



English version



Jacques Jumeau

Technology of components used in heating.

Chapter 34

Pipes connection Standards

Anciennes normes NFE 03-004 et NFE 03-005 (Avril 1965) "Pas du Gaz"				
Désignation usuelle		Dia extérieur	Pas	
En pouces	En mm		Nombre de filets au pouce	Pas en mm
1/8	5 x 10	9.729	28	0.9071
1/4	8 x 13	13.158	19	1.3368
3/8	12 x 17	16.663	19	1.3368
1/2	15 x 21	20.956	14	1.8143
5/8	16 x 23	22.912	14	1.8143
3/4	21 x 27	26.442	14	1.8143
7/8	24 x 31	30.202	14	1.8143
1 "	26 x 34	33.250	11	2.3091
1-1/4	33 x 42	41.91	11	2.3091
1-1/2	40 x 49	47.803	11	2.3091
1-3/4	45 x 55	53.746	11	2.3091
2 "	50 x 60	59.614	11	2.3091

Current standards for pipe threading

Part 1. Historical reminder of the evolution of French standards on pipe threads

In order to comply with the industrial choices of the late 19th century for piping threads, France had produced a series of standards covering the nominal dimensions in inches of the English Whitworth threads, giving them a metric transcription. These standards carried the references NF E 03-005, NF E 03-161, NF E 03-162, NF E 03-163 relating to threads without sealing in the thread said "parallel" cylindrical and NF E 03-004 relating to threads with sealing in the thread, said "tapered". They defined what was then called in France the "gas thread", because the distribution of gas city had been historically its first application of large series.

International standards ISO 7 and ISO 228 were the basis for these French standards.

In 1988, CEN took the decision to take them back to European standards in order to replace (and unify) the different existing national standards. In the following years, European standards have been drafted and published. They resume, with a few exceptions, international standards.

Although having disappeared from current standards, the metric correspondences of the old French standards are still used by plumbers in France.

Table of metric correspondences of old French standards

Old French standards NFE 03-004 and NFE 03-005 (April 1965) said "Gas pipes pitch"				
Usual designation of nominal dimension		Outside diameter (mm)	Pitch	
In inches	In mm		Pitch per inch	Pitch in mm
1/8	5x10	9.729	28	0.9071
1/4	8x13	13.158	19	1.3368
3/8	12x17	16.663	19	1.3368
1/2	15x21	20.956	14	1.8143
5/8	16x23	22.912	14	1.8143
3/4	21x27	26.442	14	1.8143
7/8	24x31	30.202	14	1.8143
1	26x34	33.250	11	2.3091
1-1/4	33x42	41.910	11	2.3091
1-1/2	40x49	47.803	11	2.3091
1-3/4	45x55	53.746	11	2.3091
2	50x60	59.614	11	2.3091

Part 2: Short description of the main standards currently in force for tapered and parallel pipe threads

2-1: The ISO228 standard.

It describes Whitworth pipe threads with a 55° thread angle without sealing in the thread, known as "parallel" threads.

The EN ISO 228 standard adds and recommends a truncated thread profile to the French standards that it replaces, but does not use the old French 60-70 (2 ¼) dimension. It specifies the method of verification of threads by limit gages. It introduces several modifications in the control methods, the main ones concerning the addition of the WGO symbol, which defines the average value representing the admissible wear of the GO male gauge and the GO threaded ring, and certain numerical values. It has 2 parts:

Part 1: Designation, dimensions, tolerances.

Part 2: Checking by limit gauges.

2-2: The EN10226 standard

It describes the Whitworth threads with a 55° thread angle and sealing in the thread, known as "tapered" threads.

It replaces without significant modification the old French standard.

It has 3 parts:

Part 1: Tapered external threads and parallel internal threads - Designation, dimensions, tolerances.

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Part 2: Tapered external threads and tapered internal threads. Dimensions, tolerances, designation.

Part 3: Checking by limit gauges

2-3: The ANSI B1-20.1 standard

This American Standard, known as the NPT (National Pipe Thread) Standard, describes Briggs pipe threads with a 60° thread angle. This standard, very complete, defines all models of threads, tapered, parallel, dryseal etc.

2-4 Comparison of the general dimensions of ISO 228 (BSPP), EN10226 (BSPT, BSPP) and NPT (ANSI B1-20.1)

ANSI B1-20.1 (NPT)		EN ISO 228, EN10226 (BSPT, BSPP)	
Denomination	Nominal dimension at the gauge plane (mm)*	Denomination	Nominal dimension at the gauge plane (mm)*
1/16-27	7.142	1/16-28	7.142
1/8-27	9.489	1/8-28	9.147
1/4-18	12.487	1/4-19	12.301
3/8-18	15.926	3/8-19	15.806
1/2-14**	19.772	1/2-14**	19.793
3/4-14**	25.117	3/4-14**	25.279
1"-11.5	31.461	1"-11	31.770
1"1/4-11.5	40.218	1"1/4-11	40.431
1"1/2-11.5	46.287	1"1/2-11	46.324
2"-11.5	58.325	2"-11	58.135

* : The gauge plane is the plane perpendicular to the thread axis where the thread dimensions are the nominal dimensions. This plane and these dimensions are the reference values for both conical and cylindrical threads.

** : One can note a quasi-equivalence for these dimensions, source of numerous assembly errors.

2-5: Table of minimum engagement lengths, special case of NPT threads (hand engagement)

The NPT standard specifies the effective thread, which is the length of the thread that makes the seal (on machined parts). It is obvious that for the installers, the notion of effective length is not very speaking, and it is more practical to know how many turns to make by hand and how many with a spanner. In the table below are indicated the distances and the number of threads that must be in contact to guarantee the tightness (hand tightening, before tightening with the spanner)

A simple rule of thumb for tapered threads (metal) is to hand tighten and then tighten a turn with the spanner.

Diameter on crests	Pitch (mm)	Turns of engagement	Length of engagement (mm)	Longueur d'engagement (mm)
1/8-27	10.242	0.941	3.3	3.10
1/4-18	13.616	1.411	3.1	4.37
3/8-18	17.055	1.411	3.3	4.66
1/2-14	21.224	1.814	3.4	6.17
3/4-14	26.569	1.814	3.7	6.71
1"-11.5	33.228	2.209	3.6	7.95

2-6: Length of the most common threads.

In reality, this normative length is little respected by manufacturers who tend, for cost reasons, to reduce it.

Dimension (inch)	Tapered thread upon EN10226 and ISO 7/1 (mm)	Parallel thread upon ISO 228-1 (mm)	Female thread upon ISO 1179 (mm)	NPT Male thread upon ANSI B1-20.1 (mm)	NPT Female thread upon ANSI B1-20.1 (mm)
1/8"	7.4	8	7.4	6.7	6.9
1/4"	44.0	10.0	11.0	10.2	10.0
3/8"	11.0	10.0	11.4	10.4	10.3
1/2"	15.0	12.0	15.0	13.6	13.6
3/4"	16.3	12.0	16.3	13.9	14.1

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Part 3: (Incomplete) list of standards applicable to pipe threads and their sealing

Threads

Description	Standard in force	National standards replaced or equivalent
Pipe threads, general purpose (inch), tapered male and female threads	ANSI/ASME B1.20.1-1983	
Pipe threads, general purpose (inch), parallel male and female threads (previously named NPS)	ANSI/ASME B1.20.1-1983	
Pipe threads where sealing is made on the threads (Whitworth thread, tapered male and female or parallel female)	EN 10226	ISO 7-1 DIN2999 (Germany) DIN3858 (Germany. Attention it has differences with ISO-7) BS 21 (England) NF-E 03.004 (France) JIS B 0203 (Japan) GB/T7306-1987(China)
Pipe fittings where sealing is not made on the thread (Whitworth thread, parallel male and female)	ISO 228	DIN259 (Germany) NFE 03.005 (France) BS 2779 (England) JIS B 0202 (Japan) GB/T7307-1987(China)
Metric threads at 60°, tapered male and parallel female thread with 1.47° pitch angle. (They are used for oil and grease fittings where self-sealing connections cannot be obtained by parallel threads with sealing washers.)	DIN 158	GB/T12716-1991 (China)
Basic profile for ISO general purpose, section 1: metric screw thread	ISO 68-1 (1998)	
Basic profile for ISO general purpose, section 2: Whitworth thread	ISO 68-2 (1998)	
ISO general-purpose metric screw threads. Basic dimensions	ISO 724 (1993)	
ISO general-purpose Whitworth threads. Basic dimensions	ISO 724 (2009)	
Metric parallel pipes threads (Used in immersion heaters with M45x2 and M77x2 threads)	NF E 03-050	
American National standard Inch. Buttress Screw Thread	AINSI B1-9-1973	

Fittings

Description	Standard
Malleable cast iron pipe fittings standard	EN 10242
Removable connection with sphero-conical junction	NF E 29-536
Metallic tube connections for fluid power and general use. Part 1: 24° cone connectors	ISO 8434-1 : 2007 DIN2353
Metallic tube connections for fluid power and general use. Part 2 : 37° flared connectors	ISO 8434-2 : 2007 DIN3865
Metallic tube connections for fluid power and general use. Part 4: 24 degree cone connectors with O-ring weld-on nipples	ISO 8434-4 : 2007 DIN3942-45
Stud ends and ports of fittings	DIN 3852

Standards for plastic pipes and their connections

Description	Standard
Plastic piping for water supply	EN 1452 NFT 54-016 (France)
Tubes and fittings in un-plasticized polyvinyl chloride (PVC-U) for water supply	ISO 4422
Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120	ASTM D1785
Standard Specification for Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80	ASTM F441
Fittings made from un-plasticized polyvinyl chloride (PVC-U), chlorinated polyvinyl chloride (PVC-C) or acrylonitrile-butadiene-styrene (ABS) with plain sockets for pipes under pressure	ISO 727 DIN 8063
Pipes and fittings in polypropylene	DIN 16962
Characteristics and requirements for components such as pipes, fittings and valves made from polyvinylidene fluoride) (PVDF)	ISO 10931
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE)	EN 1555
Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE).	EN 12201
PVC fittings	ASTM D 1785/76

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Standards for seals and sealants

Description	Standard
Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Part 1: Anaerobic jointing compounds	EN 751-1
Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Part 2: Non-hardening jointing compounds	EN 751-2
Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Unsintered PTFE tapes	EN 751-3
Rubber materials for seals and diaphragms for and gas equipment	EN 549
Flat seals in mechanical couplings	NF E 29-352
Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications	EN 681

Part 4: Miscellaneous information

Simplified markings of the thread dimensions used on drawings

Description	Standard	Examples of designation (1/4 is selected as a dimension example)
NPT pipe threads, general purpose, tapered male and female	ANSI/ASME B1.20.1-1983	NPT ¹ / ₄
NPSC pipe threads, general purpose, parallel male and female (previously NPS)	ANSI/ASME B1.20.1-1983	NPSC ¹ / ₄
- Pipe fittings where sealing is made on the thread (Whitworth thread, tapered male and tapered female or parallel female). - Pipe fittings where sealing is not made on the thread (Whitworth thread, parallel male and female).	- EN 10226 - ISO 228	Abbreviations on drawings Tapered male: R ¹ / ₄ Tapered female: Rc ¹ / ₄ Parallel male or female: G ¹ / ₄ * Parallel female: Rp ¹ / ₄ Common name: Parallel male or female: BSPP ¹ / ₄ Tapered male or female: BSPT ¹ / ₄ * : can be followed by A or B depending on the accuracy class requested
Metric threads at 60° tapered male and parallel female .	DIN 158	Keg

Usual indications of nominal pipe sizes

Diameter indication

In the USA, the nominal dimensions of the pipes are based on their internal diameter.

In Europe, DN is used for the nominal internal diameters of pipes, but the indications in inches for pipes are kept when they are threaded.

Usual indication of the pitch

The pitch in NPT and BSP is in thread count per inch, and written behind the diameter in inches.

The metric pitch is written in mm (sometimes in hundredths of a millimeter) behind the diameter in mm.

Examples:

- "NPT 1/2-14" identifies a pipe thread with a nominal inside diameter of 1/2 inch and 14 threads per inch, made in accordance with the NPT standard, therefore tapered.

- "BSPP 1/2-14" identifies a pipe thread with a nominal inside diameter of 1/2 inch and 14 threads per inch, made in accordance with the BSPP standard, therefore parallel.

This way of indicating threads is no longer allowed in Europe, but still practically used. The indication must now follow the rules described by ISO 228 and EN 10226.

- "M16-2" identifies cylindrical metric thread diameter 16 mm with a pitch of 2 mm.

- "M16-200" identifies metric cylindrical thread diameter 16 mm with a pitch of 2 mm.