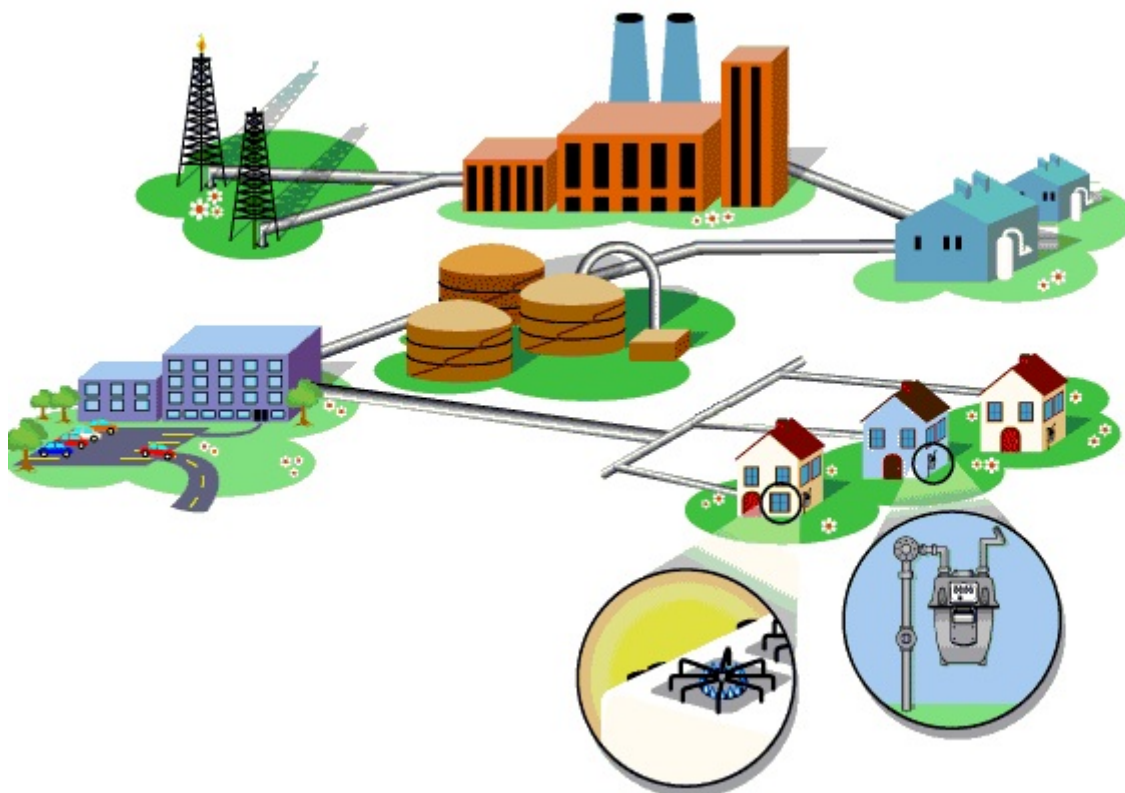




Georgian Oil & Gas Corporation

Executive Phase

Specification for QA/QC Inspection



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1. DEFINITIONS AND ABBREVIATIONS

Company: GOGC, As defined in the Contract Agreement

Contractor: Performing Company(s), As defined in the Contract Agreement

Sub- contractor: organisation appointed by the Contractor to execute a scope of work

Supplier: organisation appointed by the Contractor to supply goods

Organisation: collective term for any Contractor, supplier, and sub-contractor

ISO: International Standards Organisation

ITP: Inspection and Test Plans (also known as Quality Control Plan)

Work: the activity and processes and deliverables to be produced by the Contract Scope of Work

DCC: Document Control Centre

PEP: Project Execution Plan

QA: Quality Assurance

QC: Quality Control

2. RECEIVING HANDLING AND STORAGE OF LINEPIPE

2.1 Scope

GOGC will provide free issue materials as listed as required for pipeline construction. Contractor shall accept custody of all free issue material at designated points. Prior to acceptance Contractor shall inspect all free issue material, identify and agree all defects with GOGC. Contractor shall be responsible for carrying out any repairs to the pipe and coating following receipt of this material.

Contractor shall provide adequate equipment and personnel to unload receive and store materials, and to load and haul free issue materials from receiving point to storage and to ROW, as necessary.

2.2 Inspection

When Contractor receives line-pipe, a visual inspection of GOGC supplied items shall be carried out by the Contractor at all stages of line-pipe movement (Receipt on the PipeYard, Load on the Truck, Offload from the Truck). If it appears that numerous defects are visible, off loading/loading of line-pipe will be slowed down to allow a better evaluation of defective pipes with a more detailed inspection.

Visual inspection will ascertain the quantities of line pipes, per wall thickness on each shipment and the quality aspect of all bevels, coating aspect, markings and recording potential / existing defects at the time of hand over. A written report will be issued to record the number of line pipes on each shipment and to ensure compliance with the ITP and the Procedure.

2.3 Pipe Acceptance Criteria and Damage categories

The following visible coating defects shall be recorded (length x width in cm) :

- mechanical damage to the coating surface categorized as follows:
Category 1 - Damage through the Polyethylene layer and primer layer to bare steel.
Category 2 - Damage through the Polyethylene layer to the primer layer.
Category 3 - Damage through the Polyethylene layer only.
- pinholes,

- blisters,
- sags,
- Bubbles.

Note: Coating Mechanical damage and pin holes does not warrant pipe quarantine. After identification and recording of coating defects pipe load out shall continue.

Defects found to be outside of the following acceptance criteria, will constitute quarantine of the pipe:

- | | |
|----------------------------------|---|
| • Out-of- roundness Pipe OD body | maximum 1% |
| • Out-of-roundness at pipe ends | maximum 0.75% |
| • wall thickness | +/- 0.75mm from specified nominal wall thk |
| • Bulges, dents and flat areas | Max 3mm in depth, and shall not extend in Any direction a distance greater than $\frac{1}{4}$ the Diameter of pipe. |
| • Straightness | maximum 12mm per 12 m pipe length |
| • Squareness of pipe ends | within 1.5 mm across any diameter |
| • Bevel | bevel angle 30^0 , $+5^0$, 0^0 , root face 1.6mm +/- 0.8mm. |

The following damage shall be recorded but does not constitute quarantine of the pipe:

- Bevel mechanical damage.

It is recognized that during visual receipt inspection of pipe only extensive visible damage is possible to be identified.

2.4 QC Inspector's Responsibilities

Contractor's QC inspectors shall record the following pipe details on a Pipe Receiving / Load out Inspection Report:

- Pipe identification number.
- wall thickness identification
- Coating defect size (approximate length x width in cm) and category
- Pipe body / bevel damage
- If accessible, damaged areas shall be marked using **yellow** or **white** permanent marker or equivalent.
- Photographs shall be taken of major damage.

Contractor's QC Inspector shall sign Pipe Receiving / Load out Inspection Report the completion of each page or at the end of each shift. If the logistic Sub-Contractor Companies's Representative is available during pipe unloading he shall also sign the Pipe Receiving Report.

3. STRINGING

3.1 Scope

After the ROW preparatory works are over and before starting Welding activities, Pipes should be strung along the ROW.

The pipes should be strung on sand bags. The sand used shall to be free of stones or any hard material which could damage the coating.

3.2 Inspection

A QC Inspector shall be in place at the time of loading and stringing to perform a visual inspection of line-pipe coating, pipe material and bevel end preparation, all damage shall be recorded and entered into the MS Excel file.

4. BENDING

4.1 Scope

The line pipe will be strung in accordance with all relevant data specified on alignment sheets. The required angle in degrees will be indicated on the pipe to be bent by the Bending Engineer in coordination with bending foreman. A schedule of bends for each pipeline section shall be produced and will contain information of the pipe numbers to be bent and degree of bend.

4.2 Bending Test

Before starting production, the bending crew shall carry out a bending operation on each pipe diameter and wall thickness in the presence of GOGC. The same personnel, equipment and resources will be used for the bending test and production.

The completed test bend shall be checked with regard to the acceptance criteria, before and after bending operation, the finished bend shall be free from mechanical damage, cracks, wrinkles or buckles.

The pipe shall also be checked for ovality by passing a guage plate of 95% of the nominal pipe diameter through the pipe, the difference between the maximum and minimum diameter of the bent pipe shall not exceed 2.5% of the nominal diameter.

All bends shall be made cold and with the GOGC approved bending equipment. A cold, smooth bending machine shall be used having a full-circle bending shoe and an internal mandrel. Lined bending shoes and mandrels will be required to protect the internal and external coating. Spot heating or wrinkle bends are not allowed.

An Ultrasonic Thickness check will be performed from the inside of the pipe before and after the bending test on each pipe size with maximum and minimum wall thickness. The results will be recorded on the bending report and approved by Foreman (in coordination with QA/QC department), and by GOGC.

4.3 Acceptance Criteria and Inspection

The following parameters shall be measured and / or evaluated in order to accept bending operations:

- The minimum acceptable cold bend radius shall be the equivalent of 40 pipe diameters.
- The longitudinal axis deflection of pipe shall not be greater than on project typical drawings
- Longitudinal seams in adjacent joints shall be offset by minimum 250 mm at the pipe circumference
- The ovalisation due to bending shall not exceed 2.5% of the nominal diameter

- All bends have a tangential straight of no less than 1 meter on each end.
- All bends shall have a smooth contour and be free of mechanical damage, cracks, wrinkle or buckles.
- The coated pipes shall be visually checked for coating damage and repaired if necessary.

The bending foreman, in coordination with the QA/QC department will carry out the above inspection.

Each field bend shall have a gauge plate of 95% of the nominal diameter pulled through after completion of the bend. The QC Inspector shall witness this operation and record it on his daily report.

QC Inspector is responsible for:

- Inspect for any apparent damage or non-conformity of Line Pipe
- Record and report any damage or non-conformity to Line Pipe

The daily report shall be filed in the QA/QC office and contain, at least, following data:

- Date of bending
- Bend angle
- Pipe number / Heat Number
- Gauging of Bend
- Number of bends made that day
- KP location

5. TRENCHING

5.1 Scope

The pipe trench shall be carefully excavated and the trench bottom graded so that the pipeline is evenly supported throughout its length. The trench bottom profile shall be such as to obtain a smooth profile for the pipeline and to minimize field bending,

The pipe trench shall be excavated along the pegged alignment but where there is a change in direction, the trench shall be cut so as to accommodate the specified radius of the pipe bend. Clearance shall be maintained between the bend and trench walls to accord with the trench dimensions set out on the Project Drawings.

The finished trench shall be free from roots, stones, rocks or other hard objects which could cause damage to the pipe and its coating. De-watering shall be carried out where necessary and prior to lowering-in.

5.2 Inspection

The trench bottom shall be inspected by Trench Supervisor and QC Inspector to ensure that it is clean and free from boulders, stumps, debris or any organic material.

6. PIPE CUTTING

6.1 Inspection

Record Line-pipe details and perform inspection and tests as follows;

- Record Pipe Number and Heat Number of original pipe
- Record Original Pipe Length
- Record New Pipe Lengths ("pipe no / 1", "pipe no / 2",.....)
- Transfer Pipe Number and Heat Numbers to each cut section of pipe.
- Measure each cut section of pipe and transfer the details of the new lengths to each section of pipe.
- Perform and Report UT lamination check to new proposed weld bevel when required.
- Perform visual inspection of new weld bevel and surrounding area.
- Generate Pipe Cutting Report and submit to QA/QC department.

The minimum pup length which can be used on the pipeline is 2m.

6.2 Documentation

- Pipe Cutting Report
- UT Report

6.3 Reasons for Cutting the Weld

- Non-conformity with WPS
- Longitudinal crack can be detected by RT
- Weld defect cannot be repaired more than twice
- Any other Engineering reasons

7. WELDING

7.1 General

All pipe-line welding shall be carried out in accordance with the provisions of the Project Specification for Field Welding of Pipeline. Only competent, skilled, and qualified welders using qualified procedures shall be used for welding the pipeline.

7.2 Welding Procedures

There shall be produced detailed welding procedures in accordance with the Project Codes and Standards and Specification for Field Welding of Pipeline. Formal written Welding Procedures Specification (WPS) shall be submitted to GOGC for approval prior to start of qualification testing.

Once each WPS is approved, procedure qualification tests may begin. The tests shall be witnessed by GOGC with results of the destructive testing recorded and provided to GOGC for approval.

The Contractor shall submit to GOGC, for approval, written Weld Procedure Proposals (WPPs) to cover the range of materials, thicknesses and diameters in the work. These shall include welding repair procedures. Upon approval each WPP shall be qualified in accordance with API Standard 1104 and the requirements of this Specification. All Weld Procedure Qualification (WPQ) tests shall be witnessed by GOGC. Qualification tests on line-pipe shall be carried out on full pipe lengths unless prior approval has been obtained from GOGC. Where required, GOGC-provided test rings shall also be used for qualification purposes. Welding procedure test welds shall be carried out using the same equipment as that to be used in production welding and shall be welded under site conditions. The location for carrying out the qualification test welds shall be subject to GOGC approval.

Welding Procedure Qualifications which are carried out using automated/mechanised welding shall be tested using a minimum of three separate girth welds to prove reliability and repeatability of the welding process and examination techniques. The opportunity shall be taken to qualify different welders/welding operators during these activities.

Following qualification the Contractor shall prepare a Weld Procedure Specification (WPS), for use on site. The Contractor shall then submit the complete package of WPS's and Weld Procedure Qualification Records (WPQR's) for approval by GOGC.

Production welding shall not commence until the WPS's and WPQR's have been approved by GOGC.

The package shall consist of at least the following:-

- a) Register cross-referencing WPQR to WPS.
- b) WPS (see Figure 1 of API Standard 1104).
- c) WPQR (see Figure 2 of API Standard 1104).
- d) NDT and visual inspection reports.
- e) Mill certificates for pipes.
- f) Batch certificates for consumables.
- g) Heat treatment charts, if applicable.

All welding details required by API 1104 Section 5 and the requirements of this Specification, shall be included in each WPS and shall be qualified by the corresponding WPQR.

7.3 Welding Qualification

Welders shall be qualified to API 1104, with testing at the job site. Pipe material to be used for welder qualification purposes shall be subject to GOGC approval. In order to qualify, welders shall meet the requirements of clauses 6.4, 6.5 and 6.6 of API Standard 1104. Previously qualified welders with current certificates may be acceptable to GOGC providing all the requirements of this Specification and API 1104 are met and the tests have been witnessed and authenticated by a third party inspection authority.

During Welding Procedure Qualification, the opportunity shall be taken to qualify different welders/welding operators (see also Section 4.1.2 of this Specification).

For automated/mechanised welding processes, any change in welding equipment shall be considered an essential variable and shall require re-qualification.

Welders with unsatisfactory performance, either on test or in production work, may be asked to re-train and re-qualify or may be removed from production welding at the discretion of GOGC, all at Contractor's cost.

7.4 Welding Consumables

Electrodes, filler wires and shielding gases, and wire/flux combinations shall produce weld metal that has a tensile strength at least equal to the minimum specified for the parent pipe. Batch certificates for welding consumables shall be provided.

The Contractor shall submit a procedure for the storage and handling of welding consumables (including fluxes, if applicable) for approval by GOGC.

Welding consumables shall be stored strictly in accordance with the manufacturer's recommendations in a covered, clean, dry location, and shall be suitably segregated.

The use of heated quivers is mandatory for low-hydrogen electrodes.

Welding consumables which may be damaged or subject to deterioration shall be removed from the site.

List and copies of certificates should be provided to GOGC by the Contractor.

7.5 Welding Reports

On daily basis Contractor shall submit to GOGC copies of Welding Reports, which will include following items:

- KP
- Direction of Travel
- Welding Date
- Pipe Numbers
- Heat Numbers
- Pipe Lengths (for each pipe)
- Pipe Diameters
- Pipe Wall Thicknesses
- Pipe Bend Angles and Directions
- Weld Numbers
- Welders Numbers
- Welding Procedure
- Welding Consumables used for welding

Report shall be signed by QC Inspector and approved by GOGC

7.6 Welding Repairs

A Welding Procedure Specification for weld repairs shall be submitted together with a corresponding Welding Procedure Qualification Record (WPQR) for GOGC's approval prior to the commencement of the work. This shall include a procedure to cover a weld repair in accordance with Section 10 of API Standard 1104.

Weld body repair weld procedures shall be qualified by making a fusion line excavation to mid-thickness in a test panel welded to the relevant original weld procedure and re-welding it in accordance with the repair procedure. The repair weld shall be tested as a full penetration weld between the original weld metal and the pipe.

Root repairs require a separate WPQR which requires specific approval by GOGC.

Qualification of repair weld procedures shall be in accordance with Section 5 of API Standard 1104, as amended by Section 4 of this Specification. Mechanical tests shall include Charpy V specimens taken from the junction between original weld metal and repair weld metal at Fusion Line and Fusion Line +2mm positions.

Preheating shall be applied, as per the repair weld procedure, prior to any arc air gouging.

No more than two repairs shall be made in the same location. The use of a second repair (i.e. a re-repair) shall be subject to the following conditions:

- The re-repair procedure shall be subject to weld procedure qualification testing
- The cumulative length of re-repairs shall not exceed 5% of the total girth weld length.

In all cases where arc air gouging is used to remove a defect it shall be followed by grinding.

If repair excavations are less than 10mm apart they shall be linked into a single repair.

7.7 Weld Repair Reports

On daily basis Contractor shall submit to GOGC copies of Weld Repair Reports, which will include following items:

- Weld Repair Date
- KP
- Weld Number
- Repair Welder Number
- Defect Type
- Welder Number responsible for the defect
- Repair Welding Procedure
- Welding Consumables used for repair

Report shall be signed by QC Inspector and approved by GOGC

7.8 Inspection

Inspection and witnessing by GOGC shall not absolve Contractor from his responsibility for carrying out the necessary inspection, testing and Non Destructive Testing (NDT) required by API 1104 and by this Specification.

All welds shall be subject to 100% visual inspection to ensure good workmanship to the satisfaction of GOGC and, in any case, shall meet the requirements of Section 6.4 of API 1104.

External Magnetic Particle Examination shall be carried out on 100% of girth welds at road, rail or river crossings and repaired welds also.

Radiographic Examination shall be carried out on 100% of all girth welds.

In the event that the Contractor proposes to use Automated Ultrasonic Testing, in place of radiographic examination, the Contractor shall submit full details of the proposed system and proposed sub-Contractor Companies to GOGC at an early stage following award of contract. Approval of Automated Ultrasonic Testing techniques is at the sole discretion of GOGC. Where Automated Ultrasonic Testing techniques are approved, there shall remain a requirement for Radiographic Examination of girth welds at road, rail and river crossings, at tie-ins and for cross-checking of suspect indications revealed by ultrasonic techniques.

All field cut pipe ends shall be examined for laminar defects, over a band extending 75mm from the weld bevel, by an ultrasonic procedure approved by GOGC.

NDT procedures shall be in accordance with Section 11 of API 1104. NDT procedures for automated ultrasonic examination of girth welds (if applicable) shall, in addition, be subject to qualification testing using Procedure Qualification test girth welds made on project line-pipe material. The scope of testing and acceptance criteria for this qualification activity shall be subject to GOGC approval.

For radiography, wire type penetrameters shall be used. Penetrameters shall be in accordance with clause 11.1.4 of API 1104, or GOGC approved equivalent. Sensitivity shall be better than 2% for single image techniques. Sensitivity for other radiographic techniques shall be subject to GOGC approval.

8. FIELD JOINT COATING

8.1 General

Some sections of Pipeline on the NSGPR Project will be buried and will be protected against external corrosion by external coating. The external coatings shall be suitable for the operating conditions to which they are subjected and shall have proven good resistance to cathodic disbondment.

Field joint coating procedure shall be developed by the Contractor to ensure consistent quality specifically with regard to cure, film thickness, adhesion and low temperature flexibility characteristics.

The coating application process and repair technique shall comply with the established written procedure, which shall define all relevant details including: coating name, data sheets, pipe cleaning, blast cleaning medium and technique, surface quality, dust removal, coating application, curing procedure and coat stripping technique. The application procedure used during the pre-qualification testing once qualified shall be strictly applied and monitored to ensure consistent application quality

The coating materials shall be stored and applied by the Contractor in accordance with Manufacturer's recommendations.

8.2 Codes and Standards

This Specification references the following Codes and Standards. Where an edition date is not specified the latest edition at the time of contract award shall be used unless otherwise agreed with GOGC

ASTM D 2240-91	Standard test method for rubber property (durometer hardness)
ASTM D 5402 –93 (1999)	Standard practice for assessing the solvent resistance of organic coatings using solvent rubs
ASTM G 8-96	Standard test methods for cathodic disbonding of pipeline coatings
ASTM G 14-96	Standard test method for impact resistance of pipeline coating (falling weight test)
ASTM G 17-96	Standard test method for penetration resistance of pipeline coatings (blunt rod)
ASTM G 42-96	Standard test method for cathodic disbonding of pipeline coatings subjected to elevated temperatures
BS EN ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness.
BS EN ISO 8503-2	Preparation of steel surfaces before application of paints and related products. Method for the grading of surface profile of abrasively blast cleaned steel using a comparator (1995).

8.3 Contractor's scope of work

Contractor shall provide testing and inspection equipment, all properly calibrated, for use by GOGC during testing and inspection. Contractor shall be responsible for continuous supervision and inspection of the work.

Contractor shall supply, and maintain in good working order, all labour, transport, supervision, consumables, materials, plant, tools, equipment, lighting, spare parts, inspection and holiday detection apparatus, safety equipment, protective clothing, site cabins, weatherproof enclosures with humidity control for blast cleaning and coating, stores with temperature controls, transport, well drained stockpile area, and all other items needed to perform the work described and specified herein.

Contractor is responsible for ensuring that all work is performed to the standard of quality required by the approved project Specification. GOGC may request the provision of coating material samples, and prepared and coated test panels. Contractor shall demonstrate production of the specified surface cleanliness and roughness for site preparation.

Coating and abrasive materials shall be clearly identified with type, manufacturer's name, batch number, expiry date, pot life, etc. details.

GOGC shall be allowed access to inspect all items and phases of the work. Where field joint coating procedure acceptance tests have been agreed, GOGC will witness these tests.

8.4 Certification and Test Reports

Contractor shall establish a full reporting and recording system and shall produce daily reports, and submit a full documentation package at the end of the work, including, where applicable:

- Items prepared, method of preparation, abrasive type and grade, standard of cleanliness and profile achieved
- Coating material type, name, application method, thickness measured, etc.
- Application and inspection personnel
- Ambient temperature and humidity conditions
- Outstanding areas for coating/repair, repair results
- Certificate of conformity
- Certified copies of test results made by Manufacturer covering the physical, chemical and performance characteristics of his products, data sheets, including cathodic disbondment results.

Contractor shall provide the following procedures where applicable:

- Field joint preparation and induction heating
- Coating procedure
- Coating materials, storage, application and repair, curing
- Measures to be adopted during periods of adverse weather
- Inspection and testing, including acceptance criteria, and frequencies, coating thickness
- Preservation, packing, shipping and storage: to include methods, materials and any requirement for periodic inspection

Contractor shall supply data sheets and details of coating materials to establish the suitability of the proposed coating for the given use of the coated item. All coating materials shall conform to the specified composition. Manufacturer shall confirm in writing that the coating systems meet the requirements of this Specification and can be applied successfully to the relevant substrate.

8.5 Field Joint Identification

Details of field joint number and coating type/date shall be generated and recorded by the Contractor's tracking system and all data shall be provided to GOGC in an agreed format.

8.6 Condition of Coating Material

Coating materials shall be delivered in their original, sealed, undamaged containers with name of Manufacturer, product reference, batch numbers, shelf life and storage requirements clearly marked. Containers shall remain unopened until required for use.

Coating materials shall be stored in a safe, dry enclosure or building in accordance with local laws, Manufacturer's printed recommendations and Contract safety regulations. The storage location shall be adequately ventilated and containers shall not be exposed to direct sunlight during storage. With local high ambient temperatures, temperatures within enclosures/buildings shall be maintained in the range as recommended by Manufacturer. Materials shall be handled in such a manner to prevent damage or contamination that would make them unsuitable for use. Any material, which exhibits evidence of contamination or deterioration, shall be rejected.

Field joint material products shall be used in chronological order of the date of manufacture. Coating materials whose shelf life has expired shall not be used. Coating materials, which have deteriorated during storage, shall not be used. In all cases where deterioration is suspected, the Manufacturer's guidance shall be obtained.

8.7 Thickness Tolerance

The dry film thickness of the coating shall be a minimum of 750 microns and a maximum of 1250 microns. While the thickness of the coating in some areas may exceed the stated maximum limit, any which exceeds the Manufacturer's recommended maximum shall be grounds for removal; and reinstatement of the coating. Contractor's procedures for thickness measurement shall include proper calibration of equipment and for the use of suitably qualified personnel.

8.8 Qualification Test

Qualification test shall be carried out prior to commencing coating activities.

- Test joint shall be coated as per material specification.
- Sand blasting shall be carried out in appropriate weather conditions. Humidity shall not exceed acceptable norm. Joint surface shall be inspected after the sand blasting.
- Joint surface shall be heated to the acceptable temperature before primer application. Primer shall be mixed as per material specification. Mixing cans shall be calibrated.
- Coating material shall be applied to the joint following material specification.
- Pulling test shall be carried out day after the coating process.
- Qualification shall be accepted if pulling strength exceeds 40n per 1cm.

8.9 Visual Inspection

Each field joint shall be visually inspected after application of the coating. The field joint coating shall consist of a uniform film that is free of runs, sags, misses, blisters, pinholes, poor bonding, laminations, porosity, air entrapment at welds and is uniform in colour and properties when cured. There shall be no visible runs, sags or bubbles. The examination shall include checks for soft spots.

8.10 Holliday Testing

After application of the coating, field joints shall be 100% holiday tested generally in accordance with NACE RP0274. All post application testing shall extend over the whole field joint area and 200mm

onto the parent coating. The holiday test shall be carried out at 20 KV, using a portable instrument. A fine wire metallic brush electrode shall be used with a travel rate of 300mm per second. Equipment shall be earthed as recommended. Contractor's procedures for holiday testing shall include details of calibration techniques. The maximum number of acceptable holidays per field joint or coated item is 4. If two consecutive pipe joints show more than 2 holidays, the cause shall be investigated immediately. If 4 consecutive pipe joints fail, the coating process shall be stopped until the cause is determined. Pipe joints with more than 4 holidays shall be stripped and re-coated. All holidays shall be repaired and re-tested.

8.11 Adhesion Strength

The adhesion of the field joint coating shall be determined using a sharp knife. Two straight incisions shall be made in the coating through to the steel, the FBE or the PE, as appropriate. The incisions shall intersect at an angle of 30° / 150° . The coating shall resist disbondment when attempts are made to lift it from the 30° angle with the point of a sharp knife. Tests shall be carried out at two locations on every ten joints.

9. LOWER & LAY

9.1 General

A line of level is to be run through the minor survey control to third order standards

9.2 Inspection

GOGC and Contractor Inspectors will be present at the Lowering-in of pipe in order to ensure that operations are carried out to the specified requirements. All inspection required by ITP
Lower and Lay will be recorded and records included in "as built" survey

A daily Lower and Lay report will be kept and made available as will a record of the Holiday Detection activities, number of, frequency and severity of repairs, type of repair and location.

10. BACKFILL

10.1 General

No section of the pipeline shall be backfilled without GOGC approval. Any damage to the protective coating and wrapping shall be repaired and let sufficient time to thoroughly cure and rechecked with a holiday detector before allowing the pipeline to be backfilled. If any portion of the pipeline is covered without approval, the pipeline section shall be uncovered for inspection, repaired and/or replaced any damaged or defective work and backfilled again.

After lowering-in has been completed, but before backfilling, the ditch shall again be inspected to ensure that skids, brush, stumps, trees, boulders or debris are not in the trench. No cinders, scrap metal, welding rods, vegetable matter or any other materials potentially harmful to the pipe and coating shall be allowed in the backfill material.

After inspection of the ditch, and approval is obtained from GOGC, pipe shall be immediately backfilled, after being lowered in. The intimate backfill material shall be firmly compacted under and around the pipe to a level at least 200 mm above the pipeline. Where the pipeline is supported above the bottom of the ditch Contractor is to ensure that intimate backfill flows under the pipe and fully supports it along its length. Further layers of final backfill material shall be added not exceeding 300 mm in depth and shall

be compacted using roll compactors or other GOGC approved mechanical means in accordance with industry standard practices. Under no circumstances shall topsoil be used as padding material.

All ditching and backfilling across drainage ditches, irrigation ditches, terraces, private drives, trails or roads, rivers and other streams shall be performed in accordance with the Project Drawings, or as directed by GOGC.

10.2 Erosion Control

Erosion and sedimentation control structures shall be installed in accordance with the Project Drawings and as a minimum shall include installation of ditch breakers.

10.3 Visual Inspection

Immediately prior to commencing padding and backfill activities the GOGC representative and Contractor's QC Inspector shall jointly inspect the trench to ensure no debris has fallen into the trench. Backfilling and Compaction Reports should be done by the Contractor's QC Inspector and one copy of each report should be provided to GOGC.

10.4 Compaction Test

Contractor shall provide certified and properly calibrated Nuclear Gauge for compaction test.

Two tests will be performed at an interval of 200m in each km of pipeline. One test will be performed at the top of the pipeline and another on the undisturbed soil next to the pipeline. Prior to compaction test layer of top soil of test place will be removed. Test depth will be 300mm from the top of the subsoil material.

- If the values reach the required 100% of the undisturbed soil the test section will be accepted
- If the value does not reach required 100%, then 4 more tests will be performed at 10m interval (2 in front and 2 behind the test point)
- If the average value of these 4 tests is equal to or above 100% the section will be accepted
- If the average value does not reach the required 100% of the undisturbed soil contractor will be responsible to take action to remedy the situation

Compaction Test Reports should be done by the Contractor's QC Inspector and one copy of each report should be provided to GOGC.

11. DIRECT CURRENT VOLTAGE GRADIENT (DCVG) SURVEY OF BURIED PIPELINE

11.1 General

Contractor shall provide certified and properly calibrated DCVG technique.

DCVG technique will be used to locate the coating defects on buried pipeline. All defects shall be exposed and repaired.

DCVG survey shall be carried out progressively as pipe laying and backfilling commences along the pipeline route. Process shall be conducted by a qualified DCVG surveyor under GOGC representative's control.

DCVG survey reports should be done by the surveyor and one copy of each report should be provided to GOGC.

12. HYDROTEST

12.1 General

Pipeline cleaning and testing shall be carried out in compliance with this specification and all normative documents currently in force. Process shall be supervised by qualified Test Engineer.

Prior to commencing Cleaning, Gauging and Hydrostatic-Testing contractor shall provide to GOGC for approval all reports of previous activities and package of detailed procedures, method statements and certificates of all using materials for Pipeline Cleaning, Gauging and Hydrostatic-Testing.

12.2 Cleaning

Cleaning of the pipeline is required to remove construction debris, deleterious matter and other foreign objects from the within the pipeline. This is achieved by propelling cleaning pigs through the sections by means of only compressed air. These pigs are fitted with brushes and magnets and drive the debris etc ahead of them, cleaning the pipe.

12.3 Gauging

After the cleaning, gauging will be carried out on the section. Gauging will detect if the pipe is out of round or if there are any dents that may have been caused during construction.

The gauging is achieved by passing pig with aluminium gauging plate through the pipeline section. The gauging plate will have a diameter equivalent to 95% of the minimum internal diameter of the pipeline section.

Gauging plate shall be inspected by contractor's test engineer and GOGC representative.

- If the gauge condition is unacceptable, another cleaning and gauging process shall be performed.
- If gauge condition is unacceptable after the secondary gauging test, contractor shall be responsible to investigate reasons by propelling calliper (geometry) pig through the section, to eliminate reasons and to perform cleaning and gauging process in the same way.

12.4 Hydrotest

Hydrostatic-Testing of pipeline shall be carried out in accordance with this specification and with normative document СНиП III-42-80 currently in force.

Pressure of strength test at II,III and IV category sections shall be $1.1 P_w$ during 24 hours and pressure of hermetic test shall be P_w during 12 hours. Pressure of strength test at lowest point of the pipeline should not exceed P_{max} .

Hydrostatic-Testing on the special crossings must be carried out in accordance with following table.

Section Category	Crossing type	Test Stages	Strength test pressure	Hermetic test pressure	Strength test duration (hour)	Hermetic test duration (hour)
I	Gas main pipeline crossings through water barriers	Stage I – after the welding but before insulation and lowering. (Only sections	P_{max} (at lowest point)	P_w	6	12

		lowered with the help of underwater-technical means)				
		Stage II – after lowering but before backfilling.	$1.25 P_w$	P_w	12	12
		Stage III – simultaneously with adjacent sections of the following categories:				
		I – II	$1.25 P_w$	P_w	24	12
		III – IV	$1.1 P_w$	P_w	24	12
I	Railway and highway crossings, power line.	Stage I – before lowering and backfilling;	P_{max} (at lowest point)	P_w	24	12
		Stage II - simultaneously with adjacent sections of the following categories:				
		I – II	$1.25 P_w$	P_w	24	12
		III – IV	$1.1 P_w$	P_w	24	12
	air crossings with the capacity 500 KV and more					

* P_w -Project determined working pressure; P_{max} -Factory guaranteed test pressure.

12.5 Inspection

GOGC and Contractor QA/QC Inspectors shall be present at the Cleaning, Gauging and Hydrostatic-Testing of the pipeline at all times in order to ensure that operations are carried out to the specified requirements.

Reports should be done by Contractor's QA/QC department and one copy of each report and pressure and temperature alteration diagrams should be provided to GOGC.

13. CATHODIC PROTECTION

13.1 General

Cathodic protection (CP) systems shall be installed for active protection from wandering currents and low resistance soil corrosion of pipeline.

Installation of CP systems shall be carried out in compliance with this specification and the normative documents ГOCT 51164-98, ГOCT 25812-83, ГOCT 16149-70 and ГOCT 9.602-89 currently in force.

Contractor shall provide detailed procedures, method statement, certificates of all using materials and certificates of qualified personnel for GOGC approval prior to the commencement of the work. Process shall be supervised by contractor's qualified CP Engineer.

In order to resist corrosive processes it is necessary to retain high quality coating of the pipeline and its permanent polarization. Polarization shall be achieved by installation of protectors (galvanic anodes). Cables shall be connected to the pipeline using pin brazing machine and connection place shall be coated with appropriate coating material.

All materials used in the installation of CP systems shall comply with the requirements of the approved project materials requisition. Any replacement of materials shall also comply strictly with the original materials requisition, and be subject to the approval of GOGC.

It is considered to arrange five by five control metering units on each of two sections (total – 10 units). The fulfillment of electrochemical protection on these units is identical.

The following activities are considered on each metering unit:

ПМ-20У magnesium protector placement (17);
C3K-30 type control metering unit column (1);
CK3-26-00 type arrangement for the contact of electrochemical protection with the pipeline (1);
BPI type copper 10mm² cross-section isolated wire (77m).
Crystal (germanium) diode (type Б-50-1; one; for the carry out of polarized protector).

Technical characteristics of protector ПМ-20У:

Theoretical power recovery 2200 Ah;
Permanent potential of electrode – 1600 Mv;
Protector is placed in the activator;
The mix is used as an activator: 25% , 25% - alabaster; 50% - bentonitic clay;
The protector is placed in the cotton sack which is wrapped up in the paper sack;
The paper sack is removed from the protector prior to its placement in the ground;
Distance between protectors – 3m;
Distance between protector and pipeline – 8m;
Exploitation period – 5-10 years;
Sizes: length (minimal) – 710mm; diameter - 270±5mm;
Gross (minimal) - 60 kg;

C3K-30 and C3K-26-00 facilities, that are considered under the project, are not produced nowadays.

In case of C3K type control metering unit might be used, for example, СКИП-1 type facility the technical characteristics of which are given in the table.

Parameters	Type	
	СКИП-1	СКИП-2
1. Overall dimensions, mm	2000 (2500)x260x250	H* x260x250
2. Column diameter, mm		
- external	114	159
- internal	107	152
3. gross, kg, no more than	27	33

4. Wire section, mm		
- metering	up to 2,5	up to 10
- power	up to 35	up to 50
5. Quantity of clamps		
- metering	up to 24(2x12)	up to 48 (4x12)
- power	up to 8(2x4)	up to 16 (4x4)
- measuring with power	12+4	24+8

Electrochemical protection pipeline contact facility is simple (with copper angle hole), which is connected to the pipeline with thermit welding. Because of the simplicity and small quantity of facility we may not buy it and resolve the issue on the site.

It is also possible to buy copper wire (approx. 800m) and crystal diode (10 pieces) on the spot.

13.2 Inspection

After a period of polarisation, contractor's CP Engineer with GOGC representative shall measure the potentials at all test points (station), and if necessary take action to obtain the required protection potentials in accordance with normative documents ГOCT 51164-98/ ГOCT 25812-83 currently in force.

Contractor's CP Engineer shall record all measurements and provide to GOGC.

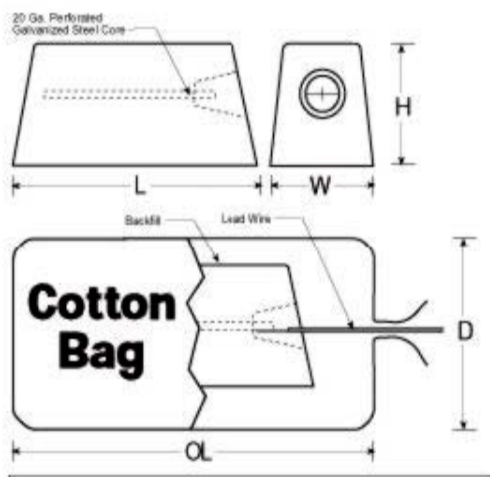
13.3 Magnesium H-1 Soil Anodes

H-1 Alloy, ASTM AZ63 (6% Aluminum, 3% Zinc) cast magnesium alloy sacrificial anodes are available in a variety of sizes and shapes and three quality levels (see chart #1), depending upon the amount of impurities alloyed in prior to casting. H-1 anodes are also available in elongated shapes for greater current output per unit weight.

Anode Size (lbs.)	Weight				Anode Dimensions									
	Bare		Pkgd.		Width (W)		Height (H)		Length (L)		Diameter (D)		Overall Length (OL)	
	Lbs	Kg	Lbs	Kg	in	mm	in	mm	in	mm	in	mm	in	mm
3	3	1.4	8	3.6	3	76	3	76	5.0	127	5.25	133	8.00	203
5	5	2.3	13	5.9	3	76	3	76	8.0	229	5.25	133	11.25	286
9	9	4.1	27	12.2	3	76	3	76	114.0	336	5.225	133	20.00	508
12	12	5.4	32	14.5	4	102	4	102	12.0	305	7.50	191	18.00	457
17	17	7.7	45	29.4	4	102	4	102	17.0	432	7.50	191	24.00	610
32	32	14.5	68	30.8	55	127	5	127	20.5	521	8.50	216	28.00	711
50	50	22.7	100	45.4	7	178	7	178	16.0	406	10.00	254	24.00	610

Other shapes, sizes and weights are available upon request.

Packaged anodes will include chemical backfill in the standard ratio of 75% gypsum, 20% bentonite and 5% sodium sulfate.



Connecting Wire: Stand and 10 feet of #12 AWG Copper Lead Wire/THWN/THNN unless otherwise specified.

Chart #1. Cast Magnesium Alloy Anodes			
	Grade "A"	Grade "B"	Grade "C"
Element	%	%	%
Aluminum	6.7-5.3	6.7-5.0	7.0-5.3
Zinc	2.5-3.5	2.5-3.5	2.0-4.0
Manganese (Min.)	0.15	0.15	0.10
Impurities:			
Iron (Max.)	0.003	0.003	0.003
Nickel (Max.)	0.002	0.003	0.003
Copper (Max.)	0.02	0.05	0.1
Silicone (Max.)	0.10	0.30	0.3
Other (Max.)	0.30	0.30	0.3
Magnesium	Balance	Balance	Balance

Typical Electrochemical Properties

Amps/Hrs./Lb. 500-540
Efficiency 50-54%
Closed Circuit Potential -1.45 to .1.55v
Copper/Copper Sulfate

Open Circuit Potential -1.50 to .1.60v
Copper/Copper Sulfate



13.4 Power Insulating Insert (PII)



Description

Power Insulating Insert – is the pipeline product, produced and tested in the factory conditions, consisting of two metal fittings with the pipeline related characteristics and conjunctive measures connected with each other with the power glass-fibre-reinforced plastic. Hermiticity of insulating insert is reached with the special seal. The inserts are being produced for the pipelines with the conditional diameter up to 1400 mm including for the working pressure up to 10

MPa.

PII are used for ensuring of separation of the object protected with cathodic protection from the unprotected, grounded or having the proper system of electric-chemical protection, and also the electric authorization of pipelines, passing through the zones of impact of roaming current.

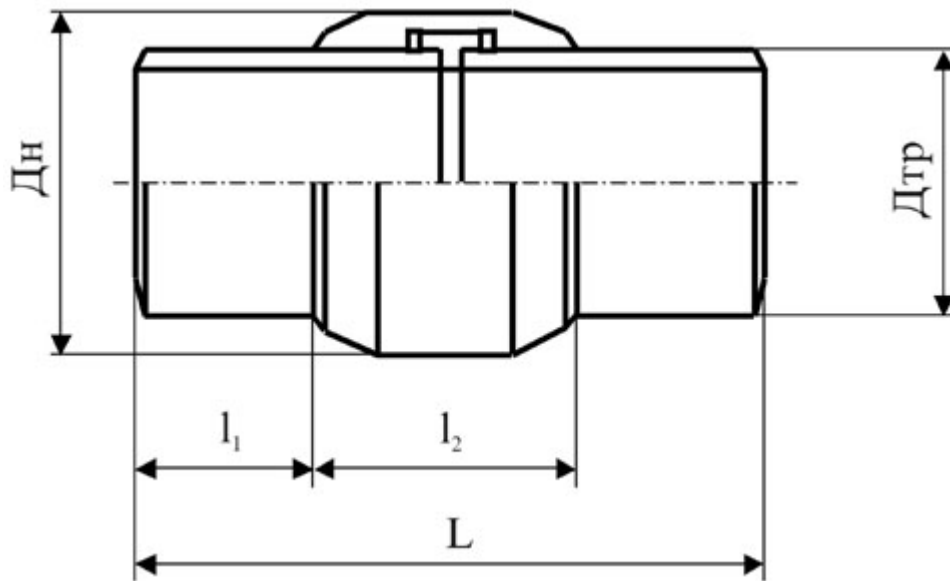
JSC “GASKOMPOZIT” produces PII in accordance with TY 1469-027-05015070-01 “Power Insulating Inserts permanent for pipelines” appendix 1. PII produced according to TY 1469-027-05015070-01 are permitted for the use on the pipelines by the Federal Mining and industrial supervision of Russia, “Permission № PPC 02-4195” of 01.08.01. in condition of observing Russian legislation in the sphere of industry safety.

PII are installed and used on the gas main and field pipelines in accordance with BCH 39-1.22-007-2002 “Guideline for the use of PII for the pipelines”. PII are installed on the least tense sections of the pipeline aboveground, in the mines or ground with the intensive insulation. In case of aboveground installation the attention should be paid to the temperature regime assurance of exploitation (from – 200 to + 450) with the help of special technological means, if it is possible to reduce the pipeline wall temperature below – 200C.

The main overall-large scale characteristics of PII are given below, the parameter designation in accordance to the pic.1.

D, mm	Pp, Мра	Рисп, Мра	Дтр,мм	Дн,мм	L,mm	l ₁ , mm	l ₂ ,mm	m, **kg
200	9,8	14,7	219	300	1000	330	335	63,5
250	9,8	14,7	273	360	800	220	360	77
300	9,8	14,7	325	425	800	370	215	107
350	9,8	14,7	377	485	1000	610	195	220
400	7,4*	11,0	426	515	800	375	213	160
	9,8	14,7	426	515	800	375	213	195
500	7,4*	11,0	530	650	1000	575	213	340
	9,8	14,7	530	660	1000	575	213	349
700	5,4*	8,1	720	860	1200	700	250	510
	7,4	11,0	720	870	1200	700	250	520
	9,8	14,7	720	910	1200	710	245	640
800	5,4*	8,1	820	970	1400	735	333	700
	7,4*	11,0	820	990	1400	735	333	730
	9,8*	14,7	820	1030	1400	980	210	940
1000	5,4*	8,1	1020	1190	1400	740	330	920
	7,4	11,0	1020	1230	1400	930	235	1300
	9,8	14,7	1020	1250	1400	930	235	1560
1200	5,4*	8,1	1220	1420	1500	1000	250	1610
	7,4	11,0	1220	1440	1500	1000	250	1830
	9,8	14,7	1220	1440	1500	1000	250	2120
1400	5,4*	8,1	1420	1630	1500	1030	235	2060
	7,4	11,0	1420	1660	1500	1030	235	2400
	9,8*	14,7	1420	1660	1500	1030	235	2700

- - According to the agreement from the pipeline of customer
** - For the nominal wall thickness of the fittings



Pic. 1 Main overall large-scale characteristics of PII

14. TESTING AND COMMISSIONING

14.1 General

At the end of each construction activity, Performing Companies shall provide to GOGC package of all reports related to this activity. Only after GOGC review and approval of this package the specified construction activity can be considered completed.