



NET4GAS, s.r.o

COMPRESSOR STATION JIRKOV 73 BAR

Coating and Painting - Specification

4.12.2017

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1 GENERAL

1.1 Scope of the Document

This specification covers the surface preparation, method of application and material to be used for all painting and coating work on the equipments, pipes, fittings, valves and vessels in the scope of work Compressor Station Jirkov 73 bar, Custody Metering Facilities HSK, Node Přimda modifications, LVS Mladotice modification and HP pipeline DN 1400 covered in the Project C4G.

Painting of Buildings is not in scope of work of this specification. For painting requirements in relation to buildings, see the building drawings and concerned specifications.

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1.2 Definitions

Term	Explanation
Project	Compressor Station Jirkov 73 bar
Employer	NET4GAS
Consultant	ILF Consulting Engineers
Contractor	The person, firm or company with whom Owner enters into a contract to which this specification applies, including the Contractor's personal representatives, successors and permitted assignees.

1.3 Abbreviations

Term	Explanation
OAR	Occupational Air Requirements
VOC	Volatile Organic Compounds
ITP	Inspection & Test Plan
DFT	Dry film thickness
NDFT	Nominal dry film thickness

PP	Polypropilene
PE	Polyethylene
PUR	Polyurethane
APS	Application procedure specification
PPT	Pre production trial
PQT	Procedure qualification trial
LVS	Line valve station
CS	Compressor stations
BDS	Border transmission station
3LPE	Three layer polyethylene factory coating

1.4 Codes and Standards

No.	Number	Title
1	ČSN EN ISO 12944parts 1-8	Paints and varnishes - Corrosion protection of steel structures by protective paint systems
2	ČSN EN ISO 8501-1	Preparation of steel substrates before application of paints and related products
3	ČSN EN ISO 8503	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates
4	ČSN EN ISO 2409	Paint and Varnishes – Cross cut Test
5	ČSN EN ISO 4624	Paint and Varnishes – Pull off Test for adhesion
6	TP_T01_01_01_03	Principles for the design, construction, reconstruction and repair of pipelines and connections for the HP pipelines up to 100 bar
7	SM_I05_01_01	Environmental protection
8	SM_I05_02_01	Principles of Occupational Health and safety organization
9	T01_06_01_01	DVZ Scope and content of the documentation for selection of Building Contractor
10	TP_T01_01_01_05	Principles of Passive Anti-Corrosion Protection of Gas Equipment

11	TPG 920 21	Corrosion protection of underground steel constructions. Coating systems selection
12	TPG 927 02	Specialized courses. Preparation of persons for obtaining professional qualification for insulation of gas equipment before or after they are buried in ground
13	TPG 927 03	Specialized courses. Preparation of persons to acquiring the technical competence for checking the insulation of the underground gas installations.
14	TPG 920 23	Protection of metallic objects and equipment against atmospheric corrosion
15	ČSN EN 10290	Steel tubes and fittings for onshore and offshore pipelines
16	ČSN EN 12068	Cathodic protection - External organic coatings for the corrosion protection
17	ČSN EN ISO 21809parts 1 and 3	Petroleum and natural gas industries –External coatings for buried or submerged pipelines used in pipeline transportation systems
18	TPG 920 24	Principles of protective coatings spark tests execution with high voltage
19	ČSN EN ISO 16276-1	Corrosion protection of steel structures by protective paint systems - Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating - Part 1: Pull-off testing
20	DVGW GW 340	FZM- Fiber concrete coating for the mechanical protection of steel pipes and fittings with polyolefine coating
21	API RP 5L2	Recommended Practice for Internal Coating of Line Pipe for Non-Corrosive Gas Transmission Service
22	ČSN EN ISO9223	Corrosion of metals and alloys - Corrosivity of atmospheres - Classification, determination and estimation
23	ČSN EN ISO 2081	Metallic and other inorganic coatings - Electroplated coatings of zinc with supplementary treatments on iron or steel
24	ČSN ISO 15726	Metallic and other inorganic coatings - Electrodeposited zinc alloys with nickel, cobalt or iron
25	ČSN EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
26	ČSN ISO 19840	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces

1.5 Conflicting Requirements and Exceptions

Contractor shall notify the Employer of any conflict between this Specification, the related datasheets, the codes and standards and any other specifications included as part of the procurement documentation.

Any exceptions to this specification and referenced documentation shall be raised by the Contractor and require approval of the Employer in writing.

1.6 Site conditions and Basic Design Data

The environmental conditions, operating conditions, medium related data, etc. under which the pipes, fittings, valves, vessels and equipments shall be operated are defined in the document: Geographical, Climatic and Environmental Conditions (C4G-JI73-ILF-KS007-GEN-MAN-901).

According to the ČSN EN ISO 9223 is atmosphere corrosivity of locations Jirkov, HSK, and Přimda classified as **C4**. Other locations are classified as **C3**.

2 CONTRACTOR'S RESPONSIBILITIES

2.1 General

The Contractor is, in addition to his responsibilities as stipulated elsewhere in the contract, responsible for all aspects of ensuring and establishing/demonstrating that the quality of the work being performed is in strict accordance with this specification and all other relevant documents.

The work described shall be performed by the Contractor or his sub-contractor and all tools, equipment, coatings, solvents, etc., necessary to complete the work shall be supplied by him.

The coating sub-contractor shall comply with all applicable laws, regulations, ordinances and requirements of the local administration.

The Employer, his assignees and the Contractor's inspection personnel shall have full access at all times to the work being performed by the sub-contractors.

The coating manufacturer's latest approved published instructions for application and system combinations of coatings shall be followed. Superimposed primers and coatings shall be compatible. In the event of conflicts, differences shall be brought to the Employer's coating specialist for resolution.

For equipment that has received a shop prime/temporary paint, the abrasive blasting to the cleanliness Sa 2 ½ after assembling and a complete painting/coating shall be provided.

Proper precautions shall be taken to protect other surfaces, threads, valve actuators, gauges, and other equipment as well as grass and soil from abrasive blasting, coating over, spray and spatter. Damage to other surfaces, equipment or environment shall be repaired by the field coating and painting Contractor at his expense.

The field coating and painting Contractor(s) shall submit surface preparation and application procedure specifications (APS) for review and acceptance by the Employer. No work can start before APS is being approved by the Employer.

On the very beginning of any coating work the PPT according to the ISO 21809-3 will take place at Contractors' expense. The range of testing (acc to the tab A1 of above mentioned standard) will be approved by Employer on the base of the APS.

Stainless steel, aluminium and other high-alloy materials shall not be painted unless otherwise specified. Under certain conditions, austenitic stainless steels, that are operated between 50°C and 150°C show signs of pitting corrosion or even stress corrosion cracking of weld areas. For this reason the weld areas only will be protected.

2.2 Quality

The Contractor is fully and entirely responsible for quality assurance and quality control. All painting and coating services shall be based on the quality requirements of ISO 9001-9003. The level of quality assurance (QA) shall be indicated in the quality assurance and control documents.

The Contractor shall submit, in detail, proposals for implementing this specification and demonstrate that this plan provides the quality assurance and control as required. The obligations of the Contractor in this respect are explained in more detail in the next chapters of this specification.

2.3 Safety

Contractor shall adhere to local and statutory regulations of the country in which the work is being carried out with respect to personnel safety. Contractor's attention is drawn to the potential fire and explosion hazards which may exist due to presence of solvent vapours or airborne dust, and to the potential dangers to personnel in the vicinity of equipment operating at high nozzle pressures and using materials which may be either toxic or an irritant to skin, eyes or lungs. Furthermore, Contractor shall observe all by company handed over safety documents.

Manufacturer's safety data sheets shall be obtained and displayed on site. Manufacturer's instructions on handling and storage shall always be followed. Flammable products, thinners, etc. are to be stored in accordance with the current applicable statutory regulations and away from any combustible materials.

Before carrying out any work, Contractor shall recognise and evaluate all substances hazardous to health. Proper instruction and on-site training shall be given in the use of hazardous materials and personal protection equipment. In the case of toxic substances medical surveillance shall be required. Contractor shall develop and implement procedures and instruction to maintain safety requirements for the following:

- Handling of materials (inclusive wasted materials)
- Provision of equipment for personal protection
- Filters and breathing apparatus related to type of thinners and paints and the blast cleaning abrasives
- Use of high pressure equipment for the work
- Use of skin irritating chemicals for the work
- Considering technical data and product information given on Safety Data Sheets of painting and coating materials
- Fire and explosion hazards evaluation
- Safety access and proper scaffolding requirements to ensure safe working conditions for the work

2.4 Contractor's management and scheduling of Work

Before any painting or coating work is performed, the Contractor shall provide to Employer management procedures and time schedule as specified below. All specified documents prior to application shall be reviewed and approved by Employer.

- Details of management, inspectors, operators, facilities, equipment, etc.
- Qualified procedures.
- A time schedule for painting that contains as a minimum the way the Contractor is going to handle the ambient conditions during blasting and coating, how to meet the technical condition demands concerning air and steel temperature and relative humidity and which system to be applied where.
- Painting schedule incl. colour code according to the technical conditions.

No steel shall be installed without previous surface preparation, zinc primer application, etc. Special care shall be taken regarding protection of installed equipment in areas where blastcleaning will be detrimental.

If Contractor or sub-contractor will require to use any coatings which Employer doesn't know or has no experience with, then PQT according to the ISO 21803-3 (in the range of the tab A1) shall be provided by Contractor at his expense.

3 PAINTING - ABOVE GROUND INSTALLATIONS

External painting of pipes, valves, flanges, fittings, vessels and equipment shall be required for above ground installation.

Painting work include surface preparation, selection, application, inspection and clean-up of paints.

The pipes, valves, fittings, vessels, flanges and equipment shall be painted with a primer coat in accordance with the manufacturer's standard subject of Employer approval suitable for the operating temperature and for the ambient conditions. The intermediate and top coat shall be provided by the Contractor as field application direct on site.

The aboveground metal pipes and other facilities shall be painted by epoxy zinc-rich primer (Min. 60µm), epoxy micaceous iron middle paint (Min. 120µm) and acrylic polyurethane top coating (Min. 80µm).

Machinery such as compressor, electric motors, instruments, spring hanger, etc. will be completely painted in accordance with the Manufacturer's painting standards – subject of Employer approval.

The final mark up color of the piping, valves, vessels and equipments shall be selected by Contractor in accordance with Employer requirements.

The Contractor shall be responsible for proper handling and storing of the painted materials prior to erection in order to minimize potential damage..

Damaged areas of the complete shop paint systems shall be repaired after erection by the painting Contractor to the satisfaction of Employer.

Only paint and painting materials approved by Employer shall be used. These materials shall be delivered to the job site in sealed and labeled containers. They shall be stored in a location that is protected from the elements, well ventilated, and free from excessive heat, open flame, or other sources of ignition.

Paint materials susceptible to freezing shall be stored in a heated area.

Primers and finish coats for any particular system shall be from the same Manufacturer, whenever possible, to assure compatibility.

Paint shall be thoroughly mixed and thinned in accordance with the Manufacturer's instructions immediately prior to application.

Only thinners of a type recommended by the Manufacturer shall be used.

Contact surfaces of steel parts to be joined by high-tensile bolting in a friction-type joint shall be left unpainted, except for inorganic zinc primers after approval by Employer.

Steel painted in the shop or in the field before erection shall not be painted within 50 mm of the edges to be welded unless otherwise agreed.

The following surfaces shall not be painted:

- Equipment supplied fully painted and approved by Employer (touch up damaged areas only if required).
- Insulation Weatherproofing.
- Cladding materials on insulated surfaces.
- Aluminium, Copper, Brass, Nickel plated, and other Nonferrous Metals.
- Un-insulated Stainless Steels (unless otherwise specified and approved by Employer)
- Equipment supplied with Manufacturer's standard finish coat.
- Plastic Pipes, Fittings and Plastic Coated Materials.
- Machined and Gasket Surfaces.
- Nameplates.
- Metal surfaces embedded in concrete.
- Exposed threads, threaded boltholes and the sealing surfaces of flange faces.
- Flange faces, connecting threads, lifting devices, measuring scales, tagging plates, etc.

3.1 Shop paints

External surfaces of all steel. shop fabricated pipeline facilities intend to aboveground installation shall to be abrasive blasted to remove all iron scales.

3.1.1 Pipes

All external surface of the pipes will be blasted to remove all scales and pipes will be delivered with **no primng/temporary painting**.

3.1.2 Flanges, elbows, bends

Flanges, elbows, bends, supports, flanged necks, etc. shall to be blasted to cleanliness Sa 2 ½ and painted by priming / temporary paint according to the manufacturer's common procedures.

3.1.3 Fasteners

All bolts, nuts, washers, screws etc. shall to be delivered with electroplated coatings according to the ISO 2081 Fe/Zn25/C or ISO 15726 – Fe/ZnNi(10)8/C or any comparable.

3.1.4 Valves, actuators, traps, filters

All ball valves, gate valves, their actuators, scraper traps, filters, insulation couplings etc. will be shop painted with complete paint system according to the following specification:

Surface preparation: Abrasive blasting to the cleanliness Sa 2 ½ according to the ISO 8501-1

Priming coat 2 comp. high-solid Zinc rich epoxy min. 60 µm NDFT

Intermediate coat 2 comp. high-solid epoxy 100 - 120µm NDFT

Top coat 2 comp. PUR 80 – 100 µm NDFT (shade RAL 9006)

Total NDFT is 240 µm for minimum.

Note: All information labels shall to be fitted to the steel body after curing of complete painting system and such a way that no damage of the paint is caused!

3.1.5 Fencing

All fences including poles and extension arms will be protected against corrosion by duplex system - hot dip zinc together with PVC layer. Razor wire shall to be made of hot dip zinc wire and/or hot dip zinc steel plate.

3.2 On site paints

All painting work as well as final paints shall fulfilled requirements of ČSN EN ISO 12944 parts 1-8, manufacturers' instructions, TPG 920 23, Employer's internal document TP_T01_01_01_05 and requirements of this specification. All paints shall to be suitable to durability "H" – high according to the ČSN EN ISO 12944-2.

All the painting shall be provided by the Contractor as field application direct on site.

3.2.1 Surface preparation for painting

Weld spatter shall be removed and sharp or rough welds rounded and contoured. Sharp edges shall be rounded, chamfered or broken.

Surfaces to be painted shall be free of all grease, oil, loose rust, and loose mill scale. Oil and grease shall be removed by solvent cleaning methods.

Surfaces prepared for painting shall be painted in the same day and before any visible rusting occurs.

Where surfaces are blast cleaned, the surface finish immediately prior to painting shall comply to ČSN EN ISO 8501-1 with quality Sa 2 1/2 and have a profile within the range of 50 µm to 70 µm.

Use of quartz sands, abrasives with content SiO₂ higher than 1% and metallic crushed or cut parts is not permitted.

The surface after cleaning shall also be free of mill scale.

Pipes, bends, elbows, supports, neck flanges etc. which are provided by priming or temporary paints as well as all other equipment delivered with no corrosion protection shall to be abrasively blasted to the cleanliness Sa 2 1/2 (Sa 3 if required) according to the ČSN EN ISO 8501-1 just before priming coat application. Dry abrasive blasting shall to be provided with pressure of 7 bar at least and by non-metal sharp-edged grit according to the ISO 11126 N/FE/G 0,25-1,6 or 11126 N/CS/G 0,25-1,6.

3.2.2 Painting system specification

All blasted surface will be covered by the painting system as specified below.

Painting system for the atmosphere corrosivity **C3**:

Surface preparation:	Abrasive blasting to the cleanliness Sa 2 1/2	
Priming coat	2 comp. high-solid Zinc rich epoxy	min. 60 µm NDFT
Intermediate coat	2 comp. high-solid epoxy	120 - 160µm NDFT
Top coat	2 comp. PUR	80 – 100 µm NDFT (shade RAL 9006)

Total NDFT is 270 µm.

Painting system for the atmosphere corrosivity **C4** (CS Jirkov, HSKA, Kateřinský potok and Node Přimda) This painting system will be also used for all other LVS on the pipeline surface where in contact with support:

Surface preparation:	Abrasive blasting to the cleanliness Sa 3	
Underlayer coat	Thermal spraying Zinacor 850	min. 120 µm NDFT
Sealing coat	2 comp. high-solid epoxy	20-40 µm NDFT
Intermediate coat	2 comp. high-solid epoxy	60-100 µm NDFT
Top coat	2 comp. PUR	80 – 100 µm NDFT (shade RAL 9006)

Total NDFT is 300 µm.

Each paint layer shall to have different color shade.

Time gap between blasting and priming coat application should not exceed 4 hours unless otherwise approved by Employer.

All paintings shall to be applied by airless spraying or high pressure air spraying. Roller or brush may only be used in case of inaccessible areas, strip coatings and local repairs. Priming/sealing coat shall not be applied by roller at all.

All edges shall to be both sides painted by "strip paints" at the each layer of the painting system according to the ČSN EN ISO 12944-7.

The above mentioned painting system shall to be applied not only on pipes, bends, flanges, fittings, and other pipeline equipment, but also also on the all supplement technology like, supports, service platforms, cranes, stairs, ladders, railing, hatches, etc. The colour shade of the top coat on these equipent will vary from the pipeline and will be determined in the APS.

3.2.3 Floor grates

Floor grates as well as stair steps shall to be protected by hot dip Zinc only. Hot dip Zinc shall fulfill the requirements of standard ČSN EN ISO1461

3.2.4 Repairs

All coating defects and damages on a valves, scraper traps etc. which were completely shop painted as well as all defects and damages of on-site applied paintings shall to be properly repaired by complete relevant painting system according to the ČSN EN ISO 12944 and TPG 920 23.

3.2.5 Miscellaneous

Safety/warning strips - That's necessary to paint yellow-black safety/warning strips where determined by the project over complete coating. Sometimes it can be on the concrete and other materials too.

All slits which could be detrimental to the corrosion protection shall to be filled by special painting compatible PUR sealant before painting is completed.

All gaps of flanges (flanges with horizontal gaps only) shall to be completely filled by filler Lukopren T1990 after painting system has been completed.

Painting work may be provided only if all weather conditions determined by manufacturer are fulfilled. Usually temperature higher than +5°C, relative humidity of air not higher than 80% and temerature of the substrate more than 3°C above the dewpoint. If there is necessary to work under unfavorable conditions e.g. in the winter to keep time schedule (it's necessary to count on it), conditions shall to be adjusted by suitable precautions e.g. by heated tents etc.

3.3 Field protection and clean-up

The paint applicator shall fully protect all equipment, walls, floors, ceilings and other surfaces from damage and shall provide the necessary drop cloths or other protection required to fully protect all surfaces from dust, paint droppings, paint mist and all other contaminants during the execution of his work.

While painting around switches and controls, painters shall be careful to avoid interference with the switches. It is imperative that all switches remain unmoved and undisturbed by the painters.

All shipping tags, wires, strings and other means of temporary or shipping identification on surfaces to be painted shall be removed, but only after checking with and receiving authorization from the Employer.

Paint applicator shall clean all surfaces, which have been spotted with paint such as window glass, floors, walls, equipment, etc., leaving the premises clean to the satisfaction of Employer.

The paint applicator shall provide a temporary shelter for storage and mixing of paint materials.

The paint applicator shall provide adequate fire fighting assurances-subject of Employer approval, for the temporary shelter and at all locations where painting work is in progress.

4 SOIL - AIR TRANSITION AREAS

The soil - air transition area is understood as an pipeline section which is limited in the ground by the 50 cm soil cover and on the other side at least 30 cm above ground level. These areas shall to be provided by the combined coating system as per Annex 2 TPG 920 23:

- Abrasive blasting up to cleanliness Sa 3 according to the ČSN EN ISO 8501-1
- Thermal sprayed Zinacor 850, thickness of 120 µm
- Solventless PUR - Protegol UR 32-55, minimal thickness of 1500 µm
- PUR top paint of adjacent above ground painting system
- Overlap of the Protegol UR 32-55 over 3LPE factory coating below ground shall to be additionally protected by a coating tape system Serviwrap R30A (at least 15 cm both sides from the 3LPE edge)

5 UNDERGROUND COATINGS

External coating of pipes, fittings and valves is required for below ground installation. If the valves installed in the pit can be painted.

All coating materials shall be properly stored, to prevent damage and deterioration, in a dry warehouse and in accordance with the supplier's recommendations.

Surfaces to be coated shall be clean, dust free and dry before application of any coating and shall meet the specified anchor pattern and surface finish before priming.

No coating shall be applied on damp surfaces, or when the relative humidity exceeds the supplier's written recommendation (normally 80%) or when the temperature of the surface to be coated is less than 3°C above the dew point unless otherwise approved by the Supplier of coating material and the Employer.

Coatings shall not be applied when the ambient temperature is below 10°C without the Employer's written approval. Contractor shall obtain and follow the supplier's recommendations for drying and curing times at all temperatures.

The coating shall be uniform, smooth and free from defects such as runs, sags, pin holing, voids or bubbles

Each coat shall be allowed to dry for at least the minimum time recommended by the material supplier prior to the application of succeeding coats. Maximum over coating times shall not be exceeded

5.1 Shop / factory coatings

The coating system, APS and ITP shall be submitted by Supplier to the Employer for approval.

5.1.1 Pipes – external coatings

All pipes to be buried will be coated by three-layer PE coating (3LPE) in accordance with ČSN EN ISO 21809-1 class B3. Quality assurance will be proved by 3.1 inspection certificates according to the ČSN EN 10 204. The length of the cutbacks is set of 150 ± 10 mm from the welding edge. The coating edge shall to be beveled by the angle of 30° or less (related to pipe axis). The epoxy primer (FBE layer) shall not exceed the edge of the PE coating more than 10 mm. The bare ends of the pipes should be protected with a temporary, easily removable corrosion paint that does not cause welding problems.

In all cases of product pipe thrust boring, controlled boring, HDD, water crossings or steep slopes crossings, etc. the coating will be additionally covered by a shop/factory mechanical protection of FZM-N / S according to DVGW GW 340 or glass reinforced plastics protection e.g. Pau Wrap or similar. The cutback of the mechanical protection shall to be of 350 ± 20 mm.

All casing pipes will be delivered "black" - with no surface treatment.

5.1.2 Pipes – internal lining (pipeline only)

Pipes with internal lining are required for pipeline only. All pipes for piping of line valve stations, border transmission stations, compressor stations, etc. are required with no internal lining.

Internal lining of the pipes is required in accordance to the API RP 5L2.

Surface preparation: Abrasive blasting to Sa 2 ½ according to the ČSN EN ISO 8501-1; surface roughness 30-40 µm.

Lining: Two component epoxy e.g. PIPESTOP 100, COPON EP 2306HF; HEMPEL'S HS GAS PIPE COATING 87633; FLUGAS K 1/SS, or any comparable which is directly manufactured for such a purpose.

Epoxy coating shall to be suitable for a long-term operation in the dry natural gas environment by the temperature range of -20°C to +60°C at 100 bars for maximum, i.e. no melting, blistering, peeling, crumbling, cracking, wrinkling etc. is allowed.

Epoxy coating shall to be applied by full automatic airless spraying device.

Nominal dry film thickness of 70 µm (NDFT) is required.

The internal cutback distance is 50 ±10 mm from welding edge.

The final lining shall to be completely smooth, perfectly adhering, thoroughly cured, free of blisters, cracks, runs and other defects.

5.1.3 Fittings / valves

The bends, elbows, gate valves, ball valves, insulation couplings etc. to be buried shall to be coated by thermoset solventless PUR Protegol UR 32-55 (on an abrasive blasted surface to Sa 2½ pursuant to the ČSN EN ISO 8501-1) according to the ČSN EN 10290 Type 2, thickness class B – 1500 µm for minimum. The cutback distance of fittings / valves is of 160±20 mm from the welding edges. Coating edge shall to be beveled / smoothed.

NOTE: All fittings (especially bends and elbows of DN ≤ 300) where cutbacks represent major part of the fitting external surface will not be shop/factory coated at all. Surface will be just blasted to remove any scales as stated in 5.1.4.

5.1.4 T – pieces,

All T-pieces, TDW fittings, reducers, flanged necks etc. are required with just priming/temporary coating or without coating at all. External surface shall be blasted to re-

move any scales. In case of priming/temporary coating to be used, cutback distance is of 50 mm \pm 10 mm from the welding edges.

5.2 On site coatings

All coating work shall to be carried out in accordance with manufacturer instructions, TPG 920 21, ČSN EN ISO 21809-3, internal document TP_T01_01_01_05 and as APS approved by Employer.

Coating may only be carried out by personnel holding a coating certificate obtained on the basis of a TPG 927 02 examination (or equivalent for foreign workers only).

For coating may only be used such materials that meet safety and reliability requirements. Quality assurance with these requirements shall to be proved by an accredited laboratory according to ČSN EN 12068 or ČSN EN ISO 21809-3. The coating material shall to be approved by the Employer prior to use. In case of request for the use of new (or for Employer unknown) coating systems, the PQT must be performed at the expence of the contractor according to the standard ČSN EN ISO 21809-3 (Table A1).

Painting work may be provided only if all weather conditions determined by manufacturer are fulfilled. Usually temperature higher than +5°C, relative humidity of air not higher than 80% and temerature of the substrate more than 3°C above the dew point. If there is necessary to work under unfavorable conditions (low temperature, rain, snowing, fog...) e.g. in the winter to keep time schedule (it's necessary to count on it), conditions shall to be adjusted by suitable precautions e.g. by heated tents etc.

5.2.1 Surface preparation for coating

Surface preparation before any coating being applied is necessary to provide by abrasive blasting as per paragraph 3.2.1 of this specification.

Where welding operations or additions to the steel surface have taken place, the welds shall be plane and smooth and have a minimum radius of 3 mm. No sharp edges, weld flux, weld spatter, pitting or holes shall be allowed.

Surfaces to be coated shall be free of all grease, oil, dirt, salts or any other contaminants, which could affect the integrity of the applied coating. The cleaning shall be by detergent or solvent cleaning according to methods as outlined in the Employer guideline.

Abrasive blasting is mandatory for all coating systems.

5.2.2 Field joint coatings – pipe to pipe

Field joint area shall to be thoroughly cleaned, degreased, dried and abrasive blasted to the cleanliness of Sa 2 ½ before coating application. Moreover abrasive blasted shall to

be also adjacent 3LPE factory coating to be roughened. The length of roughening is at least 120 mm from the factory coating edge.

For coating of field joints is possible to use one of the (or both) following coating systems:

- a) Three layer heat shrinkable sleeves – defined as “14b” acc to the ISO 21809-3 (e.g. Covalence HTLP 60 or Canusa GTS 65). Sleeves shall to be wide of 50 cm and minimal total thickness of 2,4 mm. **Preheating of the field joint area shall to be provided by induction coils!** The minimal overlap on the adjacent factory 3LPE coating is 50 mm after shrinking. Shrinkable sleeves can not be used on a field joints where PUR coating is at one or both sides of the joint.
- b) Viscoelastic coating systems together with heat shrinkable sleeves – defined as “13b” acc to the ISO 21809-3 (e.g. Stopaq Wrappingband CZH+Stopaq high Imact Shield). Viscoelastic sheets shall to be wide of 30 cm and at least 2,0 mm thick. The required width of the top shrinkable sleeve is 65 cm and minimal thickness is 1,3 mm. Viscoelastic sleeves shall to be installed two side by side with overlapping on the weld seam at each field joint. The minimal overlap on the adjacent factory coating is 80 mm. Overlap of the beginning and end part of each viscoelastic sheet is 100 mm at least.

5.2.3 Field joint coatings – hot bend to hot bend (pipe)

All field joints which connect hot bends, elbows, insulation souplings or any other pipeline facility with shop/factory PUR coating (one side or both sides of the joint) shall to be coated by solventless thermoset hot sprayed PUR coating (e.g. Protegol UR 32-55) according to the EN 10290 Type 2 thickness class B – 1500 µm. Overlap to adjacent factory coating shall to be of 10 cm at least. Connection of hot sprayed PUR coating together with the 3LPE factory coating shall to be additionally protected by wrapping of coating tape system Serviwrap R30A.

Adjacent factory coating to be overlapped by sprayed PUR shall to be roughened by blasting or grinding in the length of 120 mm at least.

It's also possible to use the coating system “b)” according to the paragraph 5.2.2 of this specification, but only in that case, when defined overlap to adjacent coating is possible to fulfill.

5.2.4 Mechanical protection of the coated field joints

Additional mechanical protection of the field joints shall to be provided in the case of connecting pipes with mechanical protection e.g. FZM. The field mechanical protection of field joint coating shall to be adequate to the factory protection (in case of FZM it can be

e.g. Cemtex or Ergelit band). The mechanical protection system shall to be approved by Employer as well as manufacturer of the factory mechanical protection.

5.2.5 Coating of CS, BTS and LVS piping

Additional requirements listed below shall to be fulfilled besides above defined requirements.

Non coated T-pieces, fittings as well as connection of all valves and hot bends together or to straight pipes shall to be coated by solventless thermoset hot sprayed PUR coating (e.g. Protegol UR 32-55) according to the EN 10290 Type 2 thickness class B – 1500 µm. Overlap to adjacent factory coating shall to be of 10 cm at least. Connection of hot sprayed PUR coating together with the 3LPE factory coating shall to be additionally protected by wrapping of coating tape system Serviwrap R30A.

All flanged necks, Underground TDW fittings etc. shall to be also coated by hot sprayed solventless PUR coating according to the above mentioned specification but after blasting before coating all bolts' threads and nuts shall to be protected by suitable measures to prevent of threads glueing.

Field joint coatings of pipe to pipe or pipe to fitting/valves with 3LPE factory coating can be coated by both systems a) or b) as per 5.2.2 as well as by system set in 5.2.3 when all relevant requirements will be fulfilled.

If factory coated pipes are on-site divided, before coating shall to be removed all coating with lose adhesion and renew edge bevel of tightly adhered coating.

In case of laying the underground pipes on the supports then supports shall to be coated also by hot sprayed PUR coating according to the EN 10290 thickness class B and pipeline (fitting) coating shall to be mechanically protected by non shielding protection e.g. Cemtex or Ergelit band.

5.2.6 Coating of cathodic protection cable connections

All local 3LPE coating damages because of cathodic protection cable connections shall to be repaired by special repairing sets consists of:

- Priming epoxy
- Compatible filler
- Hot-applied patch
- Shrinkable tube for wire insulation protecting.

Coating is possible to apply entirely on the abrasive blasted surface to a cleanliness Sa 2½. Blasting of such an area can be provided also by suitable power tools e.g. Bristle blaster.

If cable connection is made where the PUR coating is, reparation of the coating shall to be repaired by the same PUR coating as original or other system approved by manufacturer.

Cable connections of cathodic protection in the shrinkable sleeve area is not permitted.

5.2.7 Miscellaneous

In case of concrete weights to be used on the pipeline additional mechanical protection of the coating is necessary. If pipeline is protected by 3LPE then FZM-N should be used. If not possible coating should be protected by Cemtex or Ergelit band. At some special cases could be also geotextile of total weight at least 2000 g/m² good enough. If pipeline is protected by PUR coating (usually hot bends) only Cemtex or Ergelit band or any adequate tightly adhered non shielding protection si acceptable.

5.2.8 Application of coating on site

The application shall be executed under the provisions of the coating material manufacturer. Generally spraying methods shall be preferred. Brushing or rolling is acceptable only for local repairs or strip coats on inaccessible areas. Compliance with the environmental conditions (surface temperature, ambienttemperature, humidity, dew point) shall be done according to manufacturer specifications, thefollowing guidelines shall apply:

- surface temperature to be 3 C higher than the dew point
- relative humidity < 80 %
- minimum ambient temperature according to manufacturer's specification

5.2.9 Repair of Damaged Coated Surfaces

When the coating is damaged down to the steel and spot cleaning is necessary, these areas shall be cleaned by blasting. After the metal surface has been cleaned, the edge of the surrounding coating shall be feather edged to remove all cracked, loose or damaged coating. Adjacent coating shall to be roughened by blasting or grinding.

Each coating system shall to be repaired by the same coating system if possible. If not, repairing system approved by manufacturer of the original coating shall be used.

All repairs shall to follow the requirements of TPG 920 21 paragraph 6.7.

6 INSPECTION AND TESTING

6.1 General

It is the contractor's responsibility to ensure that monitoring and testing work is carried out to show that the coatings comply with this technical requirements. Employer is obligated to execute any additional tests at random to ensure compliance and the Contractor shall have suitable calibrated test equipment available for Employer disposal.

6.2 Inspection of Prepared Surfaces

All blast cleaned surfaces shall be continuously monitored and visually inspected to ensure conformance to the specified standard of cleanliness immediately prior to application of the first coat. Blast profiles shall be continuously monitored using comparators complying with ČSN EN ISO 8501-1. In addition to visual examination, and except where otherwise specified, random measurements of blast profile shall be made at a minimum frequency of ten (10) per shift per blast cleaning operative per location or one per five (5) square metres, whichever is the less frequent, using relevant tapes. These tape films shall be appended to the coating record sheets to provide a permanent record.

6.3 Visual Inspection of Coated Surfaces

All coated surfaces shall be visually examined after application of each coat for deleterious film defects e.g. blisters, pinholes, dry spray, runs, sagging, wrinkling, etc. Minor drips and runs are acceptable but all other defects shall be repaired.

6.4 Coating Thickness Measurement

Wet film thickness measurements shall be made throughout the course of application of each coat in order to ascertain the adequacy and uniformity of thickness.

Dry film thickness measurements shall be taken covering each coat prior to application of the following coat.

Dry film thickness shall be measured after each coat by the Contractor using equipment as 'Mikrotest', 'Elcometer', or equivalent and accepted by the Employer.

6.5 Additional Tests

Employer reserves the option to require the Contractor to perform such testing of coating materials as may be necessary to prove that the quality is in accordance with the Manufacturer's specifications and data sheets. Such tests shall demonstrate the

products are fully suitable, without reduction in performance or other detrimental effects, for the prevailing application conditions.

Qualities to be tested may include, but not be limited to, the following:

- Volume solids
- Viscosity
- Pigment dispersion
- Adhesion to substrate
- Drying time
- Cure time
- Percentage zinc in the dry film (zinc-rich primers only)

Test methods shall be in accordance with test methods approved by Employer, and shall be carried out under conditions that reflect the typical environmental and application conditions that prevail at the fabrication site location.

Any batch of materials found inferior in any way to the standards and specifications of the manufacturer's approved data sheets shall not be used and Employer will require further testing of materials by the Contractor until confidence in the materials is restored to Employer's satisfaction.

PUR coatings and paintings shall be tested for adequacy of cure. The test method and frequency shall be submitted by Contractor for Employer approval and may involve solvent wiping, pencil hardness testing or other chemical or mechanical methods.

6.6 Inspection and testing of paintings

Inspection and testing of the painting systems shall to be provided according to the Employer's internal document TP_T01_01_01_05 chapter D.5. Painting thickness will be measured by suitable non-destructive gauge by method 80/20 described in chapter 9 of ČSN ISO 19840.

Testing of adhesion will be detected destructively by "Pull of testing" according to the ČSN EN ISO 16276-1 or by "Cross cut test" according to the ČSN EN ISO 2409. The minimal acceptable value of Pull of testing is 4 MPa and the acceptable value of the Cross cut test is "Degree 0" and "Degree 1".

The amount of adhesion destructive testing will be provided according to the ČSN EN ISO 16276-1 or 2 respectively. All areas damaged by destructive testing shall to be thoroughly repaired by complete painting system by Contractor at his expense.

6.7 Inspection and testing of coating

Inspection and testing of the coatings shall to be provided according to the Employer's internal document TP_T01_01_01_05 chapter D.5. Coating thickness will be measured by suitable non-destructive gauge. Evaluation of the values will be provided according to the relevant standards.

Testing of adhesion will be detected destructively by "Pull of testing" according to the ČSN EN ISO 16276-1 in case of PUR coatings. The minimal acceptable value of Pull of testing is 7 MPa according to the EN 10290. The number of adhesion destructive testing will be provided according to the ČSN EN ISO 16276-1 or 2 respectively. All areas damaged by destructive testing shall to be thoroughly repaired by complete painting system by Contractor at his expense.

Adhesion testing of the shrinkable sleeves or viscoelastic coatings will be provided and evaluated by peel strength test according ČSN EN ISO 21809-1. The number of the peel strength tests is established to 2 tests per 100 coated field joints. All areas damaged by destructive testing shall to be thoroughly repaired by approved coating system by Contractor at his expense.

100% of the coated surface shall to be visually checked and holiday tested according to the TPG 920 24. Voltage of holiday testing depends on the coating system and the thickness and is defined by ČSN EN 10290 and ČSN EN ISO 21809-3.

7 REPORT

The Contractor shall prepare a coating report / daily log as specified in this section. The Content of this report to be clarified and agreed prior to starting of work with the Employer. Report shall minimum contain all main information's as:

- Construction location
- Contractor
- Subcontractor (if applicable)
- Testing institute (Third Party)
- Painting system
- Application procedure
- Ambient conditions
- Abrasive material

- Surface cleanliness
- Surface roughness
- Testing devices / equipments
- Layer thickness

Painting report shall be approved by Employer /Employer- Representative prior to start of work.