



NET4GAS, s.r.o

HP PIPELINE DN1400, NODE KATEŘINSKÝ POTOK - NODE PŘIMDA

Piping Installation and Fabrication Specification

23.11.2018

DVZ

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1 GENERAL

1.1 Scope of the Document

This specification defines the technical requirements for the fabrication and installation of the above ground and below ground process piping, auxiliaries and utilities to be constructed in HPPL pipeline. This also includes, but is not limited to valves, fittings, tanks, connections, supports etc.

The fabrication and installation of nonferrous metals and non-metallic piping systems is not scope of this specification.

1.2 Definitions

| Term | Explanation |
|-------------|--|
| Project | HP Pipeline DN 1400 |
| Employer | NET4GAS |
| Consultant | ILF Consulting Engineers |
| Supplier | Means responsible contractor regarding engineering, manufacturing and supplying of total scope as outlined within this specification |
| Third Party | Is the independent, experienced and accredited expert/institute authorised by the responsible government. |

1.3 Conflicting Requirements, Exceptions

The Supplier shall notify the Employer / Consultant of any conflict between this Specification, related datasheets, the Codes and Standard listed in the Par. 2.1 and any other Specifications included as part of the document package.

Resolution and / or interpretation precedence shall be obtained from Employer / Consultant in writing before proceeding with the construction.

1.4 Quality Assurance

Engineering, work preparation piping pre-assembling on site installation and corresponding services shall comply with the quality requirements of ISO 9001 - 9003. The level of quality assurance (QA) shall be indicated in the bid documents.

1.5 Operation and Design Life

All piping systems shall be designed to withstand 25 years life.

1.6 Local and Statutory Requirements

It shall be Supplier's responsibility to familiarize himself with all local and statutory requirements relevant to any aspect of fabrication and installation procedures and standards required for completed assemblies of piping, valves and related equipment.

1.7 Abbreviations

| Term | Explanation |
|------|--|
| CS | Compressor Station |
| ČSN | Czech Standards Institute |
| DN | Diameter Nominal |
| DP | Design Pressure |
| ISO | International Organization for Standardization |
| ITP | Inspection and Test Plan |
| TPG | Technical Regulations - Gas |
| NDT | Non-destructive Testing |
| QA | Quality Assurance |
| MTO | Material Take Off |

2 CODES, STANDARDS AND REFERENCED DOCUMENTS

2.1 Codes and Standards

The services specified herein shall be supplied, installed, and tested in accordance with the latest edition and amendments of the following codes and standards.

It shall be the Supplier responsibility to be or to become knowledgeable of the requirements of the referenced industry codes and standards as stated below, as these codes and standards, to the extent specified herein, form a part of this Specification.

2.1.1 Standards to be used

| | |
|-----------------|--|
| 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 |
| TPG 702 04 | Gas Mains and Service Pipelines of Steel for Maximum Operating Pressure up to 100 bar included |
| SM_I05_02_01 | Principles of Occupational Health and safety organization |
| ČSN EN 1594 | Gas supply systems - Pipelines for maximum operating pressures over 16 bar – Functional requirements |
| ČSN EN 10204 | Metallic products – Types of inspection documents |
| ASME B 16.5 | Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard |
| ASME B 16.47 | Large Diameter Steel Flanges |

2.2 Reference Documents

The following referenced documents shall apply and shall be read in conjunction with this document in the latest revision.

| Document Number | Document Title |
|--------------------------------|--|
| C4G-HPPL-ILF-GENER-LIN-SPC-801 | Welding Specification |
| C4G-HPPL-ILF-GENER-STR-SPC-822 | NDT Specification |
| C4G-HPPL-ILF-GENER-GEN-DAT-820 | Composition of Process Gas |
| C4G-HPPL-ILF-GENER-STR-SPC-800 | Piping Class Specifications |
| C4G-HPPL-ILF-GENER-STR-SPC-802 | Painting and Coating - Specification |
| C4G-HPPL-ILF-GENER-LIN-SPC-803 | Pressure Tests and Stresstests - Specification |

3 PROCESS DATA

3.1 Gas Quality

The pipeline system will transport non-aggressive natural gas as per C4G-HPPL-ILF-GENER-GEN-DAT-820 Composition of Process Gas.

3.2 Design Data

| | | |
|---|---|-----------------|
| Design pressure (DP) | Compressor Station Jirkov | 7.35 MPa |
| | HSK Inlet (from EUGAL) | 10.0 MPa |
| | HSK Outlet (to Kateřinský Potok) | 10.0 MPa |
| | HSK Outlet to DN 900 (I and II) | 10.0 MPa |
| | HSK Outlet to HSK DN 1000 | 10.0 MPa |
| | Safety Interconnection and Kateřinský Potok | 8.5 MPa |
| | HPPL DN 1400 | 8.5 MPa |
| Pressure Rating of Flanges | | ANSI Class 600 |
| Test Pressure (TP) | | TP=1.5 x DP |
| Design temperature | Compressor Station Jirkov | - 20 to + 85 °C |
| | BTS Hora Svaté Kateřiny | - 25 to + 50 °C |
| | HPPL DN 1400 | - 20 to + 50 °C |
| Min. /max. ambient temperature | | - 20 to + 40 °C |
| Relative humidity | | 34 to 100% |
| Safety factor (to yield point) | | 2.15 |
| Safety factor on weld ends (to yield point) | | 1.68 |
| Joint efficiency weld factor | | v = 1.0 |

The particular design parameters depending on locations, are specially stated in the related Project documents.

4 MATERIALS

4.1 Supply

4.1.1 Materials Delivered by Employer

All station piping materials delivered by Employer shall comply with relevant MTO, Datasheets and Project Specifications. Supplier shall be provided with a copy of the associated Manufacturer Certificates, including chemical and mechanical properties for the materials delivered.

Unless otherwise specified, the installation of these materials is part of the Contract.

Upon receipt and after uploading on the site, Supplier shall visual examine all supplied piping materials (pipes, fittings, valves, accessories, supports, etc.). Any discrepancy in the number of delivered goods, their dimensions and/or any visible damage or defect to the goods shall be reported to the Employer / Consultant immediately.

Unacceptable defects and damages which are found on materials shall be declared and rejected. No material shall be used for fabrication and installation without the presence of relevant material certificates on site.

Supplier shall be held responsible for defects or damages to materials which will be detected after delivery on site. Repair or replacement of such defective materials shall be at Supplier's expense.

4.1.2 Materials Delivered by Supplier

Except of materials delivered by Employer all other piping materials, valves and equipment necessary to perform the work, such as cutting, welding assembling, painting, coating, insulation, labelling, testing, drying, etc., shall be delivered by Supplier. These materials shall be new and of approved quality. The supply of these auxiliary materials and equipment shall be done in respect of weldability and chemical and physical properties and shall conform to the applicable Specifications, Codes and Standards and shall be subject for approval by Employer .

4.2 Handling and Storage

Supplier shall ensure that all materials necessary for fulfilling the work (i.e. fabrication, installation, insulation, painting, filling, drying, flushing, testing, etc.) shall be stored in accordance with good practice, on pallets or timber blocking, off the ground and above the level of standing water. Materials shall be protected against harsh weather conditions, e.g. snow, rain, UV-radiation.

Materials shall not be stored near sites of operations such as blast cleaning or painting that might leave undesirable deposits on the materials. All materials for the work shall be stored in areas separate from surplus or scrap materials.

Particular care shall be taken for valves, equipment and machinery which shall be stored in a clean, covered area. Their plug shall be maintained with their original end-plugs on, until the last moment before their installation.

4.3 Identification

Supplier shall ensure that the stencil on the each material Heat / identifying number, grade, DP, manufacturer Nr. etc. of item, is readily accessible throughout the whole fabrication and installation process.

The transfer of markings (i.e after cutting of pipes etc.) which have been originally supplied with a Type 3.2 Inspection Certificate according to CSN EN 10204 shall be performed only by nominated and trained/experienced personnel. The details and approval shall be subject of agreement / approval by Third Party.

5 FABRICATION

5.1 General

Depending on particularities of the on-site situation (accessibility, working space, logistics), Supplier is allowed to pre-fabricate spools and other assemblies in a commercial pipe fabrication shop, or a site fabrication shop. After assembly, these modules shall, if applicable, be pressure tested following the provision of the corresponding Codes and Standards. Upon completion, the tested spools and pipe assembly shall be applied with a suitable coating or paint system and will subsequently be transferred to the site location for final installation.

Supplier shall ensure that all equipment, tools, instruments, etc., necessary for fulfilling the work is available. The equipment shall be in first class operating condition, with written prove thereof and adequately replacement parts (spares and consumables) shall be available, too.

The fabrication shop shall have available suitable ovens for drying and conservation of low-hydrogen electrodes and suitable equipment for preheating, post-heating and stress relieving where and when required.

Supplier's operating personnel shall have received proper training and shall be qualified accordingly.

Before commencing any work, Supplier shall inform about this Employer and the Construction Supervisor in advance.

5.2 Procedures and Qualification

To assure full control of the fabrication process, it is obligatory to use written procedures / method statements for most operations. Therefore, before commencing any work, Supplier shall submit to the Employer procedures / method statements regarding cutting, welding, fabrication, non-destructive examination and hydrostatic testing. All these procedures / method statement are subject of the approval by Employer.

Supplier shall prepare an Inspection and Test plan and obtain Employer approval to ensure that all aspects of work performed comply fully with specified Project requirements.

5.3 Fabrication Tolerances

Supplier shall assure the installation of a system within a reasonable degree of accuracy. Therefore, all the components involved must be fabricated to some set of tolerances on those dimensions which affect the system length.

Tolerances on valves, fittings and flanges are as per applicable Standard in accordance with Piping Class Specifications Doc No. C4G-HPPL-ILF-GENER-STR-SPC-800.

5.4 Fabrication Drawings

Supplier shall prepare fabrication drawings that provide full information and instructions including typical shop details, weld preparation and procedures, etc., needed for that purpose. The drawings shall clearly indicate the spool/assembly number, materials, dimensions, fabrication details, and refer to the applicable Codes, Standards and procedures. The fabrication drawings shall identify all equipment, spools and connecting ancillaries. All drawings, e.g. P&ID's, general arrangements, piping and isometric drawings, used as a reference, shall be indicated in the fabrication / manufacturing drawings.

5.5 Checking

Each of the system components shall also be carefully checked to assure correctness.

Valves and other special items shall be checked to assure they are marked with flow arrows, the hand wheel or actuator are properly oriented and that the material to be welded is compatible with the material of the piping.

Preliminary checking of materials to be welded will indicate the need for alternate welding procedures and prevent problems later.

The location of the work and accessibility to it shall be viewed. A preliminary review check shall be done to identify interfaces with an existing structure, cable trays, ducts or other piping which are not apparent from the drawings.

The location of the terminal points on equipment shall be checked to assure that they are correct.

The type, size, rating or weld preparation of the connections shall be checked to assure that they will match the piping.

Solutions to any problem shall be worked out with the designer before installation commencement.

5.6 Fabrication Practises

5.6.1 Cutting and Bevelling

Cutting of piping may be carried out both by mechanical means and thermal methods.

Mechanical methods include the use of saws, abrasive discs, boring mills, lathes and pipe cutting machines or tools.

Thermal methods for cutting carbon and low alloy steel plate and pipe include electrical arc cutting and oxy-fuel cutting (acetylene, propane or natural gas). In the latter case, cutting is only accepted on non-galvanized carbon steel materials.

For higher alloy materials the plasma arc cutting method shall be used.

After cutting, the transfer of identification markings may be required. The transfer of markings shall be performed only by nominated and trained/experienced personnel. The details and approval may also be subject of agreement / approval by Third Party.

Bevelling of pipe ends for butt welding connection shall be carried out following the provisions of Employer internal standard TP_T01_01_01_03.

5.6.2 Bending

All changing directions of piping shall be carried out using prefabricated (standardised) elbows from stock. On-site bending is not allowed.

5.6.3 Other Forming Operations

Other forming operations such as extruding and swaging are not allowed.

5.6.4 Assembly and Preparation for Welding

In fabrication shops, piping spools shall be assembled on layout tables.

Prior to fit up, it is essential to clean properly the weld surfaces of rust, scale, grease, paint and other foreign substances which might contaminate the weld.

If moisture is present, the weld joint shall be preheated.

Special care shall be taken to remove internal burrs resulting from cutting, especially on pipe equal to or less than 2" in diameter.

Permanently and temporary installed backing rings or strips shall not be used.

Depending on the configuration of the sub-assembly and on the root opening required by the welding procedure, some allowance may be required for weld shrinkage in the longitudinal direction.

5.7 Welding process

Refer to the Project document : Welding Specification C4G-HPPL-ILF-GENER-LIN-SPC-801.

5.8 Installation Works

Works should start with the positioning of the main valves in their final position prior to the start of any welding. This will reveal any large discrepancies which may result from equipment misallocation, fabrication error or tolerance accumulation.

Adjustments or corrections may be decided upon. Adjustment of piping by local heating is prohibited.

A certain number of temporary supports will be needed during the installation. It is not allowed to weld temporary supports to the piping structure.

Where welded attachments to the pipe are involved, it is preferred that they be installed in the shop as part of a spool or module.

Cold spring of piping is not permitted.

Long plane systems can absorb considerable tolerance accumulation without the need to modify any part. Short rigid systems may not be able to accommodate any tolerance accumulation and it may be necessary to rework one or more parts.

The laying depth of the buried pipes will be specified in the project documentation, design drawings but shall generally achieve a pipe cover of less 1.0 m.

Above ground piping shall be supported in accordance with the project requirements.

All special tools necessary to perform the work shall be supplied by the Supplier and shall be new, approved quality and with required certificates.

5.9 Joints

5.9.1 Welded Joints

Because the weld bevel may not be perfectly square with the longitudinal axis of the assembly a deviation of 0,8 mm across the face of the weld bevel can be tolerated in the deviation from the required downstream location. If the gap at the joint is excessive and the downstream location cannot be maintained the joint shall be disassembled and realignment shall take place.

Weld shrinkage of field welds shall be considered for field assembly at closely coupled systems.

The minimum distance between two welds shall be at least 10 times the wall thickness of the pipe or 0.8 times the NPS, whichever is greater. The determined distance shall be measured between the edges of the two weld beads.

Wherever possible, welded joints "fitting to fitting" shall be avoided.

5.9.2 Traceability

Full traceability of any welding work shall be assured. The identification number of the welder for each pass has to be marked on the pipe adjacent to the joint with weatherproof chalk or paint marker. This information shall not be removed until the welds have been visually inspected and non-destructive tested and found acceptable.

A written procedure for weld traceability, along with a sample form of the pipe book/pipe tracking system shall be submitted for approval.

A Pipe & Weld Book shall be maintained, whereby, each pipe and weld shall be uniquely identified to its final position, this includes all works, double joint, mainline, fabrications, crossings, tie-ins, etc.

5.9.3 Flanged Joints

For flanges connection flanges comply to codes ASME B16.5 and B16.47 shall be used.

Gasket surfaces shall be carefully cleaned and inspected prior to installation. The gasket shall be properly centred on the contact surfaces of the flange. No more than one gasket shall be used between contact faces of the flange.

Before bolting up, flange faces shall be aligned to the design plane within 1 mm in 200 mm measured across any diameter. Flange bolt holes shall be aligned within 3 mm maximum offset.

Bolts shall be tightened hand tight where possible. Advantage can be taken of the bolt hole clearances to translate or rotate in the plane of the flanges. In no case shall be rotated perpendicular to the flange face. When the assembly is in its final location, bolts shall be made up wrench tight in a staggered sequence.

The bolt loading shall exert a compressive force of about twice that generated by the internal pressure to compensate not only for internal pressure but for any bending loads which may be imposed on the flange pair during operation.

For a greater safety against leakage, torque wrenches shall be used to load each bolt or stud to some predetermined value. As a guideline for calculation of bolt torque to achieve flange sealing the gasket/bolt manufacturer's recommendations shall be followed. Loading of bolts beyond the yield point is not permitted.

5.10 Pipe and Valve Supports

The foundation for valve support consists of concrete slabs. Construction of these foundation slabs is part of a separate specification.

To minimise the need of temporary supports, permanent and standardised supports shall be installed as the first step for installation of a piping system. These supports shall be placed underneath the valves.

Valve supports consist of anchor plates and shall be designed according to the relevant drawings.

Anchors, line stop and guide supports shall be placed only where indicated on piping plot plans.

Permanent pipe supports consist of sand bedding only.

5.11 Corrosion protection

Refer to the Project document : Painting and Coating - Specification C4G-HPPL-ILF-GENER-STR-SPC-802.

6 INSPECTION AND TESTING

Inspection activities related to installation and fabrication of station piping, valves and related equipment shall be performed by Third Party or other independent inspectors assigned by Employer.

The Third Party inspector shall have access to any place where work concerned with the piping fabrication and/or erection is being performed. This includes manufacture, installation, heat treatment, assembly, erection, examination and testing of the piping. He shall have the right to audit any examination, to inspect the piping using any examination method specified by the engineering design and to review all certifications and records.

6.1 NDT Testing

For the non- destructive inspection and testing of welded joints – refer to Project specification : NDT Specification C4G-HPPL-ILF-GENER-STR-SPC-822.

6.2 Pressure Testing

Prior to initial operation and after completion of the applicable examinations required, each piping system, except for the instrument air tubing, shall be tested to ensure tightness. The activities relating to pressure testing shall comply with Project specification : Pressure Tests and Stresstests – Specification C4G-HPPL-ILF-GENER-LIN-SPC-803

7 DELIVERABLE DOCUMENTS

Supplier shall prepare and submit to Employer technical documents content detailed technical information and data to fabrication, installation and testing of station piping spools, welding, flanged and treaded connection and other operations executed by Supplier. These supplier dossiers shall include, but not be limited to, the following documents:

- Welding Procedures Specifications (WPS)
- Welding Procedures Qualification Records (PQR)
- Welders qualification tests results
- Weld-logbook, giving for each part or component under fabrication:
 - Item number of the piping section containing the weld

- Weld number
- Welder identification
- Date of welding
- Welding procedure used
- Type and date of non-destructive tests
- Inspection results
- Radiographic films (if applicable)
- Date of heat treatment (if applicable)
- Records of heat treatment parameters and heat treatment charts (if applicable)
- Repairs

Additional documentation relating to welding and NDT activities - Refer to the Project documents:

Welding Specification C4G-HPPL-ILF-GENER-LIN-SPC-801

NDT Specification C4G-HPPL-ILF-GENER-STR-SPC-822

Other documents to be prepared by the Supplier:

- Approved fabrication and shop drawings
- Sequence in assembling piping components
- Spool fabrication record
- Pipe stringing list showing all piping components assembled
- Pipe spool fabrication/NDT records
- Daily construction records
- Weekly fabrication status report
- As built isometrics
- Data Book for the supplied material