

Gasunie Technical Standard

Construction Specification Instrumentation

CSM-01-E

Instrument tubing and tube fittings
(installation and testing)

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Intern/Internal

FOREWORD

This specification supersedes the thirteenth version of CSM-01-E.

With respect to the former version the following has been changed:

- Clause 1 is aligned with MSM-01-E.

Alterations are marked with a left margin line.

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1. SCOPE AND APPLICATION

This specification describes the requirements with regard to the mounting and connection of:

- seamless stainless steel precision tubes, including couplings and fittings in both metric and imperial systems;
- instruments, equipment and ancillaries in high-pressure liquid¹ and gas systems in Gasunie plants.

This specification applies to:

- new projects, in which only metric seamless precision tubes and tube fittings shall be used;
- maintenance work, in which both metric and imperial seamless precision tubes and tube fittings may be used.

In addition to table 1 the following media are applicable:

- (demi) water;
- helium;
- THT;
- oils.

1.1 Transport media

Table 1 indicates the transport media for which this specification is applicable.

Table 1: Transport media

Transport medium ¹	Natural gas	Hydrogen	Carbon dioxide	Nitrogen	(Hot) water	Ammonia
	Applicable	Applicable	Applicable	Applicable	Not judged ²	Applicable

1 The table is based on suitability of the transport medium concerned.

The scope and media for which this specification is suitable are not automatically the same as the scope and media of underlying specifications. The scope and suitability for a medium are described for each specification.

2 Suitability shall be determined on the basis of an impact analysis. The requirements that do appear to be applicable shall be observed.

¹ In central heating boiler systems, THT systems and oil systems.

2. REFERENCES

This specification is subject to the requirements of the Gasunie documents stated in this clause.

CSW-53-E	Metallic industrial piping according to NEN-EN 13480.
MSA-24-N	Tag-nummer- en naamplaten (Tag number and name plates).
MSM-01-E	Instrument tubing and tube fittings (material and sizing).

3. DEFINITIONS, ABBREVIATIONS AND SYMBOL

3.1 Definitions

In this specification the following definitions are applicable:

Ancillaries	All small ancillaries and parts required for completion of a machine or installation.
Client	The person or persons who is/are responsible, on behalf of Gasunie, for supervising the fulfilment of the contract in general and the execution of the work in particular.
Equipment	All equipment relating to an installation.
Fittings	Steel fittings and accessories required for connecting instrument tubes together and to equipment and/or ancillaries.
Instrumentation drawing or diagram	A drawing or diagram showing the arrangement, installation, connection and operation of instruments or instrumentation material.
(Pneumatic) instrumentation installations	Installations using instrument tubing (in accordance with MSM-01-E) singly or bundled with other tubing, connecting instruments and other system components.
Prescribed validation	Validation prescribed by the Client in accordance with which the Service Provider can only continue the work, on the relevant subject, following formal "acceptance" by the Client.
Service Provider	The party with whom the contract is or will be concluded.
Transport medium	A gaseous or liquefied substance that is transported by and/or stored in a Gasunie transport network; limited to: – natural gas; – hydrogen; – carbon dioxide; – nitrogen; – (hot) water; – ammonia. Additives and other substances used in the medium or in the processes are therefore expressly outside the scope.
Tube	Seamless steel precision tube with a maximum outside diameter of 25 mm for metric tubes and ¾ inch for imperial tubes.
Validation ²	The alignment of expectations demonstrating that the intended purpose will be achieved within the defined set of requirements with the process and/or product in question.

² A validation is, by definition, initiated by the Service Provider, except for validation prescribed by the Client "prescribed validation".

Verification³ Demonstrating, by means of evidence, that the product or the action corresponds to the requirements set (has the product been made correctly/has the action been carried out correctly).

3.2 Abbreviations

In this specification the following abbreviations are applicable:

PTFE	Poly Tetra Fluor Ethylene
SS	Stainless steel
TDS	Technical Data Sheet

3.3 Symbol

In this specification the following symbol is applicable:

<u>Symbol</u>	<u>Description</u>	<u>Unit</u>
<i>D</i>	Diameter of pipe	mm

³

Verification is initiated and/or carried out by the Service Provider.

4. REQUIREMENTS

The following requirements apply:

- a The requirements given in MSM-01-E shall be used for materials and sizing.
- b Install instrument tubing stress-free.
- c Buckling is prohibited when bending instrument tubes.
- d When assembling 3 mm instrument tubing: Remove coating for at least 10 mm behind the nut.
- e Underground installation: Use 3 mm coated stainless steel (AISI 316) instrument tubing in a soft polyethylene conduit.
- f For instrument tubing passing through walls, floors and/or ceilings:
 - contact between instrument tubes is not allowed;
 - installation shall be watertight, gastight and/or fire-retardant in accordance with the manufacturer's instructions;
 - mark both sides of the tubing where tubing is passing through walls, floors and/or ceilings (according MSA-24-N).
- g Install tubing for instrumentation under slope descending to the process connections.
- h The leak tightness of tubing shall be according to CSW-53-E.
- i Tubes forming part of a hydraulic system:
Flush complete system in accordance with manufacturer's instructions.
- j Use existing supports, walls, columns and other concrete or steel structural elements for supporting instrument tubing.
- k When using clips and/or clamps: maximum distance between attachment points shall be $100 \cdot D$
- l For clips and/or clamps apply:
 - Only single or twin clamps are permitted. Stacking is not permitted.
 - Clips or clamps in underground or conduit applications are not allowed.
 - Material shall be synthetic (brand Stauff).
- m Use fittings for 25 mm instrument tubing instead of bending.
- n Tube fittings:
 - are not allowed in underground installations;
 - shall be visible and accessible for maintenance purposes in aboveground installations.

4.1 Sealing of thread fittings

Install male thread fittings with a thread sealer.

Gasunie uses the following sealing systems as standard:

- liquid thread sealer, straight/tapered thread:
 - Loctite Pipe Sealant 577 (normal cure time).
- Note:
Pipe Sealant 577 is not allowed for use in pure oxygen and/or oxygen-rich systems.
- PTFE thread-sealing tape, NPT thread:
 - tape size: ¼ inch (6,4 mm) for ⅛ inch, ¼ inch and ⅜ inch couplings;
 - tape size: ½ inch (12,7 mm) for ½ inch and up couplings.

PTFE thread-sealing is not allowed for use in oil systems.

Both sealing systems, Loctite Pipe Sealant and PTFE tape, are suitable for ammonia water (25 % ammonia in water).

4.2 Installation and connection of pneumatic instruments and equipment

Requirements for pneumatic instruments and equipment:

- a Install pneumatic instrumentation panels vertically and level according to the construction drawings.
- b Protect installed equipment against damage while other work is in progress in its immediate vicinity.
- c Install instruments incorporating local indicators and operating facilities so that it is clear to which control circuit the instrument belongs.
- d Instruments and ancillaries weighing more than 500 grams shall be supported by racks, concrete foundations or supports; use existing structures.

5. VALIDATION AND VERIFICATION REQUIREMENTS

5.1 Validation

The location determination shall be submitted to the Client for validation if:

- the relevant drawings do not give sufficient information about the exact location of materials and/or equipment;
- thermal expansion and/or contraction is applicable.

5.2 Verification

5.2.1 Pre-commissioning

Requirements for pre-commissioning:

- Demonstrate that personnel are qualified according to clause 6 before pre-commissioning commences;
- Provide the required pre-commissioning forms indicated on the form⁴ "Overzicht pre-commissioning- en daaraan gerelateerde GTS-formulieren" to Client.

5.2.2 General inspection

Demonstrate that:

- all equipment is free of mechanical damage and has been installed in accordance with this specification and provided with the correct identification;
- all instrument tubing has been installed stress-free;
- tubing, with regard to leak tightness, meets the requirements given in CSW-53-E;
- all equipment is externally clean;
- (based on 10 % random checks) the tubes are deburred;
- all covers, doors, bolts, receiving devices, handles, hinges and clamps have been installed and are undamaged in accordance with this specification;
- all parts are undamaged and meet the requirements of this specification;
- unused instrument tubing entries and swivels have been blanked off with suitable plates or plugs;
- when tubes are part of a hydraulic system: complete system has been flushed in accordance with manufacturer's instructions.

5.2.3 Inspection of instrument tubing and equipment

Demonstrate that:

- when assembled in shop:
instrument tubing and equipment is gastight and/or watertight and installed and identified in accordance with the requirements given in this specification;
- contact surfaces are clean and moving parts are free.

⁴

This form will be provided when the order is placed.

6. MINIMUM QUALIFICATION REQUIREMENTS

(The stated requirements apply for the entire contract period)

Fitters working with instrument tubing as described in MSM-01-E shall have a valid certificate of competence.

The companies/institutes in table 2 are approved by Gasunie for training, examinations and issue of certificates and passes.

Table 2: Approved companies and institutes

Company/institute	Material type(s)	Remarks*
Flangeconnect https://www.flangeconnect.com/ ⁵	SS	All makes
Ingenieursburo Gommer B.V. (https://www.gommer.nl/) ⁶	SS	Gyrolok only
Swagelok (nederland.swagelok.com) ⁷	SS	All makes
T.T.C. Trainingen www.ttctrainingen.nl) ⁵	SS	All makes

* Using twin ferrule fittings

The certificate of competence shall contain:

- name (logo) of company/institute;
- surname of holder;
- initials;
- date of birth;
- place and date of issue;
- expiry date;
- type(s) of fittings;
- certificate number.

⁵ Validity period of certificate: 5 years.

⁶ Validity period of certificate: 4 years.

⁷ Validity period of certificate: 3 years.

7. DOCUMENTATION

In this specification the following informational documentation applies:

- 1 N.V. Nederlandse Gasunie, [OSB-06-N](#) "Doorvoeringen".

8. RATIONALE

(This clause is intended for the Client only)

MSM-01-E and this specification shall be consulted:

- to ensure correct connection with equipment and/or ancillaries, and
- when purchasing or installing equipment and/or ancillaries.

All signal, control, transmission and instrument supply tubing and the like shall be laid out in a neat and orderly fashion in accordance with the project-specific instrument hook-up drawings.

Instrument tubing connected to equipment which is subject to thermal movement shall incorporate provision for expansion and/or contraction, to prevent:

- forces in excess of permitted limits being imposed on fixed components causing buckling, and/or
- collapse of the instrument tubing.

Approved manufacturers of watertight, gastight and/or fire-retardant tubing and/or cable entry systems are given in OSB-06-N (see documentation 1).

If tubing and/or cable entry systems with steel frames and infill blocks are used, the Service Provider shall supply the infill blocks and install them in accordance with the manufacturer's instructions.

8.1 Sealing of tube fittings

If the Loctite sealant is used in a particular application, the Technical Data Sheet (TDS) of the Loctite sealant needs to be checked to see whether or not the Loctite is suitable for the application. If the application is not mentioned in the TDS, it is necessary to check with Loctite. This is also applicable for PTFE thread-sealing by Swagelok.

8.2 Installation and connection of pneumatic instruments and equipment

Installation of instruments, equipment and ancillaries on or in the racks, protection panels, supports and similar constructions intended for that purpose is in accordance with the assembly drawings.

Connection of tubing to instruments and ancillaries is in accordance with the project-specific construction and hook-up drawings.

When instruments or equipment to be mounted will be fixed with fasteners to the wall, vibration-resistant manometers may be mounted directly.

8.3 Installation of stainless steel (AISI 316) tube fittings

Installation sequence:

1. Cut the tubing square using a pipe cutter and deburr and clean inside and outside; contaminants shall be removed by blowing through the tubing.
2. Place nut and both front and back ferrule on the tube.
3. Push the tubing into the fitting up to the end-stop.
Tighten the nut by hand until the tube is firmly held and unable to turn.
The use of oil or grease is not allowed.
4. Establish a reference point for wrench tightening by marking both the fitting body and nut.
5. Rotate the nut $1\frac{1}{4}$ turn with an open-ended spanner.
Loosen the nut to make sure that the ferrule is gripping the tubing tightly in the correct place and is unable to move.
6. Push the tubing with ferrule attached into the fitting to the end-stop.
Tighten the nut by hand and rotate $\frac{1}{4}$ turn with an open-ended spanner.
7. Mark the tube at the back of the nut.

Reassemble sequence:

1. Prior to disassembly, mark the tube at the back of the nut; mark a line along the nut and fitting body flats.
2. Insert the tube with pre-swaged ferrules into the fitting until the front ferrule seats against the fitting body.
3. While holding the fitting body steady, rotate the nut with a wrench to the previously pulled-up position, as indicated by marks on the tube and flats. At this point, you will feel a significant increase in resistance. Tighten the nut slightly.