Gasunie Technical Standard

Construction Specification
Instrumentation

CSM-01-E

Instrument tubing and tube fittings
(installation and testing)

External

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N.V. Nederlandse Gasunie

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CSM-01-E

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(installation and testing)

This specification is drawn up by the Gasunie department
"Operations & Projects; Techniek Electro en Instrumentatie".

The specification may be distributed to suppliers and contractors.

Issued by Gasunie department "Document Management".

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FOREWORD

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

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

- subclause 4.1.1 use of single or twin clamps;
- subclause 4.1.4.2 SAIO company removed;
- subclause 5.2 leakage rate.

Alteration is marked with a left margin line.

CSM-01-E sets forth the requirements for installation and testing and MSM-01-E sets forth the requirements for material and sizing.

CONTENTS

1. SCOPE AND APPLICATION

This specification relates to stainless seamless precision tubes, including couplings and fittings in both metric and imperial systems.

This specification relates to the mounting and connection of instruments, equipment, ancillaries and the like in high-pressure liquid 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.

This specification refers to materials which have been standardised within Gasunie. Other makes and/or types are not permitted[1].

[1] Alternatives shall be subjected to the Gasunie product evaluation procedure to demonstrate that they are equivalent (in terms of function and cost).

2. REFERENCES

This specification is subject to the requirements of the Gasunie documents stated in this clause. If the documents in this specification are mentioned with a date, this specific edition is applicable.

CSA-38-E	Safety, health and environmental management at construction sites (bilingual document).
GTS_E-062	Pre-commissioning rapport: Instrument tubing (Pre-commissioning report; Instrument tubing).
GTS_E-065	Pre-commissioning rapport; Lijst beproevingsapparatuur (Pre-commissioning report; Test equipment list).
MSM-01-E	Instrument tubing and tube fittings (material and sizing).
OSB-06-N	Doorvoeringen (Trancits).
NSA-01-N	Pre-commissioning, commissioning en in bedrijf nemen van leidingen en installaties (Pre-commissioning, commissioning and start-up of pipelines and installations).

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.
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.
Tube	Seamless steel precision tube with a maximum outside diameter of 16 mm for metric tubes and ¾ inch for imperial tubes.

3.2 Abbreviations

In this specification the following abbreviations are applicable:

PTFE	Poly Tetra Fluor Ethylene
SS	Stainless steel

3.3 Symbol

In this specification the following symbol is applicable:

Symbol	Description	Unit
D	Diameter of pipe	mm

4. REQUIREMENTS

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.

4.1 Installation

All instrument tubing, tube fittings and instrumentation equipment shall be shown on relevant drawings which include dimensional data. If the relevant drawings do not give sufficient information about the exact location of materials and/or equipment, the exact location shall be determined in consultation with Gasunie management.

The installation instructions issued by the tube fitting supplier shall be complied with, unless stated otherwise in this specification.

4.1.1 Instrument tubing and tube fittings

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.

In case of any chance of liquids in a gas application, instrument tubing shall be installed such that liquid:
- cannot collect, or
- can collect only at points where drain facilities are provided.

Where sagging of the tubing cannot be avoided, drain facilities shall be provided.

Instrument tubing shall be installed stress-free in all circumstances.

Where couplings are established with female and male screw couplings, the fitter shall check the applied thread types (taper or straight).

Instrument tubing connected to equipment which is subject to thermal movement shall incorporate provision for expansion and/or contraction, to prevent:
- the imposition of forces in excess of permitted limits on fixed components and buckling, and/or
- collapse of the instrument tubing.

Instrument tubing shall be installed so as to permit easy dismantling of the installation. Pieces of tubing which cannot be disassembled, shall be prevented.

Where instrument tubing has to be bent, high-quality bending tools (for example of the "Rigid" brand) which are suitable for bending instrument tubing as stated in MSM-01-E shall be used. Great care shall be taken when bending 16 mm instrument tubing in particular, because it is susceptible to buckling.

Existing supports, walls, columns and other concrete or steel structural elements shall be used wherever possible for supporting instrument tubing.

Instrument tubing shall be installed with clips and/or clamps in such a way that no vibration can occur under operating conditions. The maximum distance between clips and/or clamps shall be 100·*D*.

Attention:
In underground or conduit applications no clips or clamps are required.

Only single or twin clamps are permitted. It is not permitted to stack two or more instrument tubes.

Clips and/or clamps and instrument tubing shall be made of the same material or plastic (for example "Stauff" clamps).

Capillary tubing shall be protected and supported over its entire length from sensing point to instrument.

Excess tubing shall be coiled up and secured to the support.

Only 3 mm coated stainless steel (AISI 316) instrument tubing in a soft polyethylene conduit (make and type: Kabuplast-F, including installation parts, DN 50) shall be used for underground installation. All other types of instrument tubing shall be installed above ground, whether protected by plastic conduit or supported by means of clips and/or clamps.

Tube fittings shall **not** be used in underground installations. Tube fittings in aboveground installations shall be visible and accessible under all circumstances. If instrument tubing is conducted through walls, floors and/or ceilings, each single tube (contact between tubes is not allowed) shall be let through provisions for watertight, gastight and/or fire-retardant installation, as specified on the relevant construction drawings.

Approved manufacturers of watertight, gastight and/or fire-retardant tubing and/or cable entry systems are given in OSB-06-N. If tubing and/or cable entry systems with steel frames and infill blocks are used, the contractor shall supply the infill blocks and install them in accordance with the manufacturer's instructions.

4.1.2 Sealing of tube fittings

Male and female tube fittings shall be installed with a thread sealer.
Gasunie has standardised on the following sealing systems:

- liquid thread sealers:
  - Loctite Pipe Sealant 572 (slow cure time);
  - Loctite Pipe Sealant 577 (normal cure time).
    Note: Pipe Sealants 572 and 577 are not allowed for use in pure oxygen and/or oxygen rich systems.
- PTFE thread sealing tape: Strip Teeze by "Crawford Fitting Company" (Swagelok).
  - Tape size: ¼ inch (6,4 mm) for ⅛ inch, ¼ inch and ⅜ inch;
    ½ inch (12,7 mm) for ½ inch and up.

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

4.1.3 Installation of stainless steel (AISI 316) tube fittings

Installation sequence:

1. The tubing is cut square using a pipe cutter and deburred inside and outside.
   After deburring and cleaning, the tubing is blown through to remove any contaminants.
2. The tubing is pushed into the fitting up to the end-stop.
   The nut is tightened by hand until the tube is firmly held and unable to turn. No oil or grease shall be used.
3. The nut is rotated 1¼ turn with an open-ended spanner.
   The nut is loosened and a visual check is made that the ferrule is gripping the tubing tightly in the correct place and is unable to move.
4. After the visual check, the tubing with ferrule attached is pushed into the fitting to the end-stop. The nut is tightened by hand and then rotated ¼ turn with an open-ended spanner.

The reassembly sequence after dismantling is as described in point 4 of this subclause. Reassembly can be done a limited amount of times.

4.1.4 Level of competence required to install tubing and tube fittings

Instrument fitters shall hold a valid certificate of competence for fitting work and shall be capable of:

- accurate reading of instrumentation drawings;
- correct installation of instruments, equipment and ancillaries;
- correct use and installation of fittings.

4.1.4.1 *Competence testing*

Fitters working with instrument tubing as described in MSM-01-E and/or this specification shall be required to pass an examination to demonstrate their competence.

The examination consists of a theoretical test and a practical test. The practical test involves making a piece of work in stainless steel, which is judged according to the following criteria:

- strength;
- tightness;
- stress-free installation.

The company/institute which provides this training issues a certificate and a pass. The certificate of competence states the type(s) of material and type(s) of fitting for which the holder is qualified and the person to whom the certificate is issued.

The certificate of competence contains all the relevant information.

The pass shall contain the following information:
- name (logo) of company/institute;
- surname of holder;
- initials;
- date of birth;
- passport photo;
- place and date of issue;
- expiry date;
- type(s) of material;
- type(s) of fittings;
- certificate number.

The pass issued by the company/institute is valid for about three years depending on the certifying company and make of fitting. Once the pass has expired, re-examination is required. The relevant information of these certificates shall be filled in in the safety passport.

4.1.4.2 Approved companies/institutes

The companies/institutes in table 1 are approved by Gasunie for training, examinations and issue of certificates and passes.

Table 1: Approved companies and institutes

Company/institute	Material type(s)	Remarks
Flangeconnect www.flangeconnect.com	SS	All makes*
Ingenieursburo Gommer B.V. (www.gommer.nl)	SS	Gyrolok only
Swagelok (nederland.swagelok.com)	SS	All makes*

* Using Twin Ferrule Fittings

4.1.5 Installation and connection of pneumatic instruments and equipment

Pneumatic instrumentation panels shall be installed vertical and level in accordance with the construction drawings. Instruments, equipment and ancillaries shall be installed in accordance with the assembly drawings on or in the racks, protection panels, supports and similar constructions intended for that purpose.

Instruments, equipment and operating facilities shall be positioned such that they are easily accessible to operating and maintenance personnel and there is sufficient space for repair and maintenance work. They shall be easily accessible without using a ladder and/or dismantling other elements.

All installed equipment shall be protected against damage while other work is in progress in their immediate vicinity.

Instruments with local read-out shall be positioned such that they can be read from the normal walkways. Instruments incorporating local read-out and operating facilities shall be positioned in such a way that it is clear to which control circuit the instrument belongs. Tubing shall be connected to instruments and ancillaries in accordance with the project specific construction and hook-up drawings.

Instruments or equipment which have/has to be mounted shall be fixed with appropriate fasteners to the wall. Manometers which resist vibrations may be mounted directly.

Instruments shall be installed vibration-free and shall not be fixed to process piping, grid floors and similar constructions. Instruments and ancillaries weighing more than 500 gram shall be suitably supported on racks, concrete foundations or supports. Existing structures shall be used as far as possible.

No welding, drilling or tapping shall be performed on tubing, machines or equipment.

4.1.6 Marking of instrument tubing

All tubing, in both main and special circuits, shall be provided with a durable, visible, legible and indelible cable marker at the connections to panels, pushbuttons, supply points, control devices, instruments, joints and the like, indicating the tube number as stated in the instrument tubing list. Where tubing is passing a wall, both sides of the tubing shall be marked.

5. PRE-COMMISSIONING

It is essential that the personnel is fully acquainted with the equipment used in the installation before pre-commissioning commences. The pre-commissioning shall be performed by qualified personnel. The entire installation, equipment and the tubing system shall be inspected and tested. The various components shall be checked for correct installation. All appropriate safety precautions shall be taken in locations where there is danger of contact with live parts (see CSA-38-E). This responsibility is not restricted to the contractor's own personnel.

Equipment which has become defective as a result of action by the contractor during testing and commissioning shall be replaced and re-installed by the contractor; all additional costs are for account of the contractor. If it is found during testing that any part of the installation does not meet the requirements, Gasunie management shall be informed.

No part of the installation shall be energised or pressurised until all components have been installed, tested and approved.

All instruments used in testing shall be calibrated and suitable for their purpose. The test instruments used shall be stated on form GTS_E-065 or on a contractor's form approved by Gasunie management. A record shall be kept of the inspection of the installation on the forms referred to in this specification or on standard forms used by the contractor or manufacturer which have been approved by Gasunie management. All pre-commissioning documents shall be prepared and submitted to Gasunie management for approval before pre-commissioning commences.

5.1 General inspection

The following checks shall be carried out during pre-commissioning:

- All points where instrument tubing passes through walls, floors and ceilings have been made watertight and/or gastight and/or fire-retardant.
- Gas sealing devices in cable ducts have been installed in accordance with the specification.
- All equipment is free of mechanical damage and has been properly installed, provided with the correct identification and the like.
- All instrument tubing shall be checked on stress free installation.
- All equipment is clean internally and externally and no materials, tools and the like have been left behind.
- All covers, doors, bolts, receiving devices, handles, hinges and clamps are correctly installed and undamaged.
- Instrument glasses and other parts damaged or lost during installation shall be replaced by identical parts (by contractor).
- Unused instrument tubing entries, swivels and the like have been blanked off with suitable plates or plugs.
- Earthing and locking connections are correctly made.
- Tubing is correctly identified, is of the correct size, is installed with effective strain relief and is properly fastened, connections are gastight and insulation, protection is undamaged.
- The following inspection report shall be applied:
  - GTS_E-062.

  Also a supplier's document which is approved by Gasunie may be used.

5.2 Inspection of instrument tubing and equipment

The following checks shall be made on instrument tubing and equipment:

- Instrument tubing and equipment is gastight and/or watertight, properly installed, correctly identified.
- All fastenings, supports, protective boxes, covers, clamps, anchor bolts and the like have been properly installed and nuts, bolts and screws are tight, to ensure that instruments and tubing are not subject to vibration.
- Contacts in instrument switches, vane-and-nozzle systems and the like are correctly fitted and set, contact surfaces are clean and moving parts are free.
- After mounting, tubing and/or parts of tubing have to be blown clean with air and finally checked on correct installation, rigid support and strength.
- After systems are installed and under pressure possible leakages have to be traced as follows:
  - Systems containing natural gas shall be inspected with a ppm-meter. Leakage rates (measurements) shall be reported to Gasunie.
    - Leakage rate for twin ferrule fittings and screwed connections: according NSA-01-N, tubing.
  - Systems containing other gases than natural gas shall be inspected with a suitable leakage detection agent (bubble test).