WATER

TECHNICAL DOCUMENT

CONTROL VALVES AND SAFETY VALVES

Technical document 079-10

Mechanical fittings and seals

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MODIFICATION HISTORY

Revision no.	Application date	Modifications
00	**15/03/2019**	Creation of the document.
01	**27/04/2020**	**Content modifications:** **Part 1 Application rules** – Article 7.1.1 Male end connections – Table 10: it is noted that S1 is a minimum dimension – Article 7.1.2 Female end connections – Table 11: it is noted that S2 is a minimum dimension – Appendix 8, Table 31 page 38: correction: Ep is a minimum dimension and not a maximum dimension.

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PART 1. IMPLEMENTATION RULES AND ADDITIONAL SPECIFICATIONS

Foreword

There are different types of fittings (brass, copper, PVC, PER, etc., quick connect, crimp, threaded or weld fittings, etc.) some of which are the subject of certification.

- “Capillary brazed copper fittings” certification for copper fittings complies with the requirements specified in standard NF EN 1254-1
- “Water distribution or drainage piping” certification for crimped or push-fit fittings for plastic tubing complies with the requirements specified in standard NF EN 1254-3.

However, no certification currently targets brass threaded fittings.

These fittings are widely used in potable water and HVAC systems.

For this reason, the decision was made to establish an addendum to the certification reference system for “Control Valves and Safety Valves” which describes the specifications to which these products must adhere.

Currently, the tests defined in this document cover:

- straight fittings
- vulcanised fibre seals, elastomer synthetic fibre seals and elastomer seals

The assessment of elbow fittings will be defined later or upon an initial admission request.

Purpose

The purpose of this document is to specify the requirements (general, dimensional and mechanical) for brass fittings and for seals.

It recommends products to use to ensure leaktightness of threaded assemblies of piping elements, either in connection with each other or in connection with network components.

The weldable ends of fittings must comply with relevant standards and certification marks where applicable.

1 Field of application

This document applies:

a) to fittings:
- made of copper alloy;
- with connection threading from 1/8 to 2.

b) to seals:
- made of vulcanised fibre (VFS), synthetic elastomer fibre (SEFS) and elastomer (ES);
- from DN8 to DN50.

used in:
- hot and cold domestic water distribution systems;
- HVAC systems where the heat transfer fluid circulates at a temperature between -5°C and 110°C;
- with a nominal pressure of PN10.

This document applies to products installed after the meter.

2 Normative references

The following reference documents are essential for the application of this document.

NF EN 12164:2016	Copper and copper alloys – Rod for free machining purposes
NF EN 12165: 2016	Copper and copper alloys – Wrought and unwrought forging stock
NF EN 1982:2017	Copper and copper alloys – Ingots and castings
NF EN 1254-1:1998	Copper and copper alloys – Plumbing fittings – Part 1: fittings with ends for capillary soldering or capillary brazing to copper tubes
NF EN 1254-3:1998	Copper and copper alloys - Plumbing fittings - Part 3: Fittings with compression ends for use with plastic pipes
NF EN ISO 228-1: 2003	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation
NF EN ISO 228-2: 2003	Pipe threads where pressure-tight joints are not made on the threads - Part 2: Verification by means of limit gauges
EN ISO 6509-1: 2014	Corrosion of metals and alloys - Determination of dezincification resistance of copper alloys with zinc - Part 1: Test method
NF EN ISO 9227: 2017	Corrosion tests in artificial atmospheres – Salt spray tests

3 Terms and definitions

3.1 Fitting

Connecting part consisting of one or more elements used in fluid conveyance systems to connect tubes and components.

3.1.1 Threaded fitting

Fitting with two threaded ends.

3.1.2 Mixed fitting

Fitting with one threaded end (male or female) and one end to be connected by a method not covered in this document.

3.2 Fitting family

The different families of fittings are defined below.

3.2.1 Nipple

Straight fitting with two male ends (MM) or one male end and one female end with identical diameters (MF).

3.2.2 Sleeve

A fitting with two female ends with identical diameters (FF).

3.2.3 Reducer fitting

Fitting with two ends of different diameters (MM reduced, MF reduced or FM reduced).

Also called reducing nipple or reducing sleeve.

3.2.4 Plug or Cap

M (Plug) or F (Cap) stopper element without opening.

3.2.5 Elbow

Connecting element with a bend at an angle that allows for a change in direction (FF or MM or MF).

3.2.6 Tee

Connecting element with three ends in the form of a T, allowing for a branch in piping (MMM or FFF).

3.2.7 Cross

Connecting element with four ends, in the shape of a cross, allowing for a double branching (MMMM).

3.2.8 Union

3.2.8.1.1 Socket/nut

Connecting element with one end connected using capillary brazing or braze welding and the other comprising a captive nut.

3.2.8.1.2 2-part or 3-part union

Straight or elbow connecting element consisting of several elements that can be disassembled.

3.2.9 Extension

Connecting element to offset the connection (MM or MF).

3.2.10 Face bushing

Connecting element with male and female threading along the entire outside and inside length, with (interior hex) stop or without stop (FF).

The list of types of fitting covered by this document is provided in Table 1 through Table 7.

Table 1: Nipple family

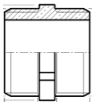
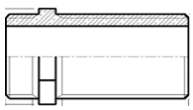
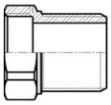
Family	Type	Reference	Figure	Table
Nipple	MM	280		Table 10
	MM long	280L		Table 10
	MF	246		Table 10 Table 11
	MF long	246L		Table 10 Table 11

Table 2: Sleeve family

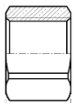
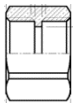
Family	Type	Reference	Figure	Table
Sleeve	FF without stop	270		Table 11 Table 26
	FF with stop	270B		Table 11 Table 26

Table 3: Reducer family

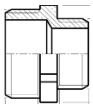
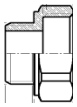
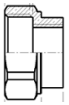
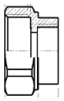
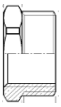
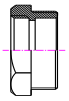
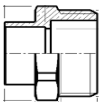
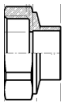
Family	Type	Reference	Figure	Table
Reducer fitting	MM	245		Table 10
	MF – male reduced	246R		Table 10 Table 11
	FF without stop	240		Table 11
	FF with stop	240B		Table 11
	MF – exterior hex – without stop	241		Table 10 Table 11
	MF – female reduced	243		Table 10 Table 11
	MF – female reduced with stop	243B		Table 10 Table 11 Table 24
	Welded – male	243 GCU*		Table 10 NF EN 1254-1
	Welded – female	270 GCU*		Table 11 Table NF EN 1254-1

Table 4: "Others" family

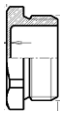
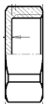
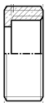
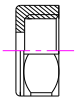
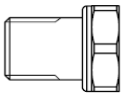
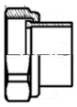
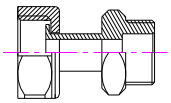
Family	Type	Reference	Figure	Table
Plug or Cap	Male	292		Table 10 Table 24
	Female – exterior hex	300		Table 11 Table 25
Face bushing	Interior hex	199		Table 10 Table 11 Table 27
Flat flared nut	/	374		Table
Extension	/	446		Table 10 Table 11 Table
Socket	Threaded	359		Table 10 for cylindrical profile, NF EN 10226-1 for conical profile Table Table
	Welded	359GCU		Table 11 Table NF EN 1254-1
Ring fitting	With captive nut	359 EP		Table 10 Table 11 Table

Table 5: Union family

Family	Type	Reference	Figure	Table
Welded spheroconical	Male	341 GCU	/	Table 10 Table Table NF EN 1254-1
	Female	340 GCU	/	Table Table NF EN 1254-1
	/	340 CU	/	Table Table NF EN 1254-1
Welded flat seal	Male	331 GCU (280+359 CGU)	/	Table 10 Table NF EN 1254-1
	Female	330 GCU (246E+359 CGU)	/	Table 10 Table 11 Table NF EN 1254-1

Table 6: Elbow family

Family	Type	Reference	Figure	Table
Elbow	MM	94	/	Table 10
	FF	90	/	Table 11
	Welded – female	90 GCU	/	Table 11 NF EN 1254-1
	Equal MF	92	/	Table 10 Table 11
	MF – male reduced	92R	/	Table 10 Table 11
	Welded – male	92 GCU	/	Table 10 NF EN 1254-1
	MF union	98	/	Table 10 Table 11
	Welded union – male	98 GCU	/	Table 10 NF EN 1254-1
	Welded union – female	96 GCU	/	Table 11 NF EN 1254-1
	Welded union	96 CU	/	Table 10 NF EN 1254-1

Table 7: Tee and cross family

Family	Type	Reference	Figure	Table
Tee	Male	135	/	Table 10
	Female	130	/	Table 11
	Welded female – Threaded female – Welded female	130 GCU	/	Table 11 NF EN 1254-1
Cross	Male	185	/	Table 10
	Female	180	/	Table 11
	Welded female	180 GCU	/	NF EN 1254-1

4 Designation

The designation of a fitting and a seal consists of the elements specified in Table 8.

Table 8: Designation components

Product / Component	Threaded fitting	Mixed fitting	Seal
Family and type	X	X	NA
Reference	X	X	NA
Materials	X	X	X
Thread designation	X	X	NA
Offset length (*)	X	NA	NA
Nominal diameter (DN)	/	X (DN of copper tube)	X
Maximum operating temperature (MOT)	/	NA	X
Certification logo	X	X	X

NA: Not Applicable

(*) if applicable

Minimum designation.

EXAMPLE 1: Threaded fitting

MM nipple, 245, brass, G 1/2 B, NF

MM nipple, 246R, brass, G 1/2 B-G 3/4 B, NF

Long MM nipple, 280L, brass, G½B, 40 mm, NF

EXAMPLE 2: Mixed fitting

Male welded nipple, 243 GCU, brass, G 1/2 B, DN12, NF

EXAMPLE 3: Seal

DN15, Elastomer, Maximum Operating Temperature (MOT) 110°C, NF

5 Materials

Materials in contact with potable water must comply with regulations: see Article 2.1 of the certification reference system for “Control Valves and Safety Valves” (ACS).

The use of materials other than those mentioned below will need to be justified in a technical file, and the file is to be submitted for review to the Specific Committee for the “Control Valves and Safety Valves” certification.

5.1 Materials for the fittings

The materials must be manufactured from alloys defined in Table 9:

Table 9: List of alloys to use depending on the production method

Production method	Alloy	Number	Normative Reference
hot die formed parts	all	all	NF EN 12165
	Copper-Zinc-Lead	CW617N CW602N*	
cast parts	Copper-Zinc (Brass)	CC754S or CB754S CB752S (*) or CC752S (*)	NF EN 1982
	Copper-Tin-Lead (Bronze)	CB499K or CC499K	
lathe-turned parts	Copper-Zinc-Lead	CW614N CW617N CW602N* CW603	NF EN 12164 (solid rod) NF EN 12168 (hollow rod)

(*) Dezincification-resistant copper alloys

NOTE:

The alloys referenced in the “4 MS” list are also authorised.

4 MS stands for 4 Member States. Declaration of intent signed in December 2010 by the competent authorities of each of the 4 MS

www.sante.gouv.fr/IMG/pdf/4MS_Declaration_of_Intent_signedVF-4MS.pdf.

5.1.1 Dezincification resistance of copper alloy

NOTE:

This article only applies for use of copper alloy resistant to dezincification.

5.1.1.1 Test method

The test is carried out as described in the NF EN ISO 6509 standard.

5.1.1.2 Requirement

The depth of dezincification in all directions must be inferior to 200 µm.

5.1.2 Type of coatings

It is strongly recommended not to use “decorative” plating for this kind of product. Only Nickel-Chrome plating is permitted.

5.2 Materials for seals

Seals must be made of:

- vulcanised fibre, MOT 70°C;
- synthetic-elastomer fibre, MOT 110°C;
- elastomer with S IRHD hardness between 65 and 95 (or SHORE hardness between 62 and 92), MOT 110°C.

NOTE:

Elastomer seals must comply with the NF EN 681-1 standard, and they must be of type WB (110°C).

5.2.1 Characteristics of the elastomer

5.2.1.1 Test method

The tests to be carried out are the following:

a) Tensile force on specimens/panels to determine

- elongation to break;
- tensile strength at failure;
- the seals (EFS, ES) must be compatible with water treated to disinfect systems with sodium hypochlorite

b) On the finished product

- IRHD or SHORE hardness (IRHD hardness = SHORE hardness + 3 pts)
- Compression set

5.2.1.2 Requirement

See Table 3 of the NF EN 681-1 standard for hardness classes 70, 80 and 90 and for elongation to break.

5.2.2 Compatibility with products used for system disinfection

This test applies to elastomer fibre seals (EFS) and elastomer seals (ES).

5.2.2.1 Principle

The seals, like all the other devices, must be compatible with water treated to disinfect systems with sodium hypochlorite.

5.2.2.2 Test method

Prepare an assembly (fitting + seal) by applying the torque defined in Table 13, and for 24 hours, keep the internal parts of the assembly in contact with a solution containing 0.10 g of sodium hypochlorite per litre of “Quality 3” water at a pressure of (3 ± 1) bar.

NOTE:

“Quality 3” water is defined as water that is appropriate for the preparation of solutions and for most chemical applications. It must be produced by single distillation, demineralisation or reverse osmosis.

5.2.2.3 Requirement

- No leak shall be detected during the test.
- No visible deterioration of the material shall be observed after disassembly. It is permissible for the seal to show marks from assembly.

6 Design characteristics

6.1 Surface condition

Surfaces must be free of defects that could negatively affect use and must not show any burring.

The assessment is carried out through a visual examination.

6.2 Thread profile

Thread profiles shall comply with Standards NF EN ISO 228-1 and NF EN 10226-1.

6.3 Tightening system

Flat spots must have dimensions capable of transmitting the tightening torque defined in the mechanical tests.

7 Dimensional characteristics

Dimensions are verified using specialised tools (ring gauge with no chamfer).

7.1 Dimensions of the fittings

NOTE:

For the purposes of this document, the terminology defined below applies.

These definitions will be used in all technical documents for certification reference systems for the dimensional characteristics of end connections.

A1: designation of male thread dimensions
A2: designation of female thread dimensions
E: entry chamfer
R: Incomplete thread
Ep: wall thickness
Ec: collar thickness
P: seal surface
S: across flats dimension or hexagon dimension
W: width of flat section or hexagon height
Z: clearance dimension
B: male thread length
F: depth of female thread

For end connections with threading that complies with the NF EN ISO 228 standard, the dimensions shall comply with the requirements in Table 10 for the male part and with those in Table 11 for the female part.

For the other dimensions specific to each type of fitting and for threads where pressure-tight joints are made on the threads (NF EN 10226-1), refer to Part 2 of this document.

7.1.1 Male end connections

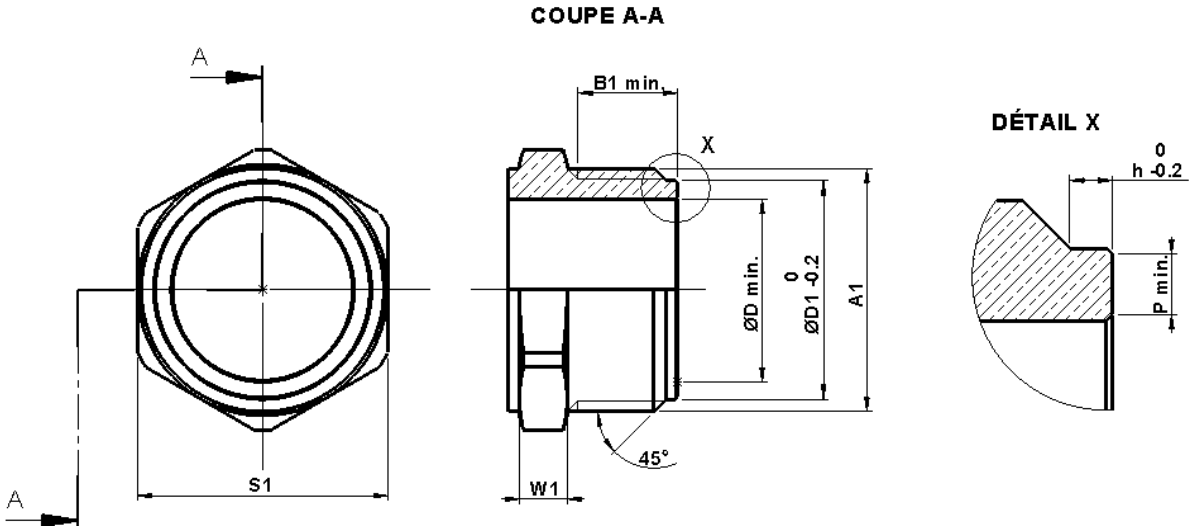


Figure 1: Male end connection

NOTE:

The "h" profile is not required.

Table 10: Dimensions of male connection (mm)

A1	h (-0.2/0)	B1 min.	ØD min.	ØD1 (-0.2/0)	P min.	S1 (*) (h13)	W1 min.
G 1/8 B	0.2	4.5	5	8.35	1.0	11	4
G 1/4 B	0.2	6.0	8	11.2	1.0	13	4
G 3/8 B	0.2	7.0	10	14.7	1.5	17	4
G 1/2 B	0.7	8.7	14	18.35	1.7	21 (-0.33/+0.2)	5
G 3/4 B	0.7	9.0	19	23.83	2.0	27	5
G 1 B	1.2	11.2	24.5	29.93	2.2	34	6
G1 1/4 B	1.2	12.0	32	38.59	2.5	42 (-0.39/+0.2)	7
G1 1/2 B	1.2	13.5	38.5	44.49	2.5	48 (-0.39/+0.2)	7
G 2 B	1.2	15.0	49	56.3	3.0	60 (-0.46/+0.2)	9

(*): S1 is a minimum nominal dimension which shall comply with tolerance h13, except for certain thread dimensions for which a tolerance is accepted as indicated in the table above.

NOTE:

The B1 min dimension includes the h dimension.

7.1.2 Female end connections

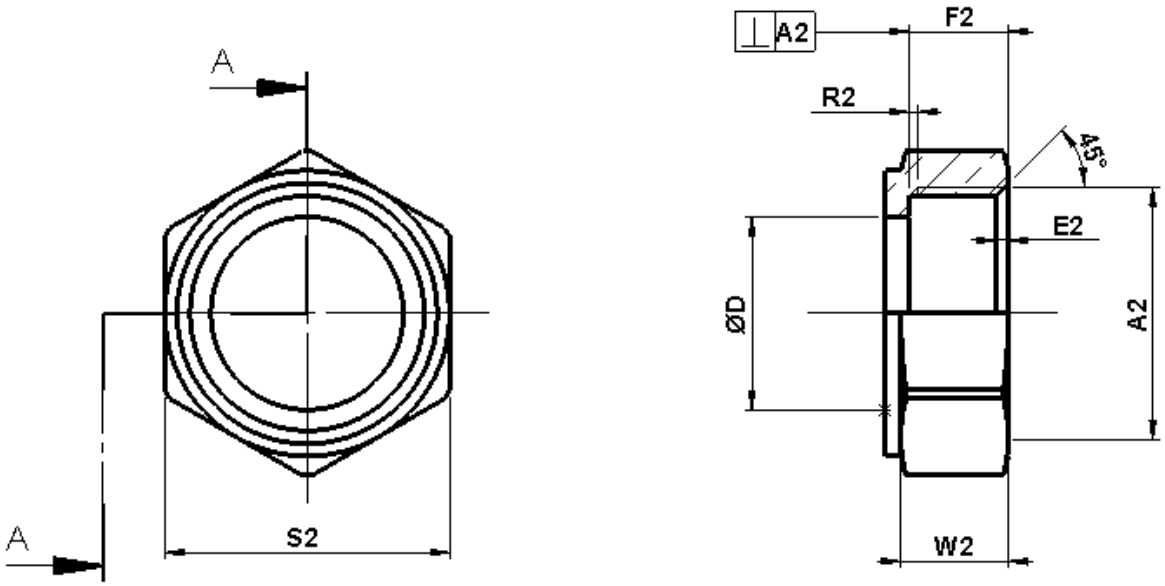


Figure 2: Female end connection

Table 11: Dimensions of female connection (mm)

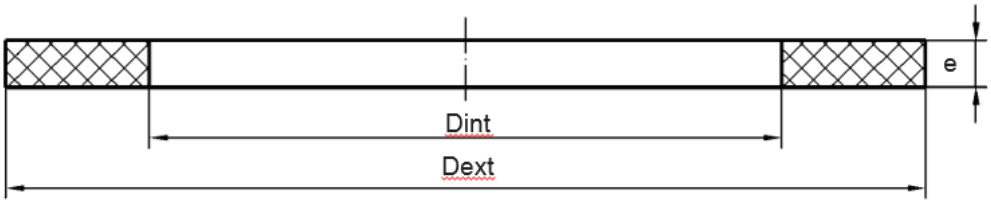
A2	F2 (0/-0.2)	R2 max.	ØD	E2 (0/+0.3)	S2 (*) (h13)	W2 min.
G 1/8	5.4	0.9	5 (+0.3/0)	0.6	13	5
G 1/4	7.3	1.3	8 (+0.2/0)	0.9	16	5
G 3/8	8.3	1.3	10 (+0.8/0)	0.9	19 or 20	5
G 1/2	10.0	1.8	14 (+0.3/0)	1.2	24	7
G 3/4	10.3	1.8	19 (+0.2/0)	1.2	30	7
G 1	12.5	2.3	24.5 (+0.2/0)	1.5	36 (-0.39/+0.2)	7
G1 1/4	13.3	2.3	32 (+0.7/0)	1.5	46 (-0.39/+0.2)	8
G1 1/2	14.8	2.3	38.5 (+0.3/0)	1.5	52 (-0.39/+0.2)	10
G 2	16.3	2.3	49 (+0.4/0)	1.5	65 (-0.46/+0.2)	10

(*): S2 is a minimum nominal dimension which shall comply with tolerance h13, except for certain female threads for which a tolerance is accepted as indicated in the table above.

NOTE 1: Dimensions R2 and E2 are given for information purposes.

NOTE 2: Tables 10 and 11 give the dimensions of the fittings' male end and female end. As regards certain families and types of fittings (for instance the "reducer fittings" family), some dimensions in the tables above are not compatible. The geometry of the fitting will impose the dimension to be respected.

7.2 Seal dimensions



Dext: External diameter
Dint: Internal diameter
th: Thickness
C: Concentricity

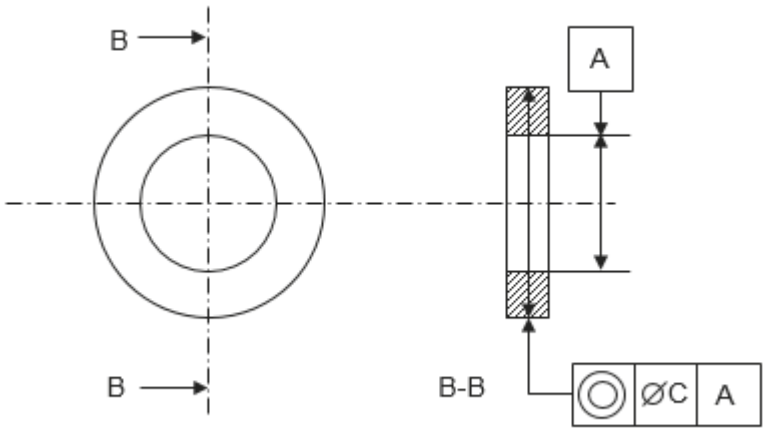


Figure 3: Flat seal

Table 12: Dimensions of flat seals

Nominal diameter (DN)	Dext	Dint VFS-SEFS	Dint ES	th VFS (±0.1)	th SEFS (±0.2)	th ES (±0.3)	Cmax mm
DN8	11.3 (+0.5/0)	7 ± 0.2	7 ± 0.25	1.5	2	2	0.2
DN10	14.3 (+0.5/0)	9 ± 0.2	9 ± 0.25	1.5	2	2	0.2
DN15	18 (-0.1/+0.5)	13 ± 0.2	13 ± 0.25	1.5	2	2	0.2
DN20	23.6 (+0.5/0)	18 ± 0.3	18 ± 0.4	1.5	2	2	0.2
DN25	29.7 (+0.5/0)	23 ± 0.3	23 ± 0.4	1.5	2	2	0.2
DN32	38.2 ± 0.5	30 ± 0.3	30 ± 0.4	1.5	2	2	0.2
DN40	44.2 (+0.5/0)	38.5 ± 0.5	38.5 ± 0.5	1.5	2	2	0.3
DN50	55.6 ±0.8	45 ± 0.5	45 ± 0.5	1.5	2	2	0.3

th: thickness in millimetres
Dext: External diameter
Dint: Internal diameter in millimetres
VFS: Vulcanised fibre seal
SEFS: Synthetic-elastomer fibre seal
ES: Elastomer seal

8 Requirements and tests

The seals must be stored at a temperature between 10 and 35°C and away from UV rays.

Before testing, they must be packaged:

- at a temperature between 15 and 25 °C
- with a relative humidity between 50 and 70%.

8.1 Seal tightening torque

The recommended tightening torque values where seal compression is optimal without deterioration of the seal are specified in Table 13.

Table 13: Recommended tightening torque for seals (Nm)

Nominal diameter (DN)	VFS	SEFS	ES
DN8	5	3	3
DN10	15	7	7
DN15	25	10	10
DN20	35	25	25
DN25	45	25	25
DN32	60	40	40
DN40	70	40	40
DN50	100	50	50

8.2 Mechanical characteristics of the fittings

The tests are defined in Table 14. They are performed on 3 new samples.

Table 14: Mechanical tests on fittings

Test	Threaded fitting	Mixed fitting
8.2.1 Torque/bending strength	X	X
8.2.2 Tensile strength	X	not applicable
8.2.3 Resistance to cracking under stress in an ammoniated environment	X	X

8.2.1 Torque/bending strength

The bending test is performed after the torque test.

8.2.1.1 Principle

The test consists of determining the mechanical strength of the fitting under different stresses.

It is broken down into 3 steps:

- Step 1: Mechanical strength of flat spots
- Step 2: Mechanical strength under torque
- Step 3: Mechanical strength under bending

Table 15: Torque strength of fittings

Thread designation	Strength of flat spots under a maximum mounting torque of (-10/0)%	Torque (Nm)	Bending moment (*)
G 1/8	10	15	30
G 1/4	15	20	30
G 3/8	30	35	40
G 1/2	50	75	80
G 3/4	70	100	150
G 1	90	125	300
G1 1/4	110	160	400
G1 1/2	120	200	500
G 2	150	250	600

(*): The calculation of the force to be applied must take into account the pipework and the accessories required by the test apparatus.

8.2.1.2 Test method

- Connect the fittings as indicated on the different diagrams of Figure 4, with standardised open-ended spanners;
- Mount the assembly on the test apparatus.

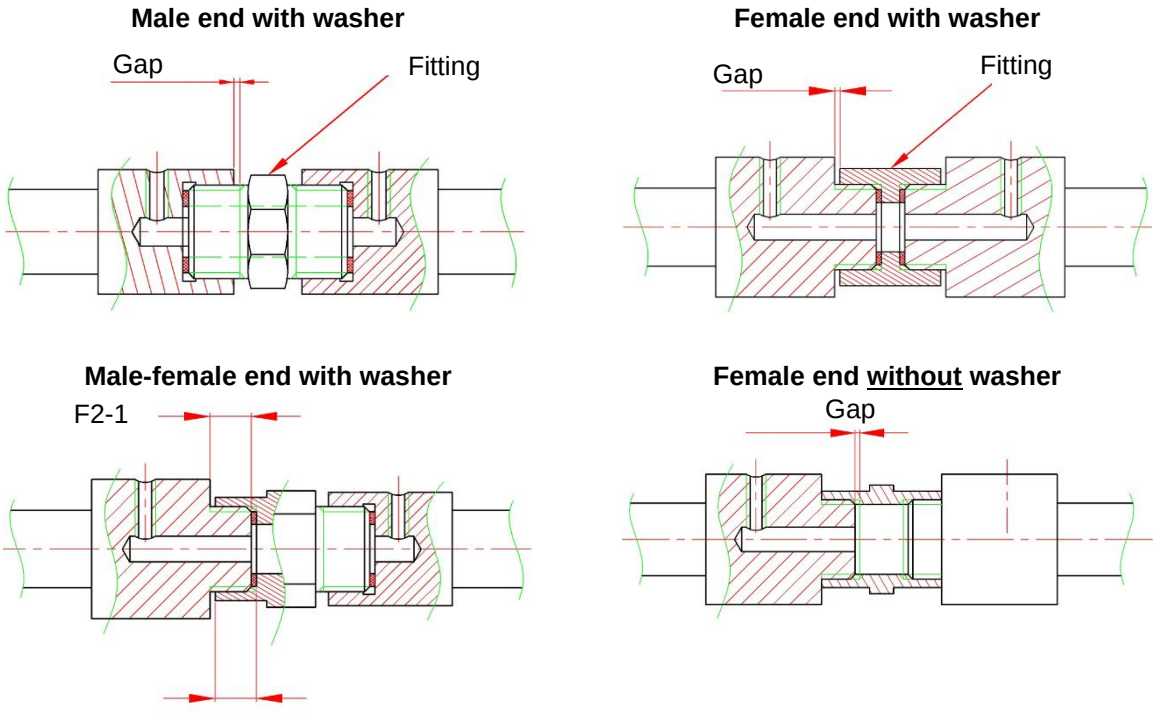


Figure 4: Assembly of end connections

NOTE:
Metallic washers substitute for the seal

Step 1: Mechanical resistance of flat spots under tightening torque

- apply the torque indicated in column 2 of Table 15 to the flat spot;
- after applying the torque, no deformation of the flat spots should be visible to the naked eye.

Step 2: Mechanical resistance of flat spots under torque

- tighten the tube onto the assembly as indicated in Figure 5;
- apply the torque indicated in column 3 of Table 15 to the end of the tube;
- maintain torque for 5 (+1/0) min, then release the stress.
- visually confirm that there is no break, permanent deformation or cracking.

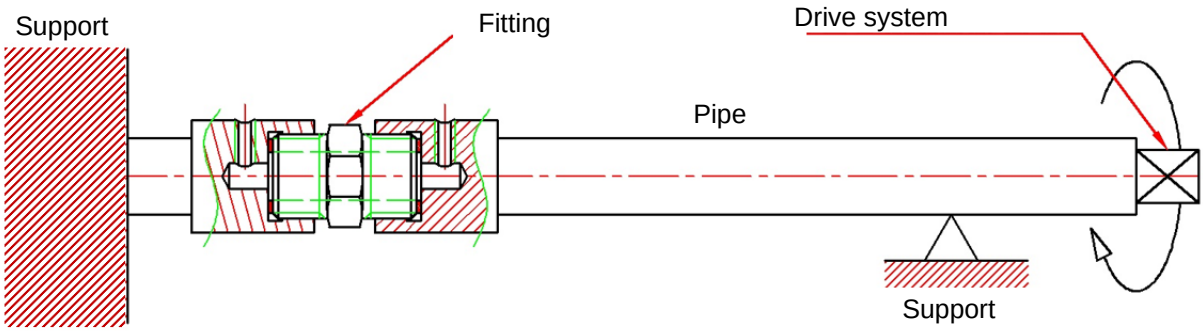


Figure 5: Configuration for torque test

Step 3: Mechanical resistance of flat spots under bending stress

- apply a force W, corresponding to the bending moment defined in column 4 of Table 15;
- maintain torque for 5 (+1/0) min, then release the stress.
- take the assembly apart to visually confirm that there is no break, permanent deformation or cracking.
- proceed to the leaktightness test.

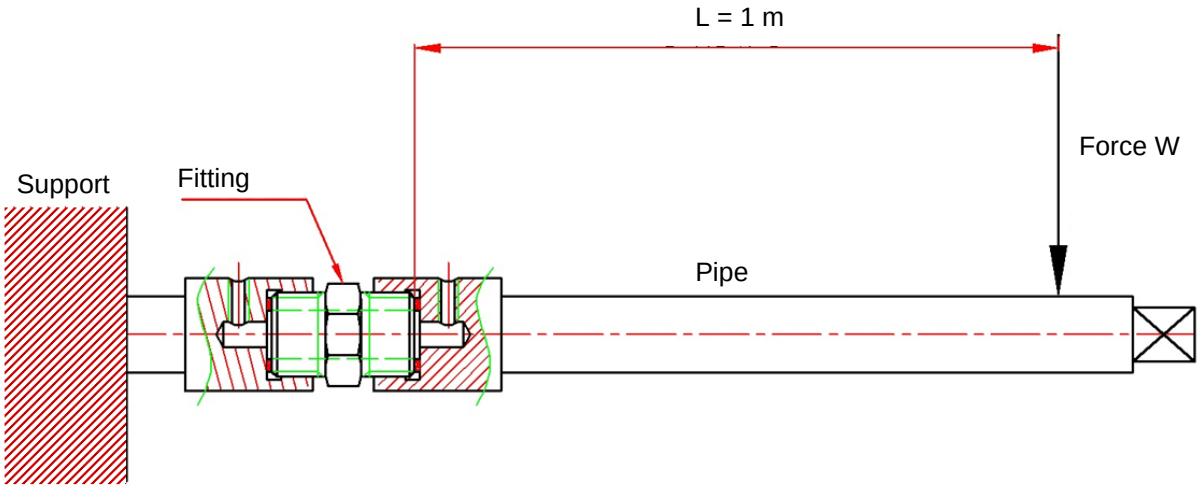


Figure 6: Configuration for bending test

8.2.1.3 Requirements

At the end of the test, verify the leaktightness of the fitting under 1.6 x PN (±1 bar) of water pressure for 5 (+1/0) minutes at ambient temperature. No leak should be observable.

8.2.2 Tensile strength

NOTE:

This test does not apply to mixed fittings.

8.2.2.1 Principle

The test consists of subjecting the fitting to an increasing deformation from a tensile force applied at a constant speed until the tensile force reaches a predetermined value.

8.2.2.2 Test method

- mount the fitting as indicated in Figure 7.
- apply the tensile force at a speed of 1 mm/min up to the value indicated in Table 16 with a force precision of (-5/0)%.
- maintain the force for 30 (+10/0) seconds and then release.

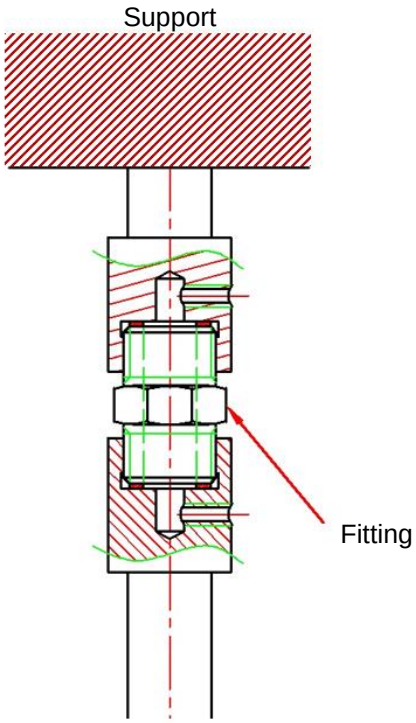


Figure 7: Configuration for tensile test

Table 16: Tensile force

Thread designation – fitting	Thread designation – socket/captive nut	Force (kN)
G 1/8	G 1/4	5.0
G 1/4	G 3/8	8.0
G 3/8	G 1/2	11.0
G 1/2	G 3/4	15.0
G 3/4	G 1	17.5
G 1	G1 1/4	20.0
G1 1/4	G1 1/2	22.5
G1 1/2	G 2	25.0
G 2	G 2 1/2	27.5

8.2.2.3 Requirements

At the end of the test, no visible break, permanent deformation or crack should appear.

8.2.3 Resistance to cracking under stress in an ammoniated environment

This test is carried out on three samples of the same type.

8.2.3.1 Principle

The test consists of verifying resistance to cracking under stress in an ammoniated environment.

After 120 hours of exposure, the parts are visually examined and tested for external leaktightness in order to detect any breaks or open fissures indicating a critical sensibility to cracking under pressure in the presence of corrosive agents.

8.2.3.2 Test conditions

- ammonia solution, 20% (by mass).
- clean solvent (e.g. ethanol)
- the pH of the test solution must be adjusted to: pH =10.2 ± 0.2
- the test temperature shall be (23 ± 2)°C with a measurement uncertainty of ± 1°C.
- the test is carried out on three fittings of the same type.

8.2.3.3 Test method

- rinse the fittings with a non-chlorine solvent.
- air dry the fittings.
- mount the fittings according to the specific instructions for each type and/or specified in the specifications.
- apply the operating stresses: nominal pressure (PN) and if necessary, apply the tightening torque with a torque wrench.
- Introduce the test pieces into the test enclosure along with the ammonia solution.

NOTE:
The volume of the solution introduced must be 200 ml for a container of 3 litres total volume.

- place the test pieces in the container so that the ammonia vapours can reach every surface: the test pieces cannot touch each other or come into contact with the ammonia solution.
- expose the test pieces to the ammonia-laden atmosphere for 120 (+2/0) hours.
- after the exposure period, remove the test pieces and rinse them.
- within a maximum of four hours after having rinsed the test pieces, verify the leaktightness of the fitting under 1.6 x PN (±1 bar) of water pressure for 5 (+1/0) minutes at ambient temperature.

8.2.3.4 Requirements

The specimens are considered resistant to cracking under stress in an ammoniated environment if, at the end of the test, two of the test pieces show no signs of a leak.

8.3 Mechanical characteristics of the seals

The tests to be carried out on the seals are defined in Table 17.

NOTE:

Depending on the type of material, some tests are not applicable.

Table 17: Mechanical tests on seals

Test	VFS	SEFS	ES
8.3.1 Compressive strength	X	X	not applicable
8.3.2 Resistance to pressure at high temperature	X	X	X

8.3.1 Compressive strength

The tests are performed on 3 samples.

8.3.1.1 Principle

The test consists of verifying the mechanical compressive strength of the seal at a predetermined torque value.

Table 18: Torque strength (Nm) of seals

Nominal diameter (DN)	VFS	SEFS	ES
DN8	10	5	5
DN10	30	10	10
DN15	40	15	15
DN20	75	40	40
DN25	110	50	50
DN32	130	100	100
DN40	140	140	140
DN50	170	170	170

8.3.1.2 Test method

- prepare the assembly (fitting + seal) as indicated in Figure 8;
- gradually apply the torque defined in Table 18 with a precision of (+10/0)%
- maintain compression for 5 (+1/0) minutes
- take the assembly apart to visually confirm that there is no deterioration.

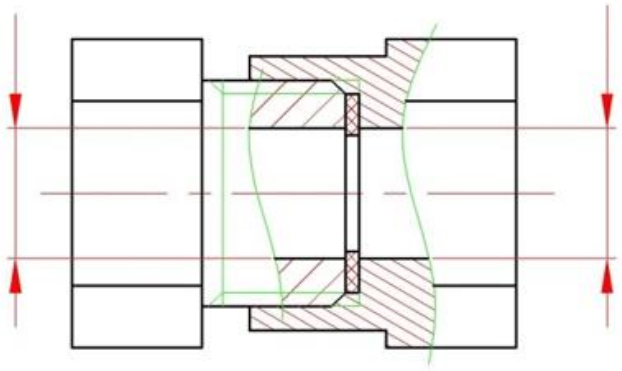


Figure 8: Assembly – seal

NOTE:

The dimensions of the fittings or device used for the test must comply with the requirements in this document.

8.3.1.3 Requirements

The samples are considered compression-resistant if, at the end of the test, none of the three samples show any deterioration.

8.3.2 Resistance to pressure at high temperature

The tests are performed on 3 samples. The pressure change test is performed after the thermal shock test.

8.3.2.1 Principle

The test consists of verifying the seals' resistance to changes in pressure at high temperature over a determined number of cycles.

It is broken down into 2 steps:

- Step 1: thermal shock
- Step 2: pressure variation

8.3.2.2 Test method

- create a test specimen (seal + fitting) that complies with the dimensional requirements defined in this document;
- tighten to the leak-tight torque defined in Table 13;
- verify the absence of any leak under 1.6 x PN (±1 bar) of water pressure for 5 minutes at ambient temperature.

Step 1: Thermal shock

- mount the completed test specimen (fitting + seal) on the test apparatus.
- subject the assembly to a flow of
    - hot water at 90 (-5/+0) °C for 60 (+3/0) min
    - then of cold water at 15 (+5/0) °C for 10 (+3/0) min

Step 2: Pressure change at temperature

- subject the assembly (fitting + seal) to circulating hot water at (60±5)°C and to a cycle of changes in pressure as defined below:
    - (3 ± 0.5) bars of pressure (dynamic) for (5 ± 1) s
    - Pause in flow for 2 s
    - (10 ± 1) bar of pressure (static) for (5 ± 1) s
- repeat this cycle 200,000 times.

8.3.2.3 Requirement

At the end of the test, verify the leaktightness of the seal under 1.6 x PN (±1 bar) of water pressure for 5 (+1/0) minutes at ambient temperature. No leak should be observable.

9 Marking

NOTE:

The marking defined below only applies to fittings.

- Manufacturer identification (name, brand, symbol, etc.)
- logo for the certification

This marking can be replaced by a code or other solution declared by the manufacturer. It must be durable and readable.

For fittings with multiple components, the marking must appear on at least one of the parts.

10 Presentation at delivery

Fittings and joints sold to the end user must be packaged.

The packaging must display the following information:

10.1 Fittings

- manufacturer ID;
- logo for the certification;
- designation;
- quantity;
- traceability reference (e.g. production order, materials batch number, date of manufacture, etc.).

10.2 Seals

- manufacturer ID;
- logo for the certification;
- maximum operating temperature (MOT);
- field of use (see Table 19);
- designation;
- quantity;
- traceability reference (e.g. production order, materials batch number, date of manufacture, etc.);
- nominal tightening torque.

10.3 “Fitting and seal” assembly

Fittings and seals can be delivered and packaged together with the information cited above.

11 Technical documentation

Technical documentation for a product must be written in the common language of the country where the product is sold.

It may be made available in electronic form. In this case, the link (QR code, web address, etc.) must accompany the product and provide direct access to the product’s technical documents.

The documentation must contain the following information:

11.1 Fitting

- manufacturer ID;
- logo for the certification;
- designation;
- materials;
- PN (Nominal Pressure);
- operating temperature range;
- fluid (if necessary);
- assembly instructions;
- Kvs (if necessary).

11.2 Seal

- Manufacturer ID;
- logo for the certification;
- designation;
- materials;
- maximum operating temperature (MOT);

- field of use (see Table 19);
- fluid (if necessary);
- nominal tightening torque;
- storage conditions (e.g. min/max temperature, etc.).

12 Leaktight products

NOTE:

This article is provided for information purposes regarding good practices.

It is strongly recommended not to combine two types of leaktightness when connecting a product.

The choice of leaktight product depends on:

- the field of use:
  - distribution of potable water;
  - HVAC;
- on the type of leaktightness as determined by the geometry of the connection:
  - leaktightness by flat seal (with stop);
  - leaktightness in the threading (no stop).

Good practices recommend cylindrical to cylindrical assemblies.

Table 19: Compatibility – leaktight material and field of use

Product	**Field of use** / **Materials**	**DHW < 90°C**	**DCW**	**HVAC Heating**	**HVAC Cooling**
Resin, paste	Leaktightness composition, anaerobic	X	X	X	X
	Leaktightness composition, hardening	X	X	X	X
Flat seal	Vulcanised fibre (max 70°C)	X (T°<70°C)	X	NA	NA
	Synthetic-elastomer fibre	X	X	X	X
	Elastomer, IRHD class 70, 80 and 90	X	X	X	X
Other	PTFE strips	NA	X	NA	X
	Oakum	NA	NA	X	X

NA: Not applicable

DHW: Domestic Hot Water

DCW: Domestic Cold Water

PTFE: Polytetrafluoroethylene

Only seals with an ACS (Health compliance certificate, DN ≥ DN63) or CLP (Conformity to Positive Lists, DN < DN63) are authorised for use on potable water distribution systems.

For fittings without ACS or CLP, the restriction of the field of use must always be indicated on the packaging and in the technical documentation. These seals covered by this technical document can be used only on HVAC systems

13 Additional service-related specifications

The holder must at minimum offer a range of products that respects the definition below:

13.1 Range for fittings

- 4 threading designations per reference type: 3/8, 1/2, 3/4 and 1
- Minimum references listed in Table 20 and only if presented in the manufacturer's catalogue.

Table 20: Fitting range

Family	Reference	3/8	1/2	3/4	1
Nipple	280	X	X	X	X
	246	X	X	X	X
	270	X	X	X	X
Reducer fitting	245	X	X	X	X
	246R	X	X	X	X
	243	X	X	X	X
	240	X	X	X	X

13.2 Range for seals

- DN10 to DN25
- vulcanised fibre

Table 21: Seal range

Materials	DN10	DN15	DN20	DN25
Vulcanised fibre (VFS)	X	X	X	X

14 Test sequence

Where applicable, the tests set out in Table 22 shall be performed in the specified sequence.
The test sequence must be performed on the same specimen.
The marking and appearance of exterior surfaces are verified on all products tested.
The technical documentation will be verified wherever it appears (packaging, data sheets, etc.).

14.1 Sequence for fittings

Table 22: Distribution of tests

Sequence	Sequence name and order of the tests
1.	**Dimensions** 7.1 Dimensions of the fittings
2.	**Mechanical strength (torque/bending)** 8.2.1 Torque/bending strength
3.	**Traction** 8.2.2 Tensile strength
4.	**Cracking under stress** 8.2.3 Resistance to cracking under stress in an ammoniated environment

14.2 Sequence for seals

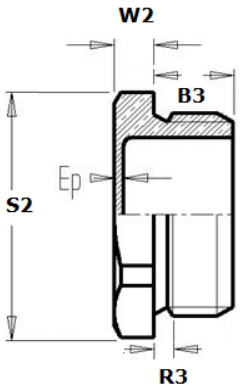
Table 23: Distribution of tests

Sequence	Sequence name and order of the tests
1.	**Dimensions** 7.2 Seal dimensions
	5.2.2 Compatibility with products used for system disinfection
2.	**Compression** 8.3.1 Compressive strength
3.	**Resistance at high temperature** 8.3.2 Resistance to pressure at high temperature

PART 2. APPENDICES: DIMENSIONAL CHARACTERISTICS SPECIFIC TO DIFFERENT TYPES OF FITTING

Appendix 1. Plug dimensions

Leaktightness under head



Leaktightness at end of threading

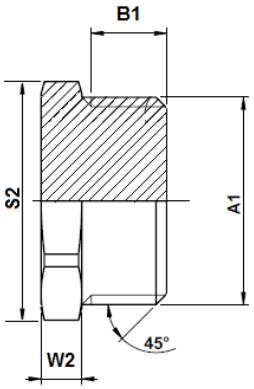


Figure 9: Plug

Table 24: Plug dimensions

A1	B3 (-0.2/0)	R3 (max.)	Min Ep	S2 (*) (h13)	W2 min.
G 1/8 B	4.5	0.9	1.2	13	5
G 1/4 B	6.0	1.3	1.2	16	5
G 3/8 B	7.0	1.3	1.2	19 or 20	5
G 1/2 B	8.2	1.8	1.2	20	7
G 3/4 B	8.5	1.8	1.2	24	7
G 1 B	10.2	2.3	1.5	30	7
G1 1/4B	11.0	2.3	1.5	36 (-0.39/+0.2)	8
G1 1/2B	12.5	2.3	1.5	46 (-0.39/+0.2)	10
G 2 B	14.0	2.3	2.0	52 (-0.46/+0.2)	10

(*): Tolerance h13, except for certain male threads for which a positive tolerance is accepted as indicated in the table above.

Appendix 2. Cap dimensions

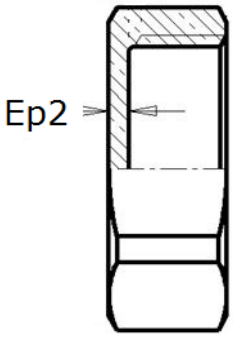


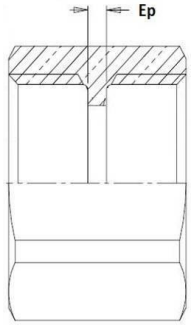
Figure 10: Cap

Table 25: Cap dimensions

A2	Ep2 min
G 1/8	1.5
G 1/4	1.5
G 3/8	1.8
G 1/2	1.8
G 3/4	2.0
G 1	2.0
G1 1/4	2.2
G1 1/2	2.2
G 2	2.5

Appendix 3. Sleeve dimensions

Sleeve with stop



Sleeve without stop

Figure 11: Sleeve

Table 26: Sleeve dimensions

A2	Min Ep	F4 min
G 1/8	1.5	9.0
G 1/4	1.5	12.0
G 3/8	1.8	14.0
G 1/2	1.8	16.4
G 3/4	2.0	17.0
G 1	2.0	20.4
G1 1/4	2.2	22.0
G1 1/2	2.2	25.0
G 2	2.5	28.0

Appendix 4. Furring channel and reducer fitting dimensions

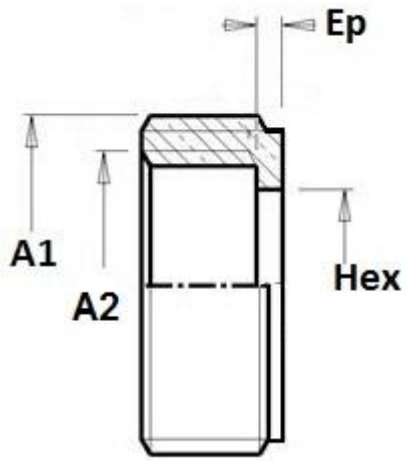


Figure 12: Reducer fitting

Table 27: Furring channel and reducer fitting dimensions

A1	A2	Min Ep	Hex
G 3/8	G 1/4	2.0	8
G 1/2	G 3/8	2.0	10
G 3/4	G 1/2	2.5	13
G 1	G 3/4	2.5	17
G1 1/4	G 1	/	/
G1 1/2	G1 1/4	/	/
G 2	G1 1/2	/	/

NOTE:
For this type of fitting, the leaktightness is ensured by the threading.

Appendix 5. GCU fitting dimensions (FF and MF)

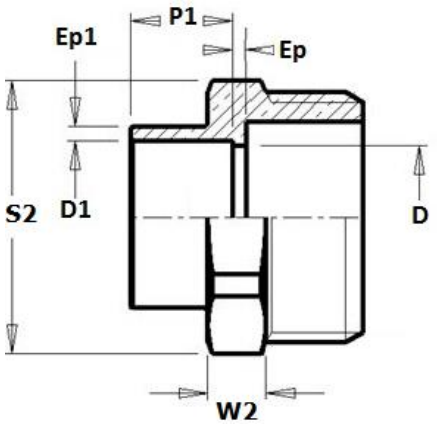


Figure 13: GCU fitting

D: interior diameter of tube (+1/0)

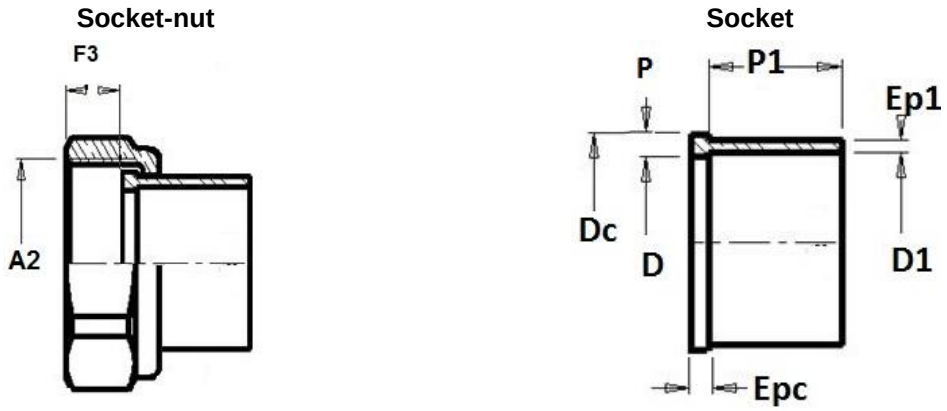
D1, P1, Ep: cf. EN 1254-1

S2 and W2: cf. dimensions of female end connection

Table 28: GCU fitting dimensions

A2	Ep1 min
G 1/8	1.0
G 1/4	1.0
G 3/8	1.0
G 1/2	1.0
G 3/4	1.0
G 1	1.5
G1 1/4	1.5
G1 1/2	1.5
G 2	1.5

Appendix 6. Dimensions of 2-part unions: socket-nut



Dc: diameter of the collar
Epc: Thickness of collar wall
D: Interior diameter of tube (+1/0)
D1, P1, Ep: cf. EN 1254-1

Figure 14: Socket-nut

Table 29: Socket-nut dimensions

A2	F3 (0/-0.2)	Dc min	Epc min	P min.
G 1/8	4.5	8.1	1.5	1.0
G 1/4	6.0	11.0	1.5	1.0
G 3/8	7.0	14.5	1.8	1.5
G 1/2	8.2	18.2	1.8	1.7
G 3/4	8.5	23.7	2.0	2.0
G 1	10.2	29.9	2.0	2.2
G1 1/4	11.0	38.5	2.2	2.5
G1 1/2	12.5	44.4	2.2	2.5
G 2	14.0	56.2	2.5	3.0

Appendix 7. Extension dimensions

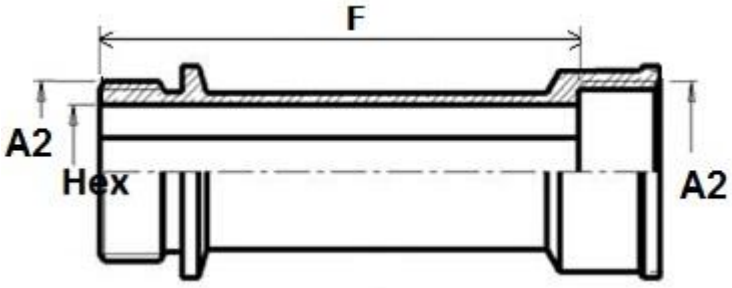


Figure 15: Extension

F: length reported by the manufacturer, distance to bearing surface of the seal; the Kv must be specified in the manufacturer's technical documentation

Table 30: Extension dimensions

A2	Hex
G 3/8	10
G 1/2	13
G 3/4	17

Appendix 8. Flat flared nut dimensions

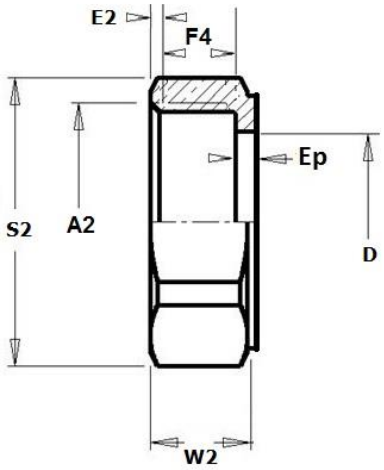


Figure 16: Flat flared nut

D: outside diameter of copper tube (+0.2/+0.5) → cf. EN 1254-1

S2, W2, E2: refer to dimensions of the female end connection

Table 31: Flat flared nut dimensions

A2	F4 (+0.2/0)	Min Ep
G 1/8	6.3	1.5
G 1/4	7.8	1.5
G 3/8	8.8	1.8
G 1/2	10.0	1.8
G 3/4	10.3	2.0
G 1	12.0	2.0
G1 1/4	12.8	2.2
G1 1/2	14.3	2.2
G 2	15.8	2.5

NOTE:

No finished products with this nut may display this certification under any circumstances (Example of nut + copper socket assembly).

The nut must allow for the creation of a flat flared joint respecting the seal bearing surface defined in the table of male end connections.

Appendix 9. Dimensions of 2-part unions: Threaded socket

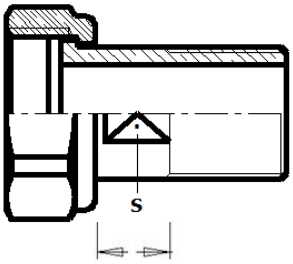


Figure 17: Smooth threaded hex socket with drive system

z: Length of the clearance of the captive nut (to be displayed between the 2 arrows).

W: Width of the flat section of the nut crimped inside the socket.

s: across-flat dimension of the nut crimped inside the socket.

For:

- the end connection: refer to dimensions of the female end connection
- the smooth threaded socket: refer to dimensions of the GCU fitting
- the crimped hex nut: refer to dimensions in the table below

Table 32: Height of tightening plane for crimped nut of 2-part union

s	W min
15 < s ≤ 20	4
20 < s ≤ 30	5
30 < s ≤ 40	6
40 < s ≤ 50	7
50 < s ≤ 70	9
70 < s ≤ 90	12

Appendix 10. Dimensions of 3-part unions

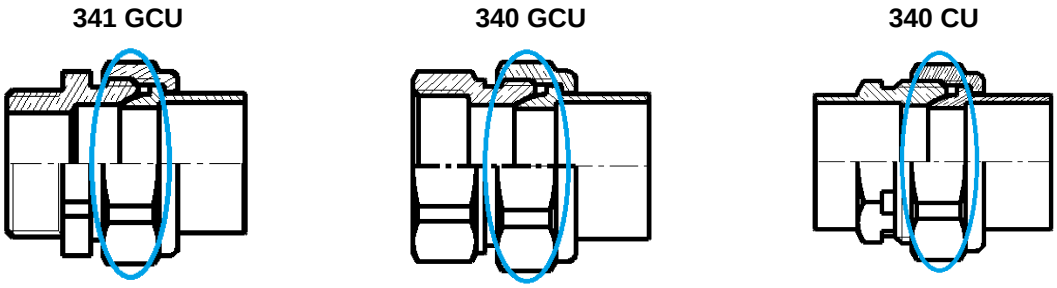


Figure 18: 3-part union:

NOTE:

The central part is the responsibility of the manufacturer.

The spherocone is unique to the manufacturer.

For:

- the end connection, refer to:
  - dimensions of the female end connection
  - dimensions of the male end connection
  - NF EN 1254-1 for the part to be welded
- the crimped hex nut: refer to dimensions in the table below
- the non-crimped nut, the height of the hex is equal to the height of the nut

Table 33: Height of tightening plane for crimped nut of 3-part union

s	W min
15 < s ≤ 20	5
20 < s ≤ 30	7
30 < s ≤ 40	7
40 < s ≤ 50	8
50 < s ≤ 70	10
70 < s ≤ 90	12

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