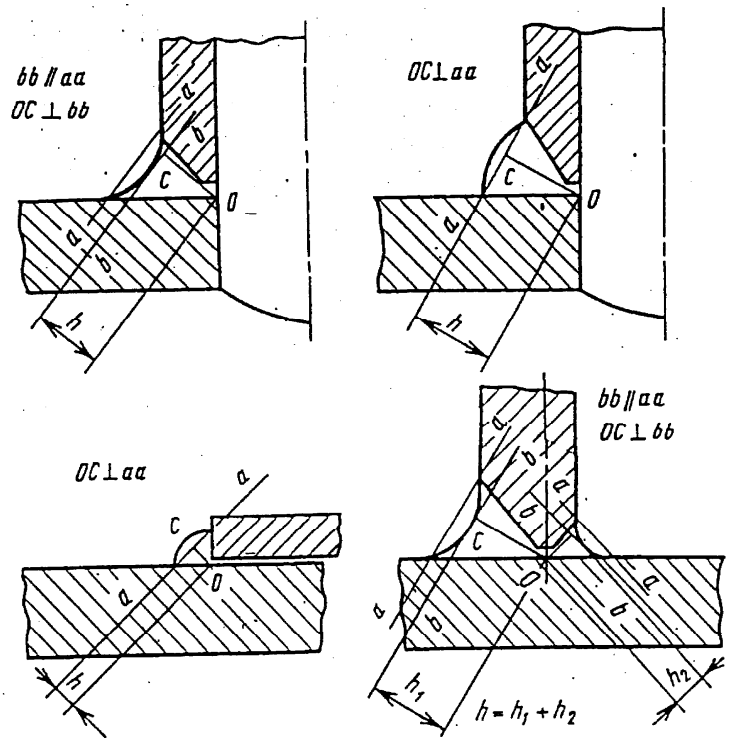


Fig. П1.1. Design height of the corner weld, h.

The design height of a two-sided corner weld should be determined as the sum of the design heights ($h_1 + h_2$) of its parts on the opposite sides.

2.4. The maximum size of an individual inclusion *a* (Fig. П1.2) - the maximum distance between two points on the external contour of the inclusion.

2.5. The maximum width of an inclusion *b* (Fig. Пl.2) - the maximum distance between two points on the external contour of the inclusion measured in the direction perpendicular to the maximum dimension of the inclusion.

2.6. Individual inclusion (Fig. П1.3) - inclusion whose minimum distance *l* from its edge to the edge of any other adjacent inclusion is not smaller than the maximum width of each of the considered inclusions but not smaller than three times the maximum dimension of the inclusion with the smallest value of this parameter (out of the two considered here).

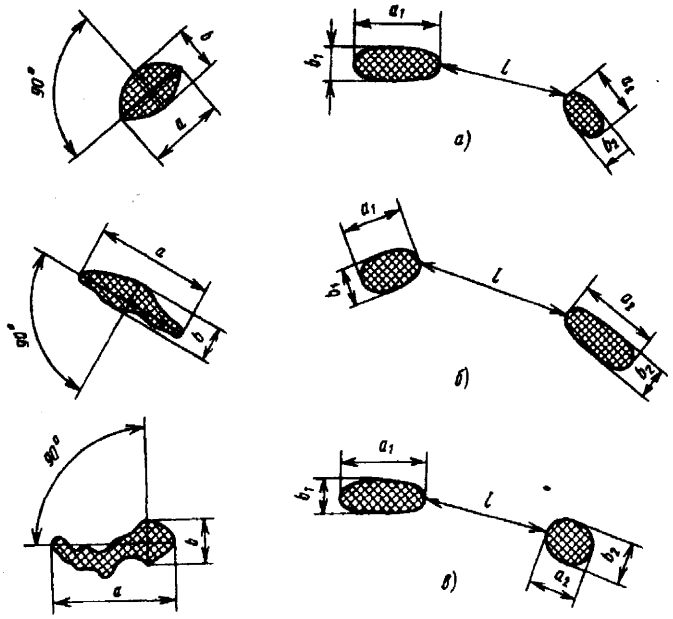


Fig. П 1.2. The maximum dimension and width of inclusion

Fig. П1.3. The Conditions of Singleness of two Inclusions Considered

a) $l \geq b_1$; $l \geq 3a_2$; $a_1 > a_2$; $b_1 > b_2$;
b) $l \geq 3a_1$; (for $b_1 < a_1$); $a_1 < a_2$; $b_1 > b_2$;
c) $l \geq 3a_2$; (for $b_2 < a_2$); $a_1 < a_2$; $b_1 < b_2$;

2.7. Cluster - (Fig. П1.4, a) - two or several inclusions (pores, slag and tungsten inclusions) of the maximum size exceeding 0.2 mm with the minimum distance between their edges being smaller than that established in item 2.6 for individual inclusions, but not smaller than the maximum width of each of any two considered adjacent inclusions.

When assessing the distances between clusters and inclusions, the cluster should be regarded as an individual inclusion.

2.8. The external contour of a cluster (Fig. Пl.4, b) - the contour limited by the outer edges of inclusions in a cluster and by the tangent lines interconnecting these edges.

2.9. The maximum size of a cluster A (Fig. Пl.4, b) - the maximum distance between two adjacent points on the external contour of the cluster.

2.10. The maximum width of a cluster B (Fig. П l.4, b) - the maximum distance between two points on the external contour of a cluster measured in the direction perpendicular to the maximum size of the cluster.

2.11. Individual cluster (Fig. Пl.5) - a cluster whose minimum distance *L* from its external contour to the external contour of any other adjacent cluster or inclusion is not smaller than three times the maximum width of each of two considered clusters (or a cluster and an inclusion), but not smaller than three times the maximum size of the cluster (inclusion) with a smaller value of this parameter (out of the two considered ones).

2.12. Group of inclusions (Fig. П l.6) - two or more inclusions with the minimum distance between its edges being smaller than the maximum width of at least one of the two considered adjacent inclusions; the external contour of the considered group of inclusions is limited by the external edges of the inclusions in the considered group and by the tangent lines interconnecting these edges.

2.13. Impermissible inclusions and clusters - individual inclusions (clusters) exceeding the established norms with respect to size, number, or summary reduced area and all non-individual inclusions (clusters), i.e., the ones, the minimum distances between which are smaller than that specified in items 2.6 and 2.11.

2.14. Indicator trace (in capillary inspection) – an area (spot) colored with penetrant on the surface of the welded joint or coating metal in the discontinuity zone.

2.15. Rounded indicator trace (in capillary inspection) – an indicator trace with the ratio of its maximum size to the maximum width not over 3.

2.16. Elongated indicator trace (in capillary inspection) – an indicator trace with the ratio of its maximum size to maximum width over 3.

2.17. Individual indicator traces (in capillary inspection) – an indicator trace, the minimum distance from the edge of which to the edge of any other adjacent indicator trace is not smaller than the maximum width of each of the two considered indicator traces, but not smaller than the maximum size of the indicator trace with a smaller value of this parameter (out of the two considered ones).

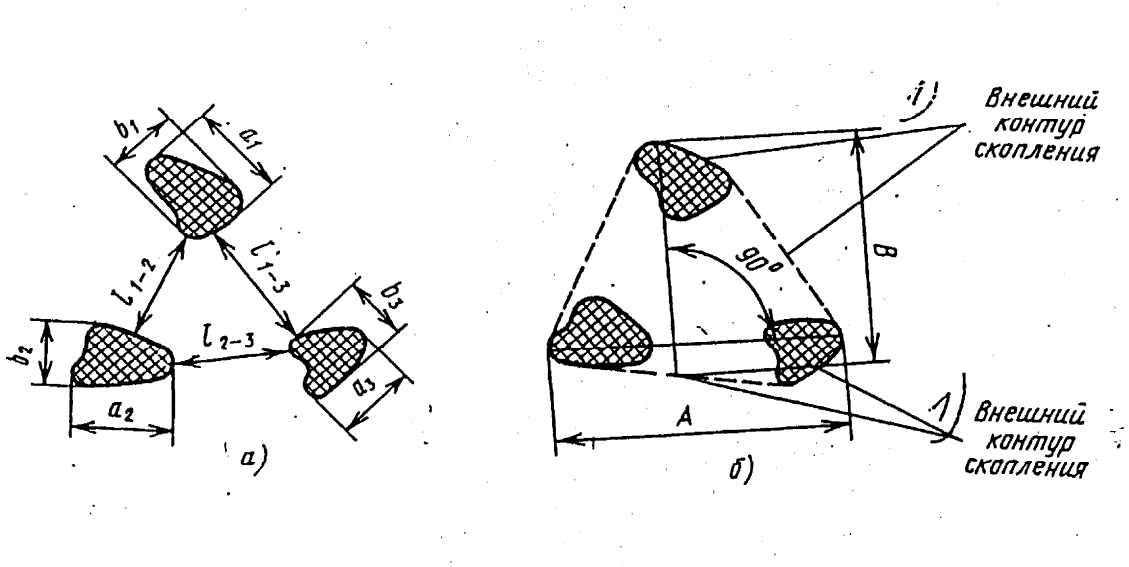


Fig. П 1.4. Cluster (A - maximum size of cluster; B - maximum width of cluster).

1) External contour of the cluster
$3b_1 = l_{1\text{-}2} \geq b_1$ (at $b_l > b_2$),
or $3b_2 >$, $l_{1\text{-}2} \geq b_2$ (at $b2 > b_l$),
or $l_{1\text{-}2} < 3a_1$ (at $a_1 < a_2$),
or $l_{1\text{-}2} < 3a_2$ (at $a_2 < a_l$)
$3b_1 > l_1 - 3 \geq b_3$ (at $b_1 < b_3$),
or $3b_3 < l_1 - 3 \geq b_3$ (at $b_3 > b_1$),
or $l_{1\text{-}3} < 3a_3$ (at $a_3 < a_1$),
or $l_{1\text{-}3} < 3a_1$ (at $a_1 < a_3$)
$3b_2 > l_{2\text{-}3} \geq b_2$ (at $b_2 > b_3$),
or $3b_3 > 1_2 - 3 \geq b_3$ (at $b_3 > b_2$)
or $1_{2\text{-}3} \geq 3a_2$ (at $a_2 < a_3$)
or $l_{2\text{-}3} < 3a_3$ (at $a_3 < a_2$)

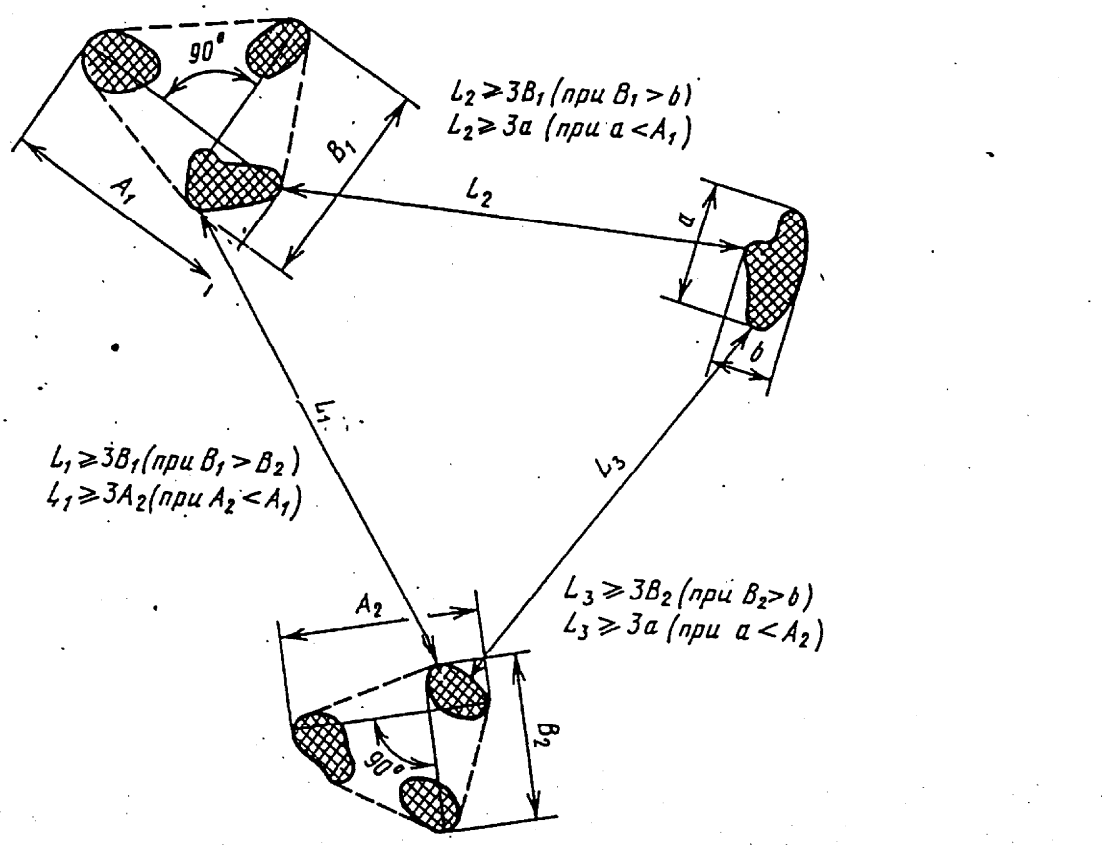


Fig. II 1.5 Individual Clusters
1) at

2.18. Impermissible indicator traces (in capillary inspection) - individual rounded indicator traces that exceed the established norms with respect to the dimensions and number of individual elongated indicator traces and all non-individual indicator traces, i.e., indicator traces the minimum distances between which are smaller than those specified in item 2.17.

2.19. Small individual inclusions (in radiographic inspection) - inclusions whose permissibility is established depending on their dimensions and the total number and summary reduced area of individual small inclusions and individual clusters.

2.20. Large individual inclusions (in radiographic inspection) - inclusions whose maximum dimension exceeds the permissible dimensions of individual small inclusions and whose permissibility is determined only depending on their size and number, without regard to their area when counting the summary reduced area and without including them into the total number of individual small inclusions and individual clusters.

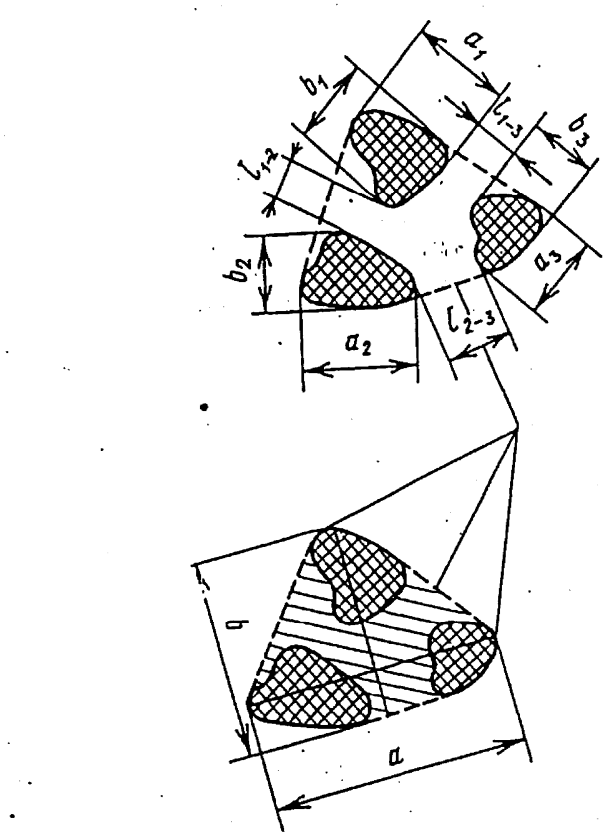
2.21. Reduced area of inclusion or cluster (in radiographic inspection) - a product of the maximum dimension of the inclusion (cluster) by its maximum width (taken into account for individual small inclusions and individual clusters).

2.22. Total reduced area of inclusions and clusters (in radiographic inspection) - the sum of the reduced areas of individual small inclusions and individual clusters.

2.23. Conventional length of discontinuities or of a reference reflector (in ultrasonic inspection) – the maximum size of the discontinuity indication zone or reference reflector in a certain direction (e.g. along the weld).

2.24. Equivalent area of discontinuity (in ultrasonic inspection) - the area of the discontinuity model located at the same distance from the input surface as the actual discontinuity at which the given informative parameters of the discontinuity and model are identical.

2.25. Echo-signal (in ultrasonic inspection) - signal caused by the reflection of the pulses of elastic waves from the interface of two media.



External contour of a group of inclusions

Fig. П 1.6. Group of inclusions (*a* - maximum size of a group of inclusions; *b* -maximum width of a group of inclusions)

$l_{1\text{-}2} < b_1$ (at $b_1 > b_2$),
or $l_{1\text{-}2} < b_2$ (at $b_2 > b_1$)
$l_{1\text{-}3} < b_1$ (at $b_1 > b_3$)
or $l_{1\text{-}3} < b_3$ (at $b_3 > b_1$),
$l_{2\text{-}3} < b_2$ (at $b_2 > b_3$),
$l_{2\text{-}3} < b_3$ (at $b_3 > b_2$).

3. Basic definitions

3.1. Control weld seam – a seam of a welded joint made with the use of tested welding materials for checking characteristics of the metal of this seam during inspection of welding materials.

3.2. Control weld surfacing – a weld surfacing made with the use of control welding (weld surfacing) materials for checking characteristics of built-up metal during inspection of welding (weld surfacing) materials.

3.3. Control welded joint – a welded joint made during production certification for checking whether the certified welding process provides for the required characteristics of the welded joint metal.

3.4. Control production welded joint - welded joint made for checking whether the characteristics of the metal of production welded joints comply with the requirements established.

3.5. Built-up metal – the metal produced during melting of the filler materials in the course of weld surfacing (welding) in the layers (beads), which is practically not diluted with the base metal.

3.6. Weld seam metal - metal produced during melting of filler materials while making a welded joint and diluted with base metal due to its melting in the zone of edges welded.

4. Groups of Single-type Welded Joints (Weld coated Surfaces)

4.1. A group of single-type welded joints comprises production welded joints of any articles produced (constructed) by the enterprise and characterized by the following common features.

4.1.1. Welding process.

4.1.2. Grade (combination of grades) of the base metal. It is permitted to include in one group the welded joints of parts made from steels of different grades which, according to the OP, should be welded using welding materials of the same grades (combination of grades).

4.1.3. Grade (combination of grades) of welding materials. A group may include welded joints made with the use of various welding materials whose grades (combination of grades) according to the OP, may be used for welding of parts made from steel of the same grade.

4.1.4. Rated thickness of welded parts in the welding zone. One group may include welded joints made by arc or electron-beam welding with the rated thickness of parts lying within the following ranges;

- up to 3 mm inclusive;
- over 3 to 10 mm inclusive;
- over 10 to 50 mm inclusive ;
- over 50 mm.

For corner, Tee, and overlap joints, these ranges refer to the welded-on parts; the thickness of the main parts may be disregarded.

4.1.5. Radius of the curvature of the part in the welding zone. A group may include welded joints of parts with a curvature radius within one of the following ranges:

- up to 12.5 mm inclusive;
- over 12.5 to 50 mm inclusive;
- over 50 to 250 mm inclusive;
- over 250 mm (including flat parts).

For corner, Tee, and overlap welded joints, these ranges refer to the welded-on parts; the curvature radiuses of the main parts may be disregarded.

4.1.6. Type of the welded joints (butt, corner, Tee, and overlap types). A group may include corner, Tee, and overlap welded joints, except corner joints used to weld branch pipes to equipment casings and pipelines.

4.1.7. Type of edge preparation. A group may include welded joints with one of the following types of edge preparation:

- one-sided edge preparation at an angle exceeding 8°;
- one-sides edge preparation at an angle up to 8° inclusive (narrow preparation);
- two-sided edge preparation.

4.1.8. Presence and type of edge buttering. A group may include welded joints with one of the following types of edge buttering:

- homogeneous buttering;
- double buttering.

4.1.9. Necessity for preliminary and concurrent heating for welding.

4.1.10. Type of thermal treatment, its temperature, and holding time.

4.1.11. Category of welded joints.

4.2. The single-type welded joints of parts made from two-layer steels should be additionally characterized by the following common features:

4.2.1. Grade of the cladding metal.

4.2.2. Peculiarities of welding technology:

- welding through entire thickness without removal of cladding layer from the prepared

edges;

- separate welding of the base metal and cladding layer using different welding materials with preliminary removal of the cladding layer from prepared edges;
- homogeneous or two-layer fusion for restoration (welding) of the cladding layer;
- presence or absence of the dividing weld surfacing.

4.3. A group of single-type anticorrosive weld surfacing combines the surfacing characterized by the following common features:

4.3.1. Method of weld surfacing.

4.3.2. Type of the anticorrosive weld surfacing,

4.3.3. Grade (combination of grades) of weld surfacing (welding), materials. A group may include anticorrosive weld coatings made by the use of weld surfacing (welding) materials of any grades (combinations of grades) which, according to the OP, may be used for making the corresponding anticorrosive coatings.

4.3.4. Necessity for preliminary and concurrent heating during weld surfacing.

4.3.5. Type of thermal treatment, its temperature, and holding time.

APPENDIX 2

FORM OF THE PROTOCOL STATEMENT MADE BY CERTIFYING COMMISSION

PROTOCOL STATEMENT No.
of the commission certifying the technology of welded joints and weld coated surfaces of equipment and pipelines of nuclear power plants

Name and address of the manufacturing plant (erection organization).

1. Characteristics of certified groups of single-type welded joints and weld coated surfaces.

1.1. Name of articles (pipeline systems) and their code.

1.2. List of certified groups of single-type welded joints and weld coated surfaces, stating the following data for each group:

- Nos. of production welded joints and drawing Nos. of corresponding assembly units;
- drawing Nos. of articles with coating surfaces;
- Nos. of production-process documentation according to which the certified welded joints and coating surfaces are made.

Note. When certification is carried out under the conditions of construction, the Nos. of production welded joints may be omitted.

2. Characteristics of control welded joints and weld surfacing.

2.1. Drawing Nos. of control welded joints (weld surfacing) for each certified group of single-type production welded joints and coating surfaces.

2.2. List of PTD used in making each control welded joint (weld surfacing).

2.3. Diagrams of cutting out specimens from control welded joints (weld surfacing), stating the application and types of specimens with reference to the corresponding standards or other technical standard documentation.

2.4.. List of the PKD used for checking the control welding joints (weld surfacing).

3. Results of nondestructive inspection of control welded joints (weld surfacing):

- visual;
- measuring
- capillary or magnetic powder;
- ultrasonic;
- radiographic (for welded joints only).

4. Results of destructive inspection of control welded joints (weld surfacing):

- mechanical properties (ultimate strength, yield point, and reduction of area) of metal of weld or coating metal determined while inspecting the welding (weld surfacing) materials before making control welded joints (weld surfacing);
- ultimate strength of the welded joint;
- results of static bending or flattening tests;

- critical brittleness temperature of weld metal or built-up metal (to be determined or confirmed when inspecting welding materials before making control welded joints);
- results of tests for resistance to intercrystalline corrosion;
- results of metallographic analyses.

Note. The results should be recorded of those tests only which are prescribed in the PK.

- general decision at the results of inspection;
- list of measures to be taken on the basis of the inspection results (in case of unsatisfactory inspection results) and results of re-tests;
- general characteristic of the quality of production welded joints (coating surfaces) made in compliance with the certified technology (during the second and nonscheduled certification).

Chairman of the Commission	Signature
Members of the Commission	Signatures
Stamp of the Enterprise (Organization) here	
Date	

APPENDIX 3
(recommended)

Form of inspector’s certificate

INSPECTOR'S CERTIFICATE

_____
(name, surname, patronymic)

the employee of the enterprise _____
has attended theoretical training in the scope of the special inspectors training and passed examinations in practical skills at _____
(enterprise)
according to the program _____
(name of nondestructive inspection method)
for practical work in performing this method of inspection.
Skill category (or official post) _____
Statement No. _____ of _____ 19 _____
According to results of examinations is authorized to perform
_____
(name of the nondestructive inspection method)
of welded joints of corresponding categories and weld coated parts of equipment and pipelines of nuclear power plants with the right (without the right) to make decisions (cross out which is unnecessary).

The certificate issued on _____ 19 _____
expiry date _____ 19 _____

Chairman of the Commission (Signature)
Secretary (Signature)

RESULTS OF PERIODIC (CONTROL) EXAMINATIONS

Mark given for theoretical knowledge _____
Mark for practical skills _____
Validity of certificate is prolonged to _____ 19_____
Statement No. _____ of _____ 19_____

Chairman of the Commission (Signature)
Secretary (Signature)
Stamp of the Enterprise or Organization) here

The form for results of periodic examinations should be repeated ten times.

APPENDIX 4
(recommended)

Form of the protocol statement made
by the inspectors certifying commission
PROTOCOL STATEMENT No.

date _____ of the session of the certifying commission of
(day, month, year)

_____
(ministry, department, association, enterprise, organization)

commission chairman _____
(official post, name)

commission members

_____
(official posts, names)

authorized to check theoretical knowledge and practical skills
in _____
(nondestructive inspection method)

of inspectors of _____
(association, enterprise, organization, shop, bay)

No.	Name	Official post	Kind of certification (primary, periodic, additional, non-scheduled)	Date of preceding examination	Decision

Chairman of the Commission_____
(signature, name)

Members of the Commission_____
(signatures, names)

Stamp of the organization here

APPENDIX 5
(mandatory)

MECHANICAL PROPERTIES OF THE WELD METAL AND BUILT-UP METAL AND CHARACTERISTICS OF WELDED JOINTS

Table П5.1. Mechanical Properties of Weld Metal and Coated Metal and Characteristics of Welded Joints during automatic welding and hidden arc welding after final high-temperature tempering

Grades of welding materials		Minimum values of mechanical properties at temperature								Critical temperature of brittleness T_{Ko}, ^{o}C (max)
		20°C				350°C				
Wire or strip	Flux	Ultimate strength R_m, MPa (kgf/mm^2)	Yield point $R_{p\,0.2}$, Mpa (kgf/mm^2)	Elongation A, %	Reduction of area z, %	Ultimate strength R_m, Mpa (kgf/mm^2)	Yield point $R_{p\,0.2}$, MPa (kgf/mm^2)	Elongation A, %	Reduction of area z, %	
1	2	3	4	5	6	7	8	9	10	11
Св-08А, Св-08АА	АН-42М АН-42 ФЦ-16 ФЦ-16А	353 (36)	196 (20)	20	55	314 (32)	176 (18)	13	50	-
	ОСЦ-45 АН -348А	372 (38)	216 (22)	16	50	-	196 (20)	-	-	-
Св-06А	АН-42 АН-42М	392 (40)	235 (24)	18	55	353 (36)	216 (22)	13	50	0
Св-08ГС	ФЦ-16 ФЦ-16А	431 (44)	245 (25)	18	55	353 (36)	216 (22)	13	50	(0) - (+15)*
Св-10ГНМА Св-10ГН1МА	ФЦ-16	539 (55)	343 (35)	16	55	490 (50)	294 (30)	14	50	(-10) - (+15)
Св-10ГН1МА	КФ-30	569 (57)	471 (48)	16	55	510 (52)	412 (42)	14	50	10
Св-10ХМФТ	АН-42М КФ-30	539 (55)	392 (40)	14	50	490 (50)	373 (38)	12	45	40
Св-10ХМФТУ	АН-42М, КФ-30	539 (55)	392 (40)	14	50	490 (50)	373 (38)	12	45	20
Св-08ХМФА	КФ-16	441 (45)	274 (28)	15	45	206** (20) 147*** (15)	-	-	-	-
Св-04Х2МА	КФ-16	392 (40)	294 (30)	16	45	294** (30) 274*** (28)	245** (25) 235*** (24)	15 16	40 45	-

Table П 5.1 (continued)

Grades of welding materials		Minimum values of mechanical properties at temperature								Critical temperature of brittleness, °C (max)
		20°C				350°C				
Wire or strip	Flux	Ultimate strength R_m, MPa (kgf/mm^2)	Yield point $R_{p\,0.2}$, MPa (kgf/mm^2)	Elongation A, %	Reduction of area z, %	Ultimate strength R_m, MPa (kgf/mm^2)	Yield point $R_{p\,0.2}$, MPa (kgf/mm^2)	Elongation A, %	Reduction of area z, %	
Св-10Г2	КФ-27	372 (38)	216 (22)	16	50	-	196 (20)	-	-	-
Св-12Х2Н2МА	ФЦ-16	539	422	15	55	490	392	14	50	0
Св-12Х2Н2МАА	ФЦ-16А	(55)	(43)			(50)	(40)			
Св-09ХГНМТА	НФ-18М	539	422	15	55	490	392	14	50	0
Св-09ХГНМТАА-ВИ	КФ-30	(55)	(43)			(50)	(40)			
Св-08Х19Н10Г2Б	ОФ-6	539	343	16	30	372	225	-	-	-
	ФЦ-17	(55)	(35)			(38)	(23)			
Св-04Х20Н10Г2Б	ОФ-6,	539	343	20	35	372	225			
(ЭП762)	ФЦ-17	(55)	(35)			(38)	(23)			
Св-10Х16Н25АМ6	ОФ-6	539	392	13	15	392	245	-	-	-
		(55)	(40)			(40)	(25)			
Св-04Х19Н11М3	ОФ-10	392	245	20	25	343	167	-	-	-
	ФЦ-18	(40)	(25)			(35)	(17)			
Св-08Х19Н10Г2Б	ОФ-10	490	314	20	30	353	196	-	-	-
	ФЦ-18	(50)	(32)			(36)	(20)			
Св-04Х20Н10Г2Б	ОФ-10	490	265	20	35	353	176	-	-	-
(ЭП762)	ФЦ-18	(50)	(27)			(36)	(18)			
Св-07Х25Н13	ОФ-10	422	245	13	15	353	157	-	-	-
	ФЦ-18	(43)	(25)			(36)	(16)			
Св-01Х12Н2-ВИ	ОФ-6	637	490	12	35	510	442	10	40	20
	ФЦ-19	(65)	(50)			(52)	(45)			
Св-03Х15Н35Г7М6Б	ОФ-6	539	343	15	15	490	294	-	25	-
		(55)	(35)			(50)	(30)			
Св-04Х17Н10М2	ОФ-6	539	294	30	45	343****	196****	20****	45****	-
Св-02Х17Н10М2-ВИ		(55)	(30)			(35)	(20)			

* Actual value should be specified in designing documentation.

** The values refer to 450°C.

*** The values refer to 510°C.

****The values refer to 530°C.

Table П5.2. **Mechanical properties of weld metal during electroslag welding after normalizing or hardening followed by high-temperature tempering**

Grades of welding materials		Minimum values of mechanical properties at temperature								Critical temperature of brittleness, ^{O}C (max)
		20°C				350°C				
Wire	flux	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, *%*	Reduction of area, z, %.	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, *%*	Reduction of area, z, %.	
Св-10ГН2МФА	ОФ-6 ФЦ-21	539 (55)	343 (35)	16	55	490 (50)-	294 (30	14	50	(-10)-(+15)*
Св-16Х2НМФТА (КП-50)	ОФ-6 ФЦ-21	608 (62)	490 (50)	15	55	539 (55)	441 (45)	14	50	0
Св-16Х2НМФТА (КП-50)	ОФ-6 ФЦ-21	549 (56)	441 (45)	15	55	490 (50)	392 (40)	12	45	0
04Х19Н11М3	ОФ-6	-	196 (20)	-	-	-	117 (12)**			

* Actual value should be specified. in designing documentation

** The values refer to 530°C.

Table П5.3 **Mechanical properties of weld metal or coating metal during manual arc welding and weld surfacing with coated electrodes after final high-temperature tempering**

Electrode grade	Minimum values of mechanical properties at temperature								Critical temperature of brittlenes, T_{K0}, °C
	20°C				350°C				
	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	
УОНИИ 13/45	353 (36)	216 (22)	22	55	314(32)	176(18)	20	55	0
УОНИИ 13/45	353 (36)	216 (22)	22	60	314(32)	176(18)	22	55	-10
ЦУ-7, ЦУ-7А	431 (44)	255 (26)	20	55	372(38)	216(22)	20	55	-10
УОНИИ 13/55	431 (44)	255 (26)	20	50	372(38)	216(22)	18	50	0
ПТ-30	539 (55)	343 (35)	16	55	490(50)	294(30)	14	50	(-10-+15)*
РТ-45АА, РТ-45А, РТ-45Б	539 (55)	422 (43)	15	55	510(52)	392(40)	14	50	0
ЭА-898/21Б, ЦТ-15К	539 (55)	343 (35)	16	30	441(45)	245(25)	10	20	-
ЗИО-8	539 (55)	294 (30)	13	15	392(40)	196(20)	10	13	-
ЦЛ-25/1, ЦЛ-25/2	539 (55)	294(30)	13	15	392(40)	196(20)	10	13	-
ЭА-395, ЦТ-10	588 (60)	363 (37)	13	15	490(50)	294(30)	10	13	-
ЦЛ-51	637 (65)	490 (50)	12	35	510(52)	442(45)	10	40	20
Н-10	392 (40)	294 (30)	16	45	294 (30)**	245 (25)**	15***	40***	-
Н-6	441 (45)	274 (28)	15	45	-	206 (21)** 147 (15)***	-	-	-
Н-23, Н-25	539 (55)	442 (43)	15	55	490 (50)	392 (40)	14	50	0

Table П 5.3 (continued)

Electrode grade	Minimum values of mechanical properties at temperature								Critical temperature of brittleness, T_{K0}, °C
	20°C				350°C				
	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	
Н-3, Н-3АА	539(55)	392(40)	18	45	442 (45)	353(36) '	14	45	20
Н-20	392(40)	255(26)	20	50	353 (36)	216(22)	18	50	0
ЭА-400/10У ЭА-400/10Т	539(55)	343(35)	18	30	431 (44)	294(30)	-	-	-
ЭА-855/51, ЭА-582/23	539(55)	343(35)	15	15	490 (50)	294(30)	-	-	-
А-1, А-1Т, А-2, А-2Т	539(55)	294(30)	30	45	343 (35)****	196 (20)****	20****	45****	-

*Actual value should be specified, in designing documentation.
**The values refer to 450°C.
***The values refer to 510°C.
****The values refer to 530°C.

Table П5.4 **MECHANICAL PROPERTIES OF WELD METAL AND COATED METAL AFTER FINAL HIGH-TEMPERATURE TEMPERING DURING ARGON-l-ARC WELDING**

Grade of filler wire	Minimum values of median mechanical properties at temperature								Critical-temperature of brittleness, (max)
	20°C				350°C				
	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	
Св-08ГС	431(44)	245(25)	18	55	392 (40)	225 (23)	13	50	0
Св-10ГНМА, Св-10ГН1МА	539(55)	343(35)	16	55	490 (50)	294 (30)	14	50	(-10)-(+15)*
Св-07Х25Н13	442(45)	245(25)	12	15	392(40)	176(18)	-	-	-
Св-12Х2Н2МА, Св-12Х2Н2МАА, Св-09ХГНМТА, Св-09ХГНМТАА-ВИ	539(55)	422(43)	15	55	490(50)	392(40)	14	50	0
Св-08Х19Н10Г2Б	539(55)	343(35)	16	30	372(38)	225(23)	10	20	-
Св-04Х20Н10Г2Б (ЭП 762)	539 (55)	343 (35)	20	35	372 (38)	225 (23)	10	25	-
Св-01Х12Н2-ВИ	637 (65)	490 (50)	12	35	510 (52)	441 (45)	10	40	-
Св-04Х19Н11М3, Св-02Х17Н10М2-ВИ, Св-04Х17Н10М2	539 (55)	294 (30)	30	45	343 (35)****	196 (20)****	20****	45****	-
Св-04Х2М2А	392 (40)	294 (30)	16	45	294 (30)**	245 (25)**	15**	40**	-
Св-08ХМФА	441 (45)	274 (28)	15	45	-	206 (21)** 147 (15)***	-	-	-

* Actual value should be specified in designing documentation.
** The values refer to 450°C.
*** The values refer to 510°C.
*** The values refer to 530°C

Table П5.5 **Mechanical properties of coated, metal in initial state after welding (surfacing)**

Welding method	Welding materials		Minimum values of mechanical properties at temperature					
			20°C			350°C		
	Type	Grade	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z %	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)
Automatic hidden arc welding	Wire Flax	Св-08Х19Н10Г2Б ОФ-6	588(60)	343 (35)	20	25	392(40)	216(22)
	Wire Flax	Св-04Х20Н10Г2Б (ЭП 762) ОФ-6	539(55)	343 (35)	24	35	392(40)	216(22)
	Strip Flax	Св-08Х19Н10Г2Б ОФ-10	490 (50)	294 (30)	25	35	353 (36)	196 (20)
	Strip Flax	Св-04Х20Н10Г2Б (ЭП 762) ОФ-10	490(50)	294 (30)	25	35	353(36)	196(29)
	Wire Flax	Св-08Х19Н10М3Б ОФ-6	570(58)	370(38)	18	35	275(28)	410(42)
Manual arc welding with coated electrodes	Electrodes	ЭА-898/21Б ЦТ-15К ЗИО-8 ЦЛ-25/1, ЦЛ-25/2	539 (55)	294 (30)	23	40	392 (40)	245 (25)
Argon-arc welding	Wire	Св-08Х19Н10Г2Б Св-04Х20Н10Г2Б	539 (55) 539 (55)	343 (35) 343 (35)	22 24	35 35	392 (40) 392 (40)	216 (22) 216 (22)

Table П5.6. **Mechanical properties of welded, joints after final high-temperature tempering**

Type of welding	Welding materials	Grades of steel of welded. joints	Minimum values of mechanical properties at 20°0	
			Ultimate strength, R_m, MPa (kgf/mm^2)	Bending angle, deg.
Automatic hidden-arc welding, manual arc welding with coated electrodes;	As specified in ПН АГ-7-099-89	l0ГН2МФА, 10ГН2МФАЛ 15Х2НМФА, 15Х2НМФА-А 06Х12Н3Д	539 (55) 539 (55) 637 (65)	60 60 40
Electroslag welding	Same	l0ГН2МФА, l0ГН2МФАЛ 15Х2НМФА, 15Х2НМФА-А (КП-50) 15Х2НМФА (КП-45)	539 (55) 608 (62) 549 (56)	40 60 60

Table П5.7. **Mechanical properties of weld metal and coated, metal during automatic hidden-arc welding**

Grades of welding materials		Minimum values of mechanical properties at 20°C								Critical temperature of britleness T_{K0}, °C, (max)
		In initial state after welding				After thermal treatment "				
Wire	Flux	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	
Св-08АА	ОСЦ-45	412 (42)	226(23)	18	50	See Table П5.1				
Св-08А	АН-348А			18	50	392(40)	235(24)	18	55	0
Св-06А	НФ-18М	432 (44)	245(25)							
Св-08ГА	ОСЦ-45	432 (44)	255(26)	18	50	392(40)	235(24)	18	50	0
Св-10ГА	АН-348-А									
Св-08ГС, Св-12ГС	ФЦ-11	452(46)	255(26)	18	50	432(44)	245(25)	18	50	0
Св-8ГСМТ	ОСЦ-45, АН-348-А, АН-42 АН-42М	452(46)	255(26)	18	50	432(44)	245(25)	18	50	0
	КФ-30	452(46)	294(30)	16	50	422(43)	275(28)	15	50	0
Св-10НМА	ФЦ-11, ФЦ-16	510 (52)	324 (33)	16	50	471(48)	314(32)	16	55	-10
Св-08ГС	КФ-30	432 (44)	275 (28)	20	55	412 (42)	235 (24)	18	55	-20

Table П5.7 (continued)

Grades of welding materials		Minimum values of mechanical properties at 20°C								Critical temperature of britleness T_{K0}, °C, (max)
		In initial state after welding				After thermal treatment "				
Wire	Flux	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	Ultimate strength, R_m MPa (kgf/mm^2)	Yield point $R_{p0.2}$ MPa, (kgf/mm^2)	Elongation A, %	Reduction of area, z, %.	
Св-10ГНМА	ФЦ-11	549 (56)	354 (36)	16	50	539 (55)	343 (35)	16	55	0
Св-08ХМ	ФЦ-11 АН-42	-	-	-	-	471 (48)	314 (32)	18	55	0
Св-08ХМФА	ФЦ-11	-	-	-	-	491 (50)	343 (35)	16	50	+10
	ФЦ-16	-	-	-	-	491 (50)	343 (35)	18	55	0
Св-06Х14	АН-22	-	-	-	-	588 (60)	412 (42)	14	45	+10
Св-04Х19Н11М3	ФЦ-17, ОФ-6	491 (50)	245 (25)	25	35	392 (40)	245 (25)	20	25	-

APPENDIX 6

REQUIREMEHTS TO THE CHEMICAL COMPOSITION OF BUILT-UP METAL

*Table П6.1.***Chemical composition of coated metal during automatic welding and hidden-arc surfacing**

Grades of welding materials		Chemical composition										
Wire or strip	Flux	Carbon	Silicon	Manganese	Chromium	Nickel	Molybdenum	Titanium	Niobium	Sulphur	Phospharus	Copper
										maximum		
Св-08А	АН-42	≤0.11	0.15-0.55	0.6-1.2	≤0.15	≤0.25	-	-	-	0.035	0.042	0.25
Св-08А	АН-42М	≤0.11	0.15-0.55	0.6-1.2	≤0.15	≤0.25	-	-		0.035	0.035	0.25
Св-08А	ФЦ-1б	≤0.11	0.15-0.40	0.45-0.85	≤0.15	≤0.25	-.	-	-	0.035	0,035	0.25
Св-06А	АН-42	0.04-0.11	0.2-0.6	0.6-1.2	≤0.15	≤0.25	-	-		0.030	0.042	0.25
Св-06А	АН-42М	0.04-0.11	0.2-0.6	0.6-1.2	≤0.15	≤0.25	-			0.030	0.035	0.25
Св-08ГС	ФЦ-1б	0.05-0.11	0.6-0.9	1.3-1.7	≤0.20	≤0.30	-	-	-	0.030	0.035	0.25
Св-10ГНМА	ФЦ-16	0.05-0.11	0.15-0.45	0.7-1.3	≤0.30	1.4-1.18	0.4-0.7 .	-	-	0.030	0,030	0.25
Св-10ГН1МА	ФЦ-16	0.0.5-0.11	0.20-0.50	0.9-1.5	≤0.30	1.4-1.18	0.45-0.75	-	-	0.030	0.030	0,25
Св-08АА	АН-42	≤0.11	0.15-0.55	0.6-1.2	≤0.15	≤0.25	-	-	-	0.025	0.035	0.25
Св-08АА	АН-42М	≤0.11	0.15-0.55	0.6-1.2	≤0.15	≤0.25	-	-	-	0.025	0.025	0.25
Св-08АА	ФЦ-16	≤0.11	0.15-0.40	0.45-0.85	≤0.15	≤0.25	-	-		0.025	0.025	0.25
Св-12Х2Н2МА	ФЦ-16 ФЦ-16А	0.06-0.12	0.5-0.45	0.65-1.10	1.40-2.1	1.20-1.90	0.45-0.75	-	-	0.020	0.025	0,15
Св-09ХГНМТА, Св-09ХГНМТАА-ВИ	НФ-18М	0.04-0.10	0.15-0.45	0.45-1.10	1.2-2.0	1.0-1.5	0.40-0.70-	0.01-0.06	-	0.020	0.025	0.15
Св-12Х2Н2МАА	ФЦ-16А	0.06-0.12	0.15-0.45	0.65-1.10	1.4-2.1	1.2-.1.9	0.45-0.75	-	-	0.015	0.012	0.08
Св-07Х25Н13	ОФ-10	≤0.09	0.30-1.2	0.8-2.0	22-26.5	11-14	-	-	-	0.020	0.030	-
Св-08ГС	КФ-30	0.12	0.30-0.70	0.7-1.4	≤0.20	≤0.30	-	≤0.06-	-	-	-	-

Table П6.1 (continued)

Grades of welding materials		Chemical composition										
Wire or strip	Flux	Carbon	Silicon	Manganese	Chromium	Nickel	Molybde-num	Titanium	Niobium	Sulphur	Phosphorus	Copp<
										maximum		
Св-08ГСМТ	КФ-30	0.12	0.20-0.60	0.6-1.2	≤0.20	≤0.30	0.15-0.40	≤0.06	-	-	-	-
Св-10ГН1МА	КФ-30	0.12	0.15-0.40	0.4-1.0	≤0.30	1.2-1.8	0.40-0.75	≤0.03	-	-	-	-
Св-10ХМФТ	АН-42	0.04-0.12	0.20-0.60	0.6-1.3	1.2-1.8	≤0.30	0.35-0.70	≤0.05	-	0.015	0.042	0.25
Св-10ХМФТУ	АН-42М	0.04-0.12	0.20-0.60	0.6-1.3	1.2-1.8	≤0.30	0.35-0.70	≤0.05	-	0.015	0.012	0.10
Св-08Х19Н10М3Б	ОФ-6	≤0.10	≤0.80	0.8-2.0	17.0-20.0	8.5-11.0	1.7-3.0	-	0.6-1.2	0.02	0.03	-
Св-03Х15Н35Г7М6Б	ОФ-6	≤0.03	≤0.90	5.0-7.5	13.0-16.0	33.0-36.0	5.0-7.5	-	1.2-1.8	0.02	0.03	-
Св-10Г2	КФ-27	≤0.12	≤0.3	0.7-1.4	-	-	-	0.01-0.05	-	0.03	0.03	
Св-04Х2МА	КФ-16	≤0.08	≤0.4	0.5-0.9	1.4-2.2	≤0.25	0.4-0.7	0.01-0.05	-	0.025	0.035	-
Св-08Х19Н10Г2Б	ОФ-10, ОФ-6 ФЦ-17, ФЦ-18	≤0.10	≤1	1.3-2.2	17.5-20.5	8.0-11.0	-	-	0.7-1.2	0,020	0.030	-
Св-04Х20Н10Г2Б (ЭП 762)	ОФ-10, ОФ-6 ФЦ-17	≤0.05	≤1	1.3-2.2	17.5-20.5	8.0-11.0	-	-	0.7-1.2	0,020	0,030	-
Св-04Х19Н11М3	ОФ-10, ОФ-6 ФЦ-17, ФЦ-18	≤0.08	0.3-1.2	0.8-2.0	16-20	9-12	1.5-3.0	-	-	0.020	0.030	- '
Св-10Х16Н25АМ6	ОФ-6	0.05-0.12	1.0	0.8-2.0	14-17	23-27	5-7	-	-	0.020	0.030	
Св-01Х12Н2-ВН	ОФ-6, ФЦ-19	≤0.035	0.15-0.55	0.20-0.75	11.0-13.5	1.6-2.5	-	-	-	0.020	0.030	
Св-08АА, Св-08А	ОСЦ-45, АН-348-А	≤0.11	0.15-0.60	0.6-1.3	-	-	-	-	-	0,035	0.045	
Св-06А	НФ-18	0.14-0.11	0.20-0.60	0.6-1.2	-	-	-	-	-	0,030	0.035	
Св-08ГА	ОСЦ-45	0.04-0.11	0.15-0.60	0.8-1.5	-	-	-	-	-	0.030	0.045	-
Св-10ГА	АН-348-А	0.04-0.11	0.15-0.45	0.7-1.4	-	-	-	-	-	0.030	0.035	
Св-08ГС Св-12ГС	ФЦ-11	0.04-0.14	0.55-1.00	0.8-1.7	-	-	-	-	-	0.030	0.040	

Table П6.1 (continued)

Grades of welding materials		Chemical composition, %										
Wire or strip	Flux	Carbon	Silicon	Manganese	Chromium	Nickel	Molybdenum	Tita-nium	Nio-bium	Sulphur	Phospho rus	Copper
										maximum		
Св-08ГСМТ	ОСЦ-45 АН-348-А АН-42	0.04-0.11	0.40-0.80	1.0-1.5	-	-	0.15-0.40	-	-	0.030	0.045	
Св-10НМА	ФЦ-11, ФЦ-16	0.04-0.12	0.15-0.60	0.5-1.5	-	0.9-1.5	0.30-0.55	-	-	0.030	0.045	
Св-10ГНМА	ФЦ-11	0.04-0.11	0.15-0.50	0.5-1.5 .	-	1.4-1.8	0.40-0.70	-	-	0.030	0.040	
Св-08ХМ	ФЦ-11					-		-	-			
	АН-22	0.04-0.11	0.15-0.50	0.5-1.0	0.8-1.2	-	0.40-0.70			0.030	0.040	
Св-08ХМФА	ФЦ-11	0.04-0.11	0.15-0.50	0.5-1.0	0.8-1.2	-	0.40-0.70	-	-	0.030	0.035	
	ФЦ-16	0.04-0.11	0.15-0.45	0.4-0.8	0.8-1.2	-	0.40-0.70			0.030	0.030	
Св-10ХМФТ	АН-42	0.05-0.13	0.15-0.50	0.5-1.0	1.3-1.8	-	0.35-0.60	-	-	0.035	0.040	
Св-06Х14	АН-22М	≤0.09	0.30-0.80	0.4-1.0	12.5-15.0	≤0.6	-	-	-	0.030	0.040	

Table П6.2 **Chemical composition on electroslag welding**

Grades of welding materials		Chemical composition, %										
Wire	Flux	Carbon	Silicon	Manga-nese	Chromi-um	Nickel	Carbon	Silicon	Manga-nese	Sulphur	Phosphoru	Copper
										maximum		
Св-10ГН2МФА	ОФ-6, ФЦ-21	0.07-0,12	0,15-0.45	0.5-1,1	0,3	1.9-2.8	0.4-0.7	0.02-0.08	-	0,02	0.025	0,30
Св-16Х2НМФТА	ОФ-6, ФЦ-21	0.12-0.18	0.15-0.45	0.4-1.0	1.6-2.3.	1.0-1.5	0.4-0.7	0.03-0.12	0.02-0.10	0.02	0.020	0.25
Св-04Х19Н11М3	ОФ-6	≤0.6	0.6	1.0-2.0	18.0-20.0	10.0-12.0	2.0-3.0	-	-	0.018	0.025	-

Table П6.3 **Chemical composition of coated metal during argon-arc welding**

Grades of welding wire	Chemical composition					
	Carbon	Silicon	Manganese	Chromium	Nickel	Molybdenum
Св-08ГС	≤0,1	0.4-0.8	1.1-1.7	-	-	-
Св-10ГНМА	0.05-0.12	≤0.3	0.5-1.1	≤0.3 .	1.4-1.8	0.45-0.70
Св-10ГН1МА	0.05-0.12	0.1-0.4	0.9-1.5	0.3	1,4-1,8	0.50-0.75
Св-12Х2Н2МА	0.06-0.14	≤0.3	0.6-1.2	1.4-2.1	1.2-1.9	0.50-0.70
Св-09ХГНМТА, Св-09ХГНМТАА-ВИ	0.05-0.12	0.1-0.4	. 0.5-1.0	1.4-2.1	1.4-2.1	0.45-0.70
Св-12Х2Н2МАА	0.06-0.13	≤0.3	0.6-1.2	1.4-2.1	1.2-1.9	0.40-0.70
Св-08Х19Н10Г2Б	≤0.10	≤0.6	1.5-2.2	18.0-20.5	9.0-10.5	-
Св-04Х20Н10Г2Б (ЭП 762)	≤0.05	≤0.6	1.5-2.2	18.0-20.5	9.0-10.5	-
Св-06А	0.04-0.10	0.15-0.50	0.4-0.7	-	-	-
Св-08Г2С	0,04-0.11	0.60-0.95	1.7-2.1	-	-	
Св-08ХМ	0.04-0,10	≤0.30	0,3-0,6	0,8-1.2	-	0.4-0.7
Св-08ХГСМА	0.04-0,10	0.35-0,70	1.0-1.5	0.8-1.2	-	0.4-0.7
Св-08ХГСМФА	0.04-0.10	0.35-0.70	1.1-1.5	0.9-1.3	-	0.4-0.7
Св-04Х2МА	≤0.06	≤0.35	0.3-0.7	1.7-2.2	-	0.4-0.7
Св-06Х14	≤0.08	0,20-0.70	0.2-07	12.5-15.0	≤0.6	
Св-10Х11НВМФ	0.06-0.13	0,20-0.60	0.3-0,7	10.3-12,0	0.7-1.1	0.9-1.3
Св-04Х19Н11М3	≤0.06	≤0.60	0.9-2.0	17.8-20.0	9.8-12.0	1.8-3.0
Св-10Х16Н25АМ6	0.06-0.12	≤0,60	0.9-2.0	14.8-17.0	24.8-27.0	5.2-7.0
Св-07Х25Н13	≤0.09	0.14-1.0	0.9-2.0	22.8-26.0	11.8-14.0	-
Св-08ХМФА	0.04-0.10	≤ 0.30	0.3-0.6	0.8-1.2	-	0.4-0.7
Св-01Х12Н2-ВИ	≤0.025	0.15-0.50	0.2-0.7	11.0-13,5	1.6-2.5	-
Св-04Х17Н10М2	≤0.09	≤0.7	1.0-2.0	16.0-18.0	9.0-11.5	1.0-2.0
Св-02Х17Н10М2-ВИ	≤0.06	≤0.7	1.0-2.0	16.0-0.18	9.0-11.0	1.0-2.0
Св-03Х15Н35Г7М6Б	≤0.03	≤0.03	6.0-7.5	14.0-16.0	34.0-35.0	6.0-7.5

Table П6.3 (continued)

Grades of welding wire	Chemical composition					
	Vanadium	Tungsten	Niobium	Sulphur	Phosphor	Copper
				Maximum		
Св-08ГС	-	-	-	0.025	0.030	0.25
Св-10ГНМА	-	-	-	0.015	0.020	0.25
Св-10ГН1МА	-	-	-	0.020	0.020	0.25
Св-12Х2Н2МА	-	-	-	0.015	0.012	0.10
Св-09ХГНМТА, Св-09ХГНМТАА-ВИ	-	-	-	0.012	0.010	0.08
Св-12Х2Н2МАА	-	-	-	0.012	0.010	-
Св-08Х19Н10Г2Б	-	-	0.7-1.3	0.020	0.030	-
Св-04Х20Н10Г2Б (ЭП 762)	-	-	0.7-1.3	0.020	0.030	-
Св-06А	-	-	-	0.020	0.025	-
Св-08Г2С	-	-	-	0.025	0.030	-
Св-08ХМ	-	-	-	0.025	0.030	-
Св-08ХГСМА	0.10-0.30	-	-	0.025	0.025	-
Св-08ХГСМФА	0.15-0.35	-	-	0.025	0.025	-
Св-04Х2МА	-	-	-	0.020	0.025	-
Св-06Х14	-	-	-	0.025	0.030	-
Св-10Х11НВМФ	0.20-0.50	1.0-1.4	-	0.025	0.030	-
Св-04Х19Н11М3	-	-	-	0.018	0.025	-
Св-10Х16Н25АМ6	-	-	-	0.018	0.025	-
Св-07Х25Н13	-	-	-	0.018	0.025	-
Св-08ХМФА	0.10-0.30	-	-	0.025	0.025	-
Св-01Х12Н2-ВИ	-	-	-	0.020	0.030	-
Св-04Х17Н10М2	Titanium 0.03	Aluminium ≤0.1	-	0.020	0.025	0.20
Св-02Х17Н10М2-ВИ	-	-	-	0.020	0.020	-
Св-03Х15Н35Г7М6Б	-	-	1.2-1.8	0.020	0.030	-

CONTENTS

REVISION No. 1

of the ПНАЭ Г-7-010-89 "Equipment and pipelines of nuclear power plants. Welded joints and surfacing. Inspection regulations"

PUT INTO EFFECT from *September 1, 2000*

Contents of revision:

1. Title page.

1) The name of the Federal executive authority "State Committee of the USSR for Supervision of the Safety of Work in Nuclear Power Engineering (the USSR Gosatomenergonadzor)" shall be replaced with the name "Federal Inspection of Russia for Nuclear and Radiation Safety (Gosatomnadzor of Russia)".

2) In the free space of the title page of ПНАЭ Г-7-010-89, below the title, shall be written: "Shall be effective with the revision No. 1 (see Decision of the Gosatomnadzor of Russia No. 7 of December 27, 1999). Changed shall be items 1.1. (Note) 1.4, 3.1.1, 3.1.2, 3.2.4, 3.2.7, 3.2.14, 4.1.1, 4.1.2, 4.1.3, 4.2.5, 4.3.5, 9.5.5, 10.2.11, 11.1.5, Table 4, Table 5, Section 14, Appendix 1".

2. Item 1.1. Note.

The term "the leading materials-science organization" and its definition, as well as the term "agreement of the leading materials-science organization" and its definition are given in Appendix 1 of the Section 1 "General requirements and definitions in" in the items 1.26 and 1.27, respectively.

3. Item 1.4.

The last sentence "The use of standards and instructions should be authorized by the USSR Gosatomenergonadzor" shall be replaced by the sentence "The use of the aforesaid standards and instructions should be authorized by the Gosatomnadzor of Russia., after which the item 1.4 shall be written as follows:

> 1.4. The inspection by any method should be carried out in compliance with State Standards covering the relevant inspection methods or with departmental methodological standards, which more specifically define methods for the inspection of welded joints and weld coated parts. In the absence of these standards, the inspection may be carried out in accordance with the methodological instructions prepared by the leading materials-science organization. The use of the aforesaid standards and instructions should be authorized by the Gosatomnadzor of Russia.

4. Item 3.1.1.

The words "that have the permission to manufacture (erect) the equipment and pipelines of the nuclear power plants, issued by the local authorities of the USSR Gosatomenergonadzor, which shall be issued in the order specified by the USSR Gosatomenergonadzor" shall be replaced with the words "that have the license of the Gosatomnadzor of Russia", after which the item 3.1.1 shall be written as follows:

> 3.1.1. Operations involving the welding and surfacing of the equipment and pipelines should be performed by the manufacturing plants (erection organizations) that are staffed with skilled personnel, technological and quality control services, and all the pertinent technical facilities required for the performance of corresponding operations, and t that have the license of the Gosatomnadzor of Russia.

5. Item 3.1.2.

The item shall be deleted.

6. Item 3.2.4.

The words "with participation of an inspector representing the USSR

Gosatomenergonadzor" shall be replaced with the words "with participation of an inspector representing the Gosatomnadzor of Russia", after which item 3.2.4 shall be written as follows:

3.2.4. The nonscheduled certification should be undertaken when the PTD at the manufacturing plant (erection organization) has undergone such changes which may worsen the properties or quality of the manufactured welded joints (weld coated surfaces) performed in accordance with the certified technology and in the case of deteriorated quality of such joints and surfaces made by the manufacturing plant (erection organization). On such an occasion, the decision as to whether there is a need for the nonscheduled certification should be taken by the certification commission of the manufacturing plant (erection organization) with participation of an inspector representing the Gosatomnadzor of Russia.

7. Item 3.2.7.

The words "an inspector of the USSR Gosatomenergonadzor" shall be replaced with the words "an inspector of the Gosatomnadzor of Russia", after which the item 3.2.7 shall be written as follows:

3.2.7. The staff of the certifying commissions should include the head of the manufacturing plant (erection organization) or his deputy (chief engineer), the head of the service responsible for welding and surfacing, a representative of the quality control department, an inspector of the Gosatomnadzor of Russia, as well as other highly skilled experts in welding practice and quality control of welded joints (weld surfacing), and a representative of the design organization at the discretion of the management of the manufacturing plant (erection organization) in charge of the certification.

The members of the certifying commission shall be approved by the order of the manufacturing plant (erection organization).

8. Item 3.2.14.

1) The first sentence.

The words "to the local authority of the USSR Gosatomenergonadzor" shall be replaced with the words "for approval to the interregional territorial district of the Gosatomnadzor of Russia".

2) The second sentence shall be deleted, after which the item 3.2.14 shall be written as follows:

3.2.14. The inspection statement, drawn up according to item 3.2.10, shall be submitted for approval to the interregional territorial district of the Gosatomnadzor of Russia in the region where the manufacturing plant (erection organization) that carried out the certification is located.

9. Item 4.1.1.

The second paragraph of the item shall be deleted, after which the item 4.1.1 shall be written as follows:

4.1.1. The certification of inspectors (experts, flaw-detection operators, quality control inspectors, directly engaged in inspection) should be carried out by testing their theoretical knowledge and practical skills in specific inspection methods.

10. Item 4.1.2.

The words "after agreeing upon with the local body of the USSR Gosatomenergonadzor" shall be replaced with the words "and agreed upon with the interregional territorial district of the Gosatomnadzor of Russia", after which item 4.1.2 shall be written as follows:

4.1.2. The list of the inspector staff positions to be certified shall be specified by the certifying enterprise and agreed upon with the interregional territorial district of the Gosatomnadzor of Russia.

11. Item 4.1.3.

The words "appointed on agreement with the local body of the USSR Gosatomenergonadzor" shall be replaced with the words "having a license of the Gosatomnadzor of Russia", after which item 4.1.3 shall be written as follows:

4.1.3. The inspectors shall be certified by permanent certifying commissions at the manufacturing plants (erection organizations) and/or special organizations having a license of the Gosatomnadzor of Russia.

12. Item 4.2.5.

The words "representative of the USSR Gosatomenergonadzor" shall be replaced with the words "inspector of the Gosatomnadzor of Russia", after which item 4.2.5 shall be written as follows:

4.2.5. The nonscheduled certification is prescribed to the inspectors before granting them permits for work after temporary suspension from work, as a punishment for violation of the inspection technology or repeated negligence, as well as on the request of a member of the leading materials-science organization, a member of the certifying commission, a inspector of the Gosatomnadzor of Russia, who have checked the proper performance of a certain inspection method and have discovered some violation of the prescribed inspection technology.

13. Item 4.3.5.

The sentence "These forms may be changed upon agreement with the USSR Gosatomenergonadzor" shall be replaced with the sentence "These forms cannot be changed without approval of the Gosatomnadzor of Russia", after which the item 4.3.5 shall be written as follows;

4.3.5. The recommended forms of the inspector certificates and forms of the minutes taken at the session of the certifying commission are given in Appendices 3 and 4.

These forms cannot be changed without approval of the Gosatomnadzor of Russia.

14. Item 9.5.5.

1) The words "the leading branch materials-science organization" shall be replaced with the words "the leading materials-science organization".

2) The words "the regional agency of the USSR Gosatomenergonadzor" shall be replaced with the words "the interregional territorial district of the Gosatomnadzor of Russia", after which item 9.5.5 shall be written as follows:

9.5.5. The welded joints should be subjected to radiographic inspection through one wall, except when it is technically impossible. The technical impossibility should be agreed upon with the leading materials-science organization and the interregional territorial district of the Gosatomnadzor of Russia.

15. Table 4. Methods and Scope of Nondestructive Inspection of Buttering of Parts from Steel of Pearlitic Class and from High-Chromium Steels and of Nondestructive Inspection of Coated Anticorrosive Coating on Parts (Articles) from Steels of Pearlitic Class.

The last line of the Table.

The words "and the USSR Gosatomenergonadzor" shall be replaced with the words "and approval of the Gosatomnadzor of Russia", after which the sentence shall be written as follows:

Methods and scope of inspection should be established by designing organization on agreement with manufacturing plant, leading materials-science organization and approval of the Gosatomnadzor of Russia.

16. Table 5. Methods and Scope of Nondestructive Inspection of Welded Joints of Tubes in Tube Plates and Headers.

Note. The last sentence.

The words "on approval by the local agency of the USSR Gosatomenergonadzor" shall be

replaced with the words ", should be approved by the interregional territorial district of the Gosatomnadzor of Russia", after which the last sentence shall be written as follows:

This decision should be taken by the designing agency jointly with the manufacturing plant constructing organization) and with the leading materials-science organization, should be approved by the interregional territorial district of the Gosatomnadzor of Russia and should be recorded in the production-process documentation.

17. Item 10.2.11.

The words "approved by the leading interdepartmental materials-science organization", shall be deleted, after which item 10.2.11 shall be written as follows:

10.2.11. The destructive inspection of surfacing materials intended for making anticorrosive coatings should be carried out in compliance with the standards or instructions of the leading materials-science organization.

18. Item 11.1.5.

The words "the USSR Gosatomenergonadzor" shall be replaced with the words "should be approved by the Gosatomnadzor of Russia", after which item 11.1.5 shall be written as follows:

11.1.5. The quality assessment norms of the reinforcing weld surfacing should be established by the designing organization on agreement with the manufacturing plant, leading materials-science organization, and should be approved by the Gosatomnadzor of Russia.

19. Section 14. Deviations from established requirements.

The first paragraph.

The words "(of branch subordination or, in cases defined by the USSR Gosatomenergonadzor, interdepartmental), with the customer, and the USSR Gosatomenergonadzor." shall be replaced with the words "with the customer, operating organization and approved by the Gosatomnadzor of Russia", after which Section 14 shall be written as follows:

Section 14. Deviations from established requirements.

In some cases, when the inspection by one of the above-listed methods or in the prescribed scope is technically impossible or when the correction of the defective welded joint (weld coated part) can impair its operational reliability, one may resort to well-motivated deviations from established norms, formalized by a joint decision of the designing (projecting) organization, manufacturing plant (erection organization) agreed upon with the leading materials-science organization with the customer, operating organization and approved by the Gosatomnadzor of Russia.

If deviations from the norms of the assessment of the quality of welded joints of the categories I, Iн, II, IIн, do not go beyond the limits established for welded joints of III category, the decision may be taken without participation of the customer.

20. Appendix 1. Terms and basic definitions, Section 1 "General terms and definitions".

The items 1.26 and 1.27 shall be included additionally:

1.26. The leading materials-science organization – organization approved by respective body for the nuclear power use for providing services to operating organization or to other organizations in choosing materials, welding method, ensuring the quality of the manufacture of the equipment and pipelines to carry our expert examination of the project, design, and engineering documentation, as well as documents that ground the nuclear and radiation safety of NPP and which has the license of the Gosatomnadzor of Russia for this activity.

1.27. Agreement with the leading materials-science organization – positive opinion of the leading materials-science organization, prepared at the request of operating organization or other organizations.