

**TEESING**

S. L. ten Cate  
08-2015

# TYPES OF THREAD

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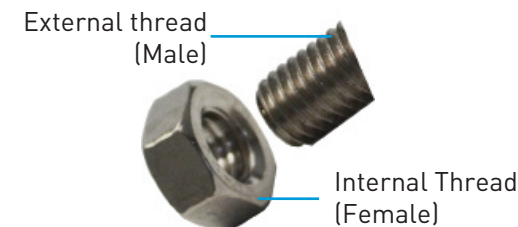
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### 1.1 GENDER

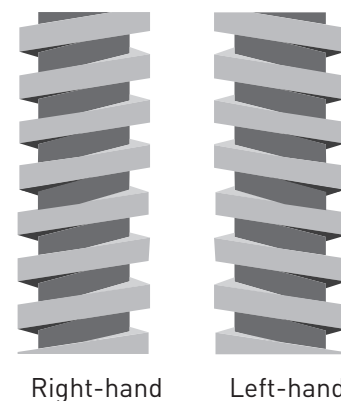
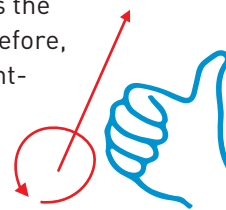
Every matched pair of threads, external and internal, can be described as male and female. For example, a screw has male thread, while the matching hole has female thread.



### 1.2 HANDEDNESS

The helix of a thread can twist in two possible directions. Most threads are oriented so that the threaded item when seen from a point of view on the axis through the center of the helix, moves away from the viewer when it is turned in a clockwise direction, and moves towards the viewer when it is turned counter clockwise.

By common convention, right-handedness is the default handedness for screw threads. Therefore, most threaded parts and fasteners have right-handed threads.



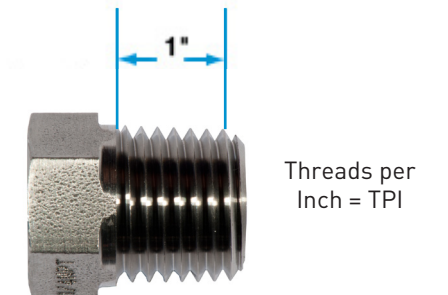
### 1.3 DESIGN

The type of thread can be identified by the following characteristics.



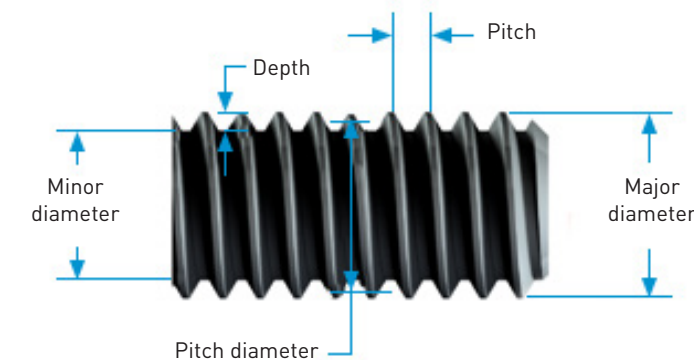
### 1.4 PITCH/TPI:

The pitch is the distance from the crest of one thread to the next in mm. TPI (Threads per inch) is used by inch thread.



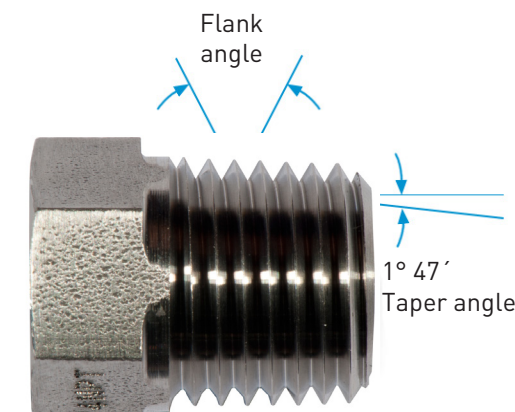
### 1.5 DIAMETER:

The major diameter is determined by the thread tips. The minor diameter is determined by the groove of the thread. The pitch diameter is the distance of two opposite flanks or the distance of the centreline of the profile.



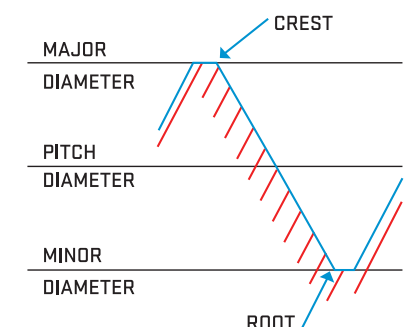
### 1.6 ANGLE

The flank angle is the angle between the flank of a screw thread and the perpendicular to the axis of the screw. Tapered threads have a taper angle. This is the angle between the taper and the centre axis of the pipe.



### 1.7 CREST/ROOT

The outer-most part of the thread is called crest, the inner-most part of the thread is called root.



## 2.1 M - ISO THREAD (METRIC)

|   |               |                          |
|---|---------------|--------------------------|
| M | Coarse Thread | ISO 724 (DIN 13-1)       |
| M | Fine Thread   | ISO 724 (DIN 13-2 to 11) |

## 2.2 NPT - PIPE THREAD

|      |              |
|------|--------------|
| NPT  | ANSI B1.20.1 |
| NPTF | ANSI B1.20.3 |

## 2.3 G/R/RP - WHITWORTH THREAD (BSPP/BSPT)

|         |        |                                      |
|---------|--------|--------------------------------------|
| G       | = BSPP | ISO 228 (DIN 259)                    |
| R/Rp/Rc | = BSPT | ISO 7 (DIN 2999 replaced by EN10226) |

## 2.4 UNC/UNF - UNIFIED NATIONAL THREAD

|     |           |
|-----|-----------|
| UNC | ANSI B1.1 |
| UNF | ASNI B1.1 |

## 2.5 EXTRA: COMPARISON SHEET (M – BSPP – BSPT – NPT – UNC – UNF)

## 2.1 M - ISO THREAD (METRIC)

ISO Metric thread is a globally standardized thread. Compared to standard threads (coarse thread), a fine thread has a smaller pitch.

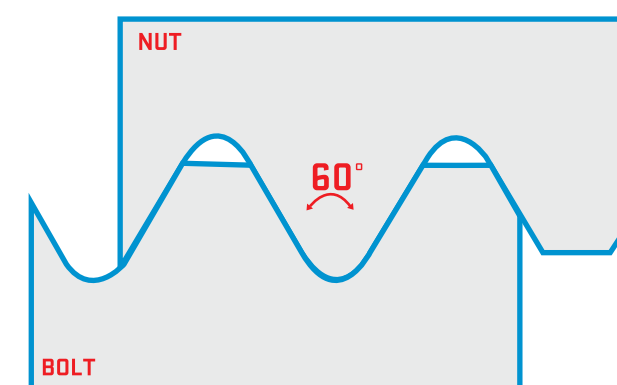
### Coarse Thread

pitch can be displayed or omitted after thread size

| Thread size (mm) | Major diameter (mm) | Minor diameter (mm) | Pitch (mm) | Thread size (mm) | Major diameter (mm) | Minor diameter (mm) | Pitch (mm) |
|------------------|---------------------|---------------------|------------|------------------|---------------------|---------------------|------------|
| M 3              | 2,98                | 2,459               | 0,5        | M 3 x 0,35       | 2,981               | 2,621               | 0,35       |
| M 4              | 3,978               | 3,242               | 0,7        | M 4 x 0,5        | 3,978               | 3,242               | 0,5        |
| M 5              | 4,976               | 4,134               | 0,8        | M 5 x 0,5        | 4,98                | 4,459               | 0,5        |
| M 6              | 5,974               | 4,917               | 1          | M 6 x 0,75       | 5,978               | 5,188               | 0,75       |
| M 8              | 7,974               | 6,917               | 1          | M 8 x 0,75       | 7,978               | 7,188               | 0,75       |
| M 10             | 9,968               | 8,376               | 1,5        | M 10 x 0,75      | 9,978               | 9,188               | 0,75       |
|                  |                     |                     |            | M 10 x 1         | 9,974               | 8,917               | 1          |
|                  |                     |                     |            | M 10 x 1,25      | 9,972               | 8,647               | 1,25       |
| M 12             | 11,97               | 10,106              | 1,75       | M 12 x 1         | 11,97               | 10,917              | 1          |
|                  |                     |                     |            | M 12 x 1,25      | 11,97               | 10,647              | 1,25       |
|                  |                     |                     |            | M 12 x 1,5       | 11,97               | 10,376              | 1,5        |
| M 16             | 15,96               | 13,835              | 2          | M 16 x 1         | 15,97               | 14,917              | 1          |
|                  |                     |                     |            | M 16 x 1,5       | 15,97               | 14,376              | 1,5        |
| M 20             | 19,96               | 17,294              | 2,5        | M 20 x 1         | 19,97               | 18,917              | 1          |
|                  |                     |                     |            | M 20 x 1,5       | 19,97               | 18,376              | 1,5        |
|                  |                     |                     |            | M 20 x 2         | 19,96               | 17,835              | 2          |
| M 24             | 23,95               | 20,752              | 3          | M 24 x 1,0       | 23,97               | 22,917              | 1,0        |
|                  |                     |                     |            | M 24 x 1,5       | 23,97               | 22,376              | 1,5        |

The flank angle is 60°.

Female and Male thread are both parallel.



### 2.2 NPT - PIPE THREAD

The most common types of pipe thread are:

- NPT - American Taper Pipe Thread  
= National Pipe Taper
- NPTF - American Taper Pipe Thread for Dryseal joint without sealant compound  
= National Pipe Taper Fuel

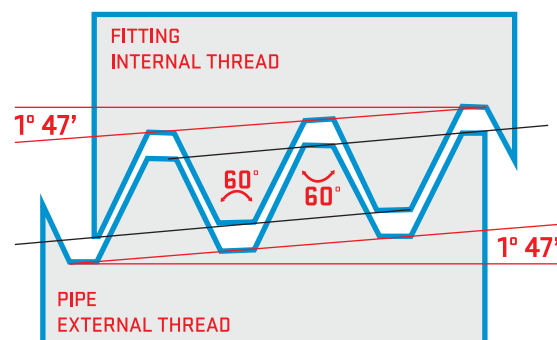
NPT and NPTF appear to be identical. Both have the same pitch diameter at the top of the hole of the internal thread or end of the pipe on external threads and both have the same thread lengths or depths. However, there is a subtle difference in the root and crest diameters of the threads.

#### NPT / NPTF

| Thread size    | Major Diameter (mm) | TPI  |
|----------------|---------------------|------|
| 1/16" – 27 NPT | 7,938               | 27   |
| 1/8" – 27 NPT  | 10,287              | 27   |
| 1/4" – 18 NPT  | 13,716              | 18   |
| 3/8" – 18 NPT  | 17,145              | 18   |
| 1/2" – 14 NPT  | 21,336              | 14   |
| 3/4" – 14 NPT  | 26,670              | 14   |
| 1" – 11 ½ NPT  | 33,401              | 11,5 |
| 2" – 11 ½ NPT  | 60,325              | 11,5 |

The flank angle is 60°.

Female and Male thread are both tapered with equal angles.



NPT threads are also sometimes referred to as:

- MIP (Male Iron Pipe)
- FIP (Female Iron Pipe)
- IPT (Iron Pipe Thread)
- FPT (Female Pipe Thread)
- MPT (Male Pipe Thread)

Note that these references are somewhat casual, and might possibly be used in reference to NPS instead of NPT Thread. NPS thread –National Pipe Straight- is not interchangeable with NPT thread.

### 2.3 G/R/RP - WHITWORTH THREAD (BSPP/BSPT)

The most common types of whitworth thread are:

- BSPP (G) – British Standard Pipe Parallel
- BSPT (R/Rp) – British Standard Tapered Pipe, for pipes and tapered thread.  
An appropriate sealing compound can be used in the thread to ensure a leak-proof joint.

#### BSPP (G)

| Thread size (inch) | Major Diameter (mm) | Minor Diameter (mm) | TPI |
|--------------------|---------------------|---------------------|-----|
| G 1/16"            | 7,723               | 6,561               | 28  |
| G 1/8"             | 9,728               | 8,566               | 28  |
| G 1/4"             | 13,157              | 11,445              | 19  |
| G 3/8"             | 16,662              | 14,950              | 19  |
| G 1/2"             | 20,955              | 18,631              | 14  |
| G 3/4"             | 26,441              | 24,117              | 14  |
| G 1"               | 33,249              | 30,291              | 11  |
| G 2"               | 59,614              | 56,656              | 11  |

#### BSPT (R/Rp)

| Male Thread size (inch) | Female Thread size (inch) | Major Diameter (mm) | Minor Female Diameter (mm) | TPI |
|-------------------------|---------------------------|---------------------|----------------------------|-----|
| R 1/16"                 | Rp 1/16"                  | 7,723               | 6,490                      | 28  |
| R 1/8"                  | Rp 1/8"                   | 9,728               | 8,495                      | 28  |
| R 1/4"                  | Rp 1/4"                   | 13,157              | 11,341                     | 19  |
| R 3/8"                  | Rp 3/8"                   | 16,662              | 14,846                     | 19  |
| R 1/2"                  | Rp 1/2"                   | 20,955              | 18,489                     | 14  |
| R 3/4"                  | Rp 3/4"                   | 26,441              | 23,975                     | 14  |
| R 1"                    | Rp 1"                     | 33,249              | 30,111                     | 11  |
| R 2"                    | Rp 2"                     | 59,614              | 56,476                     | 11  |

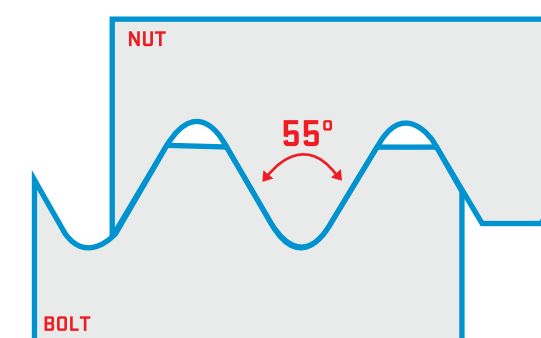
The flank angle is 55°.

BSPP: Female and Male thread are both parallel.

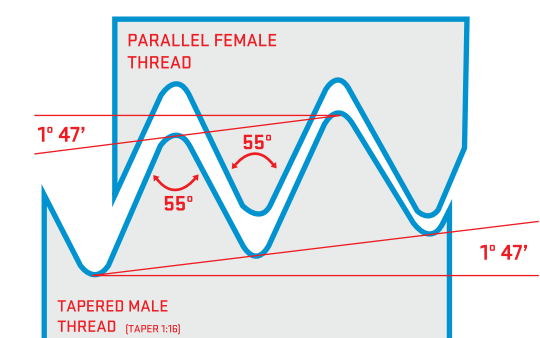
BSPT: Female thread is parallel and male thread is tapered.

- Female thread can also be tapered: Rc, but this is not common.

#### BSPP



#### BSPT



## 2.4 UNC/UNF - UNIFIED NATIONAL THREAD

The most common types of UN (Unified National) thread are:

- UNC – Unified National Coarse Thread, comparable with the ISO metric thread.
- UNF – Unified National Fine Thread.

\*Compared to standard threads (coarse thread), a fine thread has a smaller pitch.

Unified threads come in three different classes:

1A (external) & 1B (internal): for applications where a liberal tolerance is required to permit easy assembly even with slightly nicked threads.

2A (external) & 2B (internal): most commonly used class for general applications

3A (external) & 3B (internal): for applications where closeness of fit and/or accuracy of thread elements are important.

## UNC (2A)

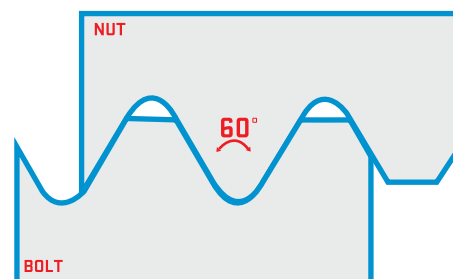
| Nominal Diameter | Major Diameter (mm) | Minor Diameter (mm) | TPI |
|------------------|---------------------|---------------------|-----|
| 1/4" x 20 UNC    | 6,322               | 4,978               | 20  |
| 5/16" x 18 UNC   | 7,907               | 6,401               | 18  |
| 3/8" x 16 UNC    | 9,491               | 7,798               | 16  |
| 7/16" x 14 UNC   | 11,076              | 9,144               | 14  |
| 1/2" x 13 UNC    | 12,661              | 10,592              | 13  |
| 5/8" x 11 UNC    | 15,834              | 13,386              | 11  |
| 3/4" x 10 UNC    | 19,004              | 16,307              | 10  |
| 7/8" x 9 UNC     | 22,176              | 19,177              | 9   |
| 1" x 8 UNC       | 25,349              | 21,971              | 8   |
| 2" x 4,5 UNC     | 50,726              | 44,679              | 4,5 |

## UNF (2A)

| Nominal Diameter | Major Diameter (mm) | Minor Diameter (mm) | TPI |
|------------------|---------------------|---------------------|-----|
| 1/4" x 28 UNF    | 6,325               | 5,360               | 28  |
| 5/16" x 24 UNF   | 7,910               | 6,782               | 24  |
| 3/8" x 24 UNF    | 9,497               | 8,382               | 24  |
| 7/16" x 20 UNF   | 11,079              | 9,728               | 20  |
| 1/2" x 20 UNF    | 12,667              | 11,328              | 20  |
| 5/8" x 18 UNF    | 15,839              | 14,351              | 18  |
| 3/4" x 16 UNF    | 19,012              | 17,323              | 16  |
| 7/8" x 14 UNF    | 22,184              | 20,269              | 14  |
| 1" x 12 UNF      | 25,354              | 23,114              | 12  |

The flank angle is 60°.

Female and Male thread are both parallel.



## 2.5 EXTRA: COMPARISON SHEET (M – BSPP – BSPT – NPT – UNC – UNF)

## UNC (2A)

|               | Metric:<br>Standard/Fine | Inch:<br>BSPP (G)       | BSPT (R)   | NPT        | UNC/UNF                 |
|---------------|--------------------------|-------------------------|------------|------------|-------------------------|
| Type          | Parallel                 | Parallel                | Tapered    | Tapered    | Parallel                |
| Flank angle   | 60°                      | 55°                     | 55°        | 60°        | 60°                     |
| Thread angle  | 0°                       | 0°                      | 1°47'      | 1°47'      | 0°                      |
| Seal location | O-ring/ Gasket/<br>Cone  | O-ring/ Gasket/<br>Cone | On threads | On threads | O-ring/ Gasket/<br>Cone |

## Major Diameter (mm):

|       | BSPP (G) | BSPT (R/Rp) | NPT    | UNC    | UNF    |
|-------|----------|-------------|--------|--------|--------|
| 1/16" | 7,723    | 7,723       | 7,938  |        |        |
| 1/8"  | 9,728    | 9,728       | 10,287 |        |        |
| 1/4"  | 13,157   | 13,157      | 13,716 | 6,322  | 6,325  |
| 3/8"  | 16,662   | 16,662      | 17,145 | 9,491  | 9,497  |
| 1/2"  | 20,955   | 20,955      | 21,336 | 12,661 | 12,667 |
| 3/4"  | 26,441   | 26,441      | 26,670 | 19,004 | 19,012 |
| 1"    | 33,249   | 33,249      | 33,401 | 25,349 | 25,354 |
| 2"    | 59,614   | 59,614      | 60,325 | 50,726 | -      |

## Minor Diameter (mm):

|       | BSPP (G) | BSPT (R/Rp) | UNC    | UNF    |
|-------|----------|-------------|--------|--------|
| 1/16" | 6,561    | 6,490       |        |        |
| 1/8"  | 8,566    | 8,495       |        |        |
| 1/4"  | 11,445   | 11,341      | 4,978  | 5,360  |
| 3/8"  | 14,950   | 14,846      | 7,798  | 8,382  |
| 1/2"  | 18,631   | 18,489      | 10,592 | 11,328 |
| 3/4"  | 24,117   | 23,975      | 16,307 | 17,323 |
| 1"    | 30,291   | 30,111      | 21,971 | 23,114 |
| 2"    | 56,656   | 56,476      | 44,679 | -      |

## TPI (Treads per inch):

|       | BSPP (G) | BSPT (R/Rp) | NPT  | UNC | UNF |
|-------|----------|-------------|------|-----|-----|
| 1/16" | 28       | 28          | 27   |     |     |
| 1/8"  | 28       | 28          | 27   |     |     |
| 1/4"  | 19       | 19          | 18   | 20  | 28  |
| 3/8"  | 19       | 19          | 18   | 16  | 24  |
| 1/2"  | 14       | 14          | 14   | 13  | 20  |
| 3/4"  | 14       | 14          | 14   | 10  | 16  |
| 1"    | 11       | 11          | 11,5 | 8   | 12  |
| 2"    | 11       | 11          | 11,5 | 4,5 | -   |



Male thread

| D (mm) | pitch (mm) | TPI (threads per inch) | BSP (BSPP & BSPT) | Metric fine | NPT | UN/JIC/SAE (Thread class 2) |
|--------|------------|------------------------|-------------------|-------------|-----|-----------------------------|
| 9,73   |            | 28                     | 1/8               |             |     |                             |
| 9,97   | 1          |                        |                   | M10x1       |     |                             |
| 10,29  |            | 27                     |                   |             | 1/8 |                             |
| 11,11  |            | 20                     |                   |             |     | 7/16-20 UNF                 |
| 11,97  | 1,5        |                        |                   | M12x1,5     |     |                             |
| 12,70  |            | 20                     |                   |             |     | 1/2-20 UNF                  |
| 13,16  |            | 19                     | 1/4               |             |     |                             |
| 13,72  |            | 18                     |                   |             | 1/4 |                             |
| 13,97  | 1,5        |                        |                   | M14x1,5     |     |                             |
| 14,29  |            | 18                     |                   |             |     | 9/16-18 UNF                 |
| 15,88  |            | 18                     |                   |             |     | 5/8-18 UNF                  |
| 15,97  | 1,5        |                        |                   | M16x1,5     |     |                             |
| 16,66  |            | 19                     | 3/8               |             |     |                             |
| 17,15  |            | 18                     |                   |             | 3/8 |                             |
| 17,46  |            | 16                     |                   |             |     | 11/16-16 UN                 |
| 17,97  | 1,5        |                        |                   | M18x1,5     |     |                             |
| 19,05  |            | 16                     |                   |             |     | 3/4-16 UNF                  |
| 19,97  | 1,5        |                        |                   | M20x1,5     |     |                             |
| 20,64  |            | 16                     |                   |             |     | 13/16-16 UNF                |
| 20,96  |            | 14                     | 1/2               |             |     |                             |
| 21,34  |            | 14                     |                   |             | 1/2 |                             |
| 21,97  | 1,5        |                        |                   | M22x1,5     |     |                             |
| 22,23  |            | 14                     |                   |             |     | 7/8-14 UNF                  |
| 23,97  | 1,5        |                        |                   | M24x1,5     |     |                             |
| 25,40  |            | 12                     |                   |             |     | 1-12 UN                     |
| 25,97  | 1,5        |                        |                   | M26x1,5     |     |                             |
| 26,44  |            | 14                     | 3/4               |             |     |                             |
| 26,67  |            | 14                     |                   |             | 3/4 |                             |
| 26,96  | 2          |                        |                   | M27x2       |     |                             |
| 26,99  |            | 12                     |                   |             |     | 1 1/16-12 UN                |
| 26,99  |            | 16                     |                   |             |     | 1 1/16-16 UN                |

Male thread

| D (mm) | pitch (mm) | TPI (threads per inch) | BSP (BSPP & BSPT) | Metric fine | NPT   | UN/JIC/SAE (Thread class 2) |
|--------|------------|------------------------|-------------------|-------------|-------|-----------------------------|
| 29,96  | 1,5        |                        |                   | M30x1,5     |       |                             |
| 29,96  | 2          |                        |                   | M30x2       |       |                             |
| 30,16  |            | 12                     |                   |             |       | 1 3/16-12 UN                |
| 32,96  | 2          |                        |                   | M33x2       |       |                             |
| 33,25  |            | 11                     | 1                 |             |       |                             |
| 33,34  |            | 12                     |                   |             |       | 1 5/16-12 UN                |
| 33,40  |            | 11,5                   |                   |             | 1     |                             |
| 35,96  | 2          |                        |                   | M36x2       |       |                             |
| 36,51  |            | 12                     |                   |             |       | 1 7/16-12 UN                |
| 37,96  | 1,5        |                        |                   | M38x1,5     |       |                             |
| 41,28  |            | 12                     |                   |             |       | 1 5/8-12 UN                 |
| 41,91  |            | 11                     | 1 1/4             |             |       |                             |
| 41,96  | 1,5        |                        |                   | M42x1,5     |       |                             |
| 41,96  | 2          |                        |                   | M42x2       |       |                             |
| 42,16  |            | 11,5                   |                   |             | 1 1/4 |                             |
| 42,86  |            | 12                     |                   |             |       | 1 11/16-12 UN               |
| 44,96  | 1,5        |                        |                   | M45x1,5     |       |                             |
| 44,96  | 2          |                        |                   | M45x2       |       |                             |
| 47,63  |            | 12                     |                   |             |       | 1 7/8-12 UN                 |
| 47,80  |            | 11                     | 1 1/2             |             |       |                             |
| 47,96  | 2          |                        |                   | M48x2       |       |                             |
| 48,26  |            | 11,5                   |                   |             | 1 1/2 |                             |
| 50,80  |            | 12                     |                   |             |       | 2-12 UN                     |
| 51,96  | 1,5        |                        |                   | M52x1,5     |       |                             |
| 51,96  | 2          |                        |                   | M52x2       |       |                             |
| 59,61  |            | 11                     | 2                 |             |       |                             |
| 60,33  |            | 11,5                   |                   |             | 2     |                             |
| 63,50  |            | 12                     |                   |             |       | 2 1/2-12 UN                 |
| 64,96  | 2          |                        |                   | M65x2       |       |                             |

Female thread

| D (mm) | pitch (mm) | TPI (threads per inch) | BSP (BSPP & BSPT) | Metric fine | NPT | UN/JIC/SAE (Thread class 2) |
|--------|------------|------------------------|-------------------|-------------|-----|-----------------------------|
| 8,54   |            | 27                     |                   |             | 1/8 |                             |
| 8,57   |            | 28                     | 1/8               |             |     |                             |
| 8,92   | 1          |                        |                   | M10x1       |     |                             |
| 9,73   |            | 20                     |                   |             |     | 7/16-20 UNF                 |
| 10,38  | 1,5        |                        |                   | M12x1,5     |     |                             |
| 11,07  |            | 18                     |                   |             | 1/4 |                             |
| 11,33  |            | 20                     |                   |             |     | 1/2-20 UNF                  |
| 11,45  |            | 19                     | 1/4               |             |     |                             |
| 12,38  | 1,5        |                        |                   | M14x1,5     |     |                             |
| 12,75  |            | 18                     |                   |             |     | 9/16-18 UNF                 |
| 14,35  |            | 18                     |                   |             |     | 5/8-18 UNF                  |
| 14,38  | 1,5        |                        |                   | M16x1,5     |     |                             |
| 14,49  |            | 18                     |                   |             | 3/8 |                             |
| 14,95  |            | 19                     | 3/8               |             |     |                             |
| 15,75  |            | 16                     |                   |             |     | 11/16-16 UN                 |
| 16,38  | 1,5        |                        |                   | M18x1,5     |     |                             |
| 17,32  |            | 16                     |                   |             |     | 3/4-16 UNF                  |
| 17,90  |            | 14                     |                   |             | 1/2 |                             |
| 18,38  | 1,5        |                        |                   | M20x1,5     |     |                             |
| 18,63  |            | 14                     | 1/2               |             |     |                             |
| 18,92  |            | 16                     |                   |             |     | 13/16-16 UN                 |
| 20,27  |            | 14                     |                   |             |     | 7/8-14 UNF                  |
| 20,38  | 1,5        |                        |                   | M22x1,5     |     |                             |
| 22,38  | 1,5        |                        |                   | M24x1,5     |     |                             |
| 23,11  |            | 12                     |                   |             |     | 1-12 UNF                    |
| 23,21  |            | 14                     |                   |             | 3/4 |                             |
| 24,12  |            | 14                     | 3/4               |             |     |                             |
| 24,38  | 1,5        |                        |                   | M26x1,5     |     |                             |
| 24,69  |            | 12                     |                   |             |     | 1 1/16-12 UN                |
| 24,84  | 2          |                        |                   | M27x2       |     |                             |
| 25,27  |            | 16                     |                   |             |     | 1 1/16-16 UN                |

Female thread

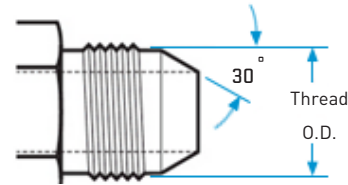
| D (mm) | pitch (mm) | TPI (threads per inch) | BSP (BSPP & BSPT) | Metric fine | NPT   | UN/JIC/SAE (Thread class 2) |
|--------|------------|------------------------|-------------------|-------------|-------|-----------------------------|
| 27,84  | 2          |                        |                   | M30x2       |       |                             |
| 27,86  |            | 12                     |                   |             |       | 1 3/16-12 UN                |
| 28,38  | 1,5        |                        |                   | M30x1,5     |       |                             |
| 29,15  |            | 11,5                   |                   |             | 1     |                             |
| 30,29  |            | 11                     | 1                 |             |       |                             |
| 30,84  | 2          |                        |                   | M33x2       |       |                             |
| 31,04  |            | 12                     |                   |             |       | 1 5/16-12 UN                |
| 33,84  | 2          |                        |                   | M36x2       |       |                             |
| 34,21  |            | 12                     |                   |             |       | 1 7/16-12 UN                |
| 36,38  | 1,5        |                        |                   | M38x1,5     |       |                             |
| 37,87  |            | 11,5                   |                   |             | 1 1/4 |                             |
| 38,95  |            | 11                     | 1 1/4             |             |       |                             |
| 38,99  |            | 12                     |                   |             |       | 1 5/8-12 UN                 |
| 39,84  | 2          |                        |                   | M42x2       |       |                             |
| 40,38  | 1,5        |                        |                   | M42x1,5     |       |                             |
| 40,56  |            | 12                     |                   |             |       | 1 11/16-12 UN               |
| 42,84  | 2          |                        |                   | M45x2       |       |                             |
| 43,38  | 1,5        |                        |                   | M45x1,5     |       |                             |
| 43,49  |            | 11,5                   |                   |             | 1 1/2 |                             |
| 44,85  |            | 11                     | 1 1/2             |             |       |                             |
| 45,34  |            | 12                     |                   |             |       | 1 7/8-12 UN                 |
| 45,84  | 2          |                        |                   | M48x2       |       |                             |
| 48,51  |            | 12                     |                   |             |       | 2-12 UN                     |
| 49,84  | 2          |                        |                   | M52x2       |       |                             |
| 50,38  | 1,5        |                        |                   | M52x1,5     |       |                             |
| 56,66  |            | 11                     | 2                 |             |       |                             |
| 57,63  |            | 11,5                   |                   |             | 2     |                             |
| 61,21  |            | 12                     |                   |             |       | 2 1/2-12 UN                 |
| 62,84  | 2          |                        |                   | M65x2       |       |                             |



## 3.1 FREQUENTLY ASKED QUESTIONS

## 3.1.1 HOW TO IDENTIFY THREAD TYPES?

1. Determine if the thread is male or female (visual inspection)?
2. Determine if the thread is tapered or straight/parallel (visual inspection)?
  - Check: Measure the thread with a calliper at the beginning and the end, if it is the same value the thread is straight/parallel.
3. Measure the thread diameter (male: major diameter, female: minor diameter).
  - The diameter measurement obtained in this step may not be exactly the same as the listed nominal size for the given thread. The main reason for this variation is industry or manufacturing tolerances.
4. Determine the thread pitch.
  - Easiest with the use of a pitch gauge.
5. Identify the end connection.
  - Most common angles: 30°, 37° and 45°.



## Thread identification example

According to the mentioned method:

1. The fitting is visibly male.
2. The thread is visibly straight.
3. The measured diameter is 26,4 mm (this can be easily converted: inches decimal x 25,4 = mm).
4. Threads per inch (TPI): 14
  - When you are not sure, you can search the threading table for a matching diameter and find the possible thread pitches. (For example UNC and UNF have 'the same diameter' but the TPI is different 20 or 28).
5. Not applicable.  
Result: G3/4 male thread.

## 3.1.2 WHAT DOES NPTF STAND FOR: FEMALE, FINE OR FUEL?

NPTF stands for National Pipe Taper Fuel. This could be male or female. NPTF is designed to provide a more leak-free seal without the use of teflon tape or other sealant compound. A common mistake is to assume that NPTF stands for NPT female or NPT fine. NPT fine does not exist.

## 3.1.3 WHICH FEMALE THREADS ARE TAPERED/CONICAL?

Most common used tapered internal threads:

- NPT
- BSPT: Rc

## 3.1.4 WHAT IS THE DIFFERENCE BETWEEN G-THREAD (BSPP) AND R-THREAD (BSPT)?

BSPT thread is tapered when we speak about male thread (R), but the female thread can be tapered (Rc) or parallel (Rp). BSPP thread is parallel, male and female (G).

What is the difference then between female parallel Rp-thread and female parallel G-thread?

G-threads have a parallel shape in accordance with the DIN-EN-ISO 228-1 standard.

Rp-threads have a parallel shape in accordance with the ISO 7-1 and DIN-EN 10226-1 standard.

In the case of a thread of size 1/8", for example, the threads are specified as G1/8 or R1/8.

Male G-threads (parallel) can only be screwed into female G-threads.

Male R-threads (tapered) can be screwed into female G or R-threads.

The following table shows the internal minimum thread diameter, with the upper deviation.

## G - WITHWORTH PIPE THREAD

## RP - WITHWORTH PIPE THREAD

| ø       | TPI | ø       | Drill - øB | Nut Thread minor ø Min | Nut Thread minor ø Max | ø        | TPI | ø       | Drill - øB | Nut Thread minor ø Min | Nut Thread minor ø Max |
|---------|-----|---------|------------|------------------------|------------------------|----------|-----|---------|------------|------------------------|------------------------|
| G 1/16  | 28  | 7.723   | 6.80       | 6.516                  | 6.843                  | Rp 1/16  | 28  | 7.723   | 6.55       | 6.490                  | 6.632                  |
| G 1/8   | 28  | 9.728   | 8.80       | 8.566                  | 8.848                  | Rp 1/8   | 28  | 9.728   | 8.60       | 8.495                  | 8.637                  |
| G 1/4   | 19  | 13.157  | 11.80      | 11.445                 | 11.890                 | Rp 1/4   | 19  | 13.157  | 11.50      | 11.341                 | 11.549                 |
| G 3/8   | 19  | 16.662  | 15.25      | 14.950                 | 15.395                 | Rp 3/8   | 19  | 16.662  | 15.00      | 14.846                 | 15.054                 |
| G 1/2   | 14  | 20.955  | 19.00      | 18.631                 | 19.172                 | Rp 1/2   | 14  | 20.955  | 18.50      | 18.489                 | 18.773                 |
| G 5/8   | 14  | 22.911  | 21.00      | 20.587                 | 21.128                 |          |     |         |            |                        |                        |
| G 3/4   | 14  | 26.441  | 24.50      | 24.117                 | 24.658                 | Rp 3/4   | 14  | 29.441  | 24.00      | 23.975                 | 24.259                 |
| G 7/8   | 14  | 30.201  | 28.25      | 27.877                 | 28.418                 |          |     |         |            |                        |                        |
| G 1     | 11  | 33.249  | 30.75      | 30.291                 | 30.931                 | Rp 1     | 11  | 33.249  | 30.25      | 30.111                 | 30.471                 |
| G 1.1/8 | 11  | 37.897  | 35.50      | 34.939                 | 35.579                 |          |     |         |            |                        |                        |
| G 1.1/4 | 11  | 41.910  | 39.50      | 38.952                 | 39.592                 | Rp 1.1/4 | 11  | 41.910  | 39.00      | 38.772                 | 39.132                 |
| G 1.3/8 | 11  | 44.320  | 42.00      | 41.365                 | 42.005                 |          |     |         |            |                        |                        |
| G 1.1/2 | 11  | 47.803  | 45.25      | 44.845                 | 45.485                 | Rp 1.1/2 | 11  | 47.803  | 45.00      | 44.665                 | 45.025                 |
| G 1.3/4 | 11  | 53.746  | 51.10      | 50.788                 | 51.428                 |          |     |         |            |                        |                        |
| G 2     | 11  | 59.614  | 57.00      | 56.656                 | 57.296                 | Rp 2     | 11  | 59.614  | 56.50      | 56.476                 | 56.836                 |
| G 2.1/4 | 11  | 65.710  | 63.10      | 62.752                 | 63.392                 |          |     |         |            |                        |                        |
| G 2.1/2 | 11  | 75.184  | 73.00      | 72.226                 | 72.866                 | Rp 2.1/2 | 11  | 75.184  | 72.25      | 72.083                 | 72.443                 |
| G 2.3/4 | 11  | 81.534  | 79.00      | 78.576                 | 79.216                 |          |     |         |            |                        |                        |
| G 3     | 11  | 87.884  | 85.50      | 84.926                 | 85.566                 | Rp 3     | 11  | 87.884  | 85.00      | 84.783                 | 85.143                 |
| G 3.1/2 | 11  | 100.330 | 98.00      | 97.327                 | 98.012                 |          |     |         |            |                        |                        |
| G 4     | 11  | 113.030 | 110.50     | 110.072                | 110.712                | Rp 4     | 11  | 113.030 | 110.00     | 109.860                | 110.289                |

The tolerances on the pitch diameter of the internal G-threads correspond to the 'positive' deviation of the diameter tolerances in ISO 7-1, with the exception of those for thread sizes 1/16, 1/8, 1/4 and 3/8, for which slightly higher values are specified.

#### INTERNAL G-THREAD

| Designation of thread | Number of threads in 25.4 mm | Pitch | Tolerance on pitch diameter     |                                 | Thread size | Equivalent diametral tolerance on parallel internal threads<br>mm |
|-----------------------|------------------------------|-------|---------------------------------|---------------------------------|-------------|-------------------------------------------------------------------|
|                       |                              |       | Internal thread lower deviation | Internal thread Upper deviation |             |                                                                   |
| 1/16                  | 28                           | 0.907 | 0                               | +0.107                          | 1/16        | +/-0.071                                                          |
| 1/8                   | 28                           | 0.907 | 0                               | +0.107                          | 1/8         | +/-0.071                                                          |
| 1/4                   | 19                           | 1.337 | 0                               | +0.125                          | 1/4         | +/-0.104                                                          |
| 3/8                   | 19                           | 1.337 | 0                               | +0.125                          | 3/8         | +/-0.104                                                          |
| 1/2                   | 14                           | 1.814 | 0                               | +0.142                          | 1/2         | +/-0.142                                                          |
| 5/8                   | 14                           | 1.814 | 0                               | +0.142                          |             |                                                                   |
| 3/4                   | 14                           | 1.814 | 0                               | +0.142                          | 3/4         | +/-0.142                                                          |
| 7/8                   | 14                           | 1.814 | 0                               | +0.142                          |             |                                                                   |
| 1                     | 11                           | 2.309 | 0                               | +0.180                          | 1           | +/-0.180                                                          |
| 1 1/8                 | 11                           | 2.309 | 0                               | +0.180                          |             |                                                                   |
| 1 1/4                 | 11                           | 2.309 | 0                               | +0.180                          | 1 1/4       | +/-0.180                                                          |
| 1 1/2                 | 11                           | 2.309 | 0                               | +0.180                          | 1 1/2       | +/-0.180                                                          |
| 1 3/4                 | 11                           | 2.309 | 0                               | +0.180                          |             |                                                                   |
| 2                     | 11                           | 2.309 | 0                               | +0.180                          | 2           | +/-0.180                                                          |

The combination of an external parallel thread G, tolerance A or B in accordance with DIN-EN-ISO 228-1 with an internal parallel thread Rp in accordance with ISO 7-1, needs special consideration. When it is necessary to have this combination, the positive or negative tolerance of the internal thread in accordance with ISO 7-1 shall be considered in the relevant product standards, where external parallel thread G are used.

**Never try to mate a BSP fitting with an NPT (or NPS) fitting if the pressure holding capability is at all critical.**

#### 3.1.5 CAN I USE AN O-RING SEALING WITH NPT THREAD?

Sealing NPT thread with an o-ring is impossible. NPT thread is tapered thread and should screw in only partway. Therefore, the sealing itself is realized directly on the thread, with PTFE tape or a liquid sealant.

#### 3.1.6 ARE NPT AND BSP PIPE THREADS COMPATIBLE?

While NPT threads are common in the United States, BSP threads are widely used in many other countries. NPT/NPS and BSP threads are not compatible due to the differences in their thread forms, and not just the fact that most diametrical sizes have a different pitch. NPT/NPS threads have a 60° included angle and have flattened peaks and valleys; BSP threads have a 55° included angle and have rounded peaks and valleys. (Sometimes 1/2" and 3/4" NPT and BSP threads are combined, because they are very close in design, they have the same pitch).

**Never try to mate a BSP fitting with an NPT (or NPS) fitting if the pressure holding capability is at all critical.**

| Pipe Size | Pitch (Threads/Inch) |     |
|-----------|----------------------|-----|
|           | NPT/NPS              | BSP |
| 1/16"     | 27                   | --- |
| 1/8"      | 27                   | 28  |
| 1/4"      | 18                   | 19  |
| 3/8"      | 18                   | 19  |
| 1/2"      | 14                   | 14  |
| 5/8"      | ---                  | 14  |
| 3/4"      | 14                   | 14  |
| 1"        | 11 1/2               | 11  |

#### 3.1.7 WHAT IS SCREW/NUT GALLING AND HOW CAN IT BE AVOIDED?

Galling occurs when two like metals rub against each other. As the metals heat up from friction, the molecules of each bind together, eventually causing failure as the surfaces weld together. The higher the speed and the higher the pressure, the more likely this is to occur. Often different kind of fasteners, such as those made of stainless steel, aluminium and titanium are most likely to be subject to galling when tightened. Galling can be avoided by good lubrication, by using PTFE tape and by using brass or plastic nuts instead of for example stainless steel nuts. Metal-to-metal contacts are appropriate for low duty cycles or when good lubrication can be supplied, otherwise, stainless steel nuts running on stainless steel screws should be avoided.

#### 3.1.8 WHAT KIND OF SEALING METHOD IS RECOMMENDED WHEN MOUNTING A PA/PVDF FITTING WITH MALE TAPERED THREAD INTO A METAL COUNTERPART?

This combination of materials is not ideal and therefore not recommended. However, when this combination is prescribed, our advice is to use PTFE-tape. There is a possibility that a leaktight connection can be achieved without PTFE-tape, but there is a greater chance of damaging the thread on the PA/PVDF coupling. Damaged thread increases the risk of leaks and after removal the fitting must be replaced.

### 3.1.9 WHAT KIND OF THREAD DOES A JIC-FITTING HAVE?

A JIC-fitting -Joint Industry Council- is a type of flare fitting machined with a 37-degree flare seating surface and UNF thread. The flare fittings seal with metal to metal contact between the flared nose of the fitting and the flared tube face in the female connection.

| Fitting size (JIC) | UNF thread |
|--------------------|------------|
| D02                | 5/16x24    |
| D03                | 3/8x24     |
| D04                | 7/16x20    |
| D05                | 1/2x20     |
| D06                | 9/16x18    |
| D07                | 5/8x18     |
| D08                | 3/4x16     |
| D10                | 7/8x14     |
| D12                | 1 1/16x12  |
| D16                | 1 5/16x12  |
| D20                | 1 5/8x12   |
| D24                | 1 7/8x12   |



O-rings



Bonded seals



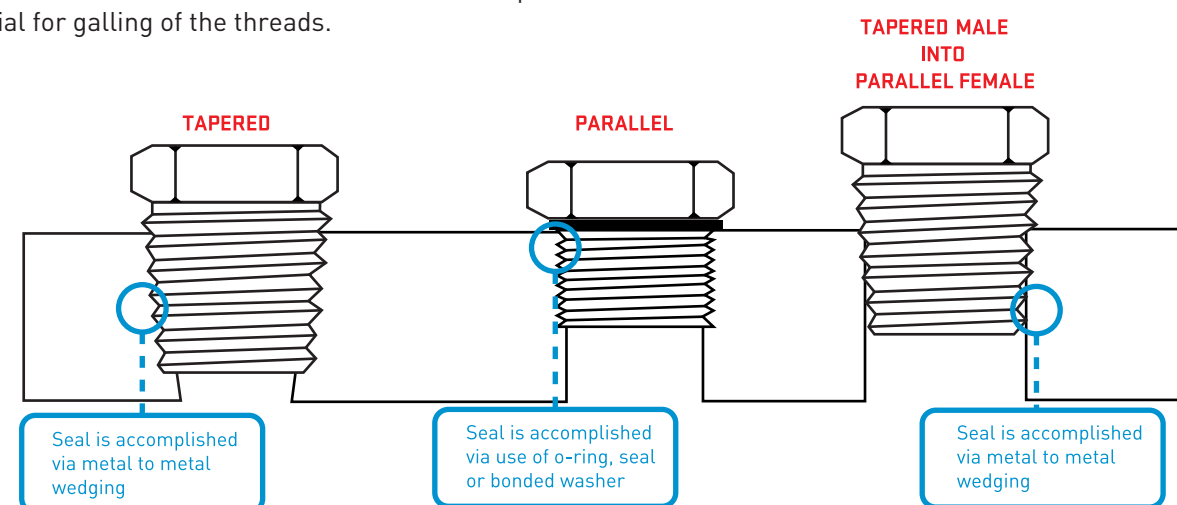
### APPENDIX: CONVERSION FACTOR

|             |                              |
|-------------|------------------------------|
| Length      | 1 inch = 0,0254 m            |
|             | 1 foot = 0,3048 m            |
| Temperature | 1 Fahrenheit = 5/9(°F-32) °C |
| Force       | 1 kgf = 9,81 N               |
| Pressure    | 1 kgf/cm² = 0,0981•10⁶ Pa    |
|             | 1 atm = 0,981 bar            |
|             | 1 lb/in² (psi) = 0,0689 bar  |
|             | 1 cal = 4,187 J              |
|             | 1 kWh = 3,6•10⁶ J            |
|             | 1 kcal/h = 1,163 W           |
|             | 1 pk = 745,5 W               |

### 3.2 THREAD SEAL TYPES

Parallel and tapered threads require different sealing solutions.

When the female thread and the male thread are both parallel an o-ring or bonded seal is often used. O-rings are one of the most common seals, because they are inexpensive, easy to make, reliable and have simple mounting requirements. When the male thread is tapered an o-ring seal can't be used, because the thread can only be screwed in only partially. At Teesing we use PTFE tape or Loctite. Without an additional sealant all tapered threads leak! The sealant reduces the potential for galling of the threads.

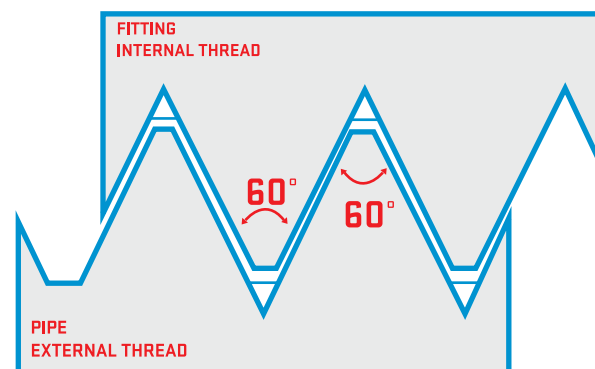
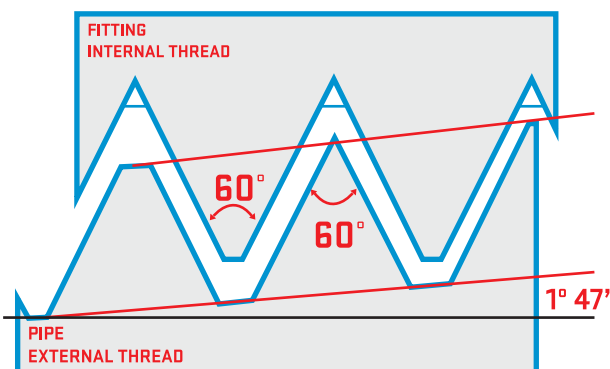


| Inches | Inches decimal | Millimeters |
|--------|----------------|-------------|
| 1/16"  | 0,0625         | 1,588       |
| 1/8"   | 0,125          | 3,175       |
| 1/4"   | 0,25           | 6,350       |
| 3/8"   | 0,375          | 9,525       |
| 1/2"   | 0,5            | 12,700      |
| 3/4"   | 0,75           | 19,050      |
| 1"     | 1              | 25,400      |
| 2"     | 2              | 50,800      |

### APPENDIX: OTHER THREADS

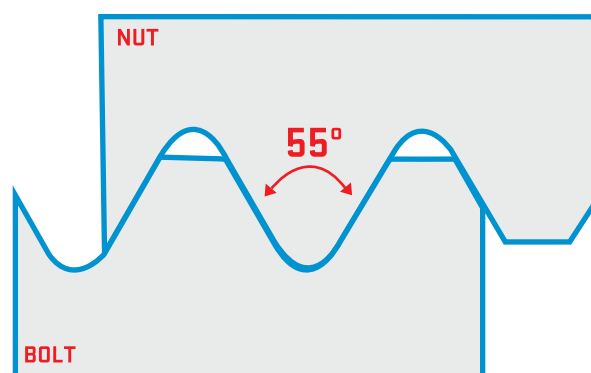
#### Pipe thread

NPSC – NPSF – NPSL – NPSM ANSI B1.20.1-1983



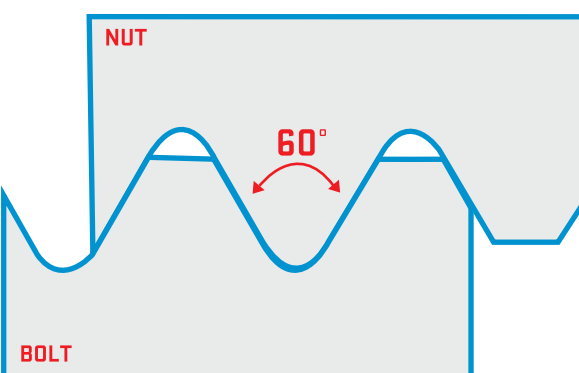
#### Whitworth thread

BSF Fine thread BS 84  
W = BSW Coarse thread BS 84



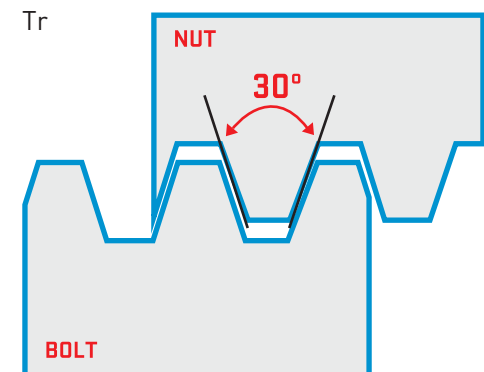
#### UN (Unified National) thread

UNEF Extra Fine thread ANSI B1.1  
UNR ANSI B1.1  
UNS ANSI B1.1



#### Trapezoidal thread

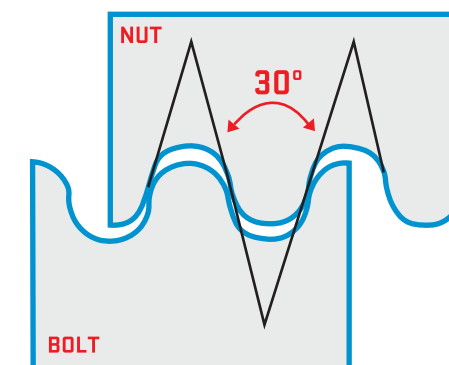
Tr DIN 103



### APPENDIX: OTHER THREADS

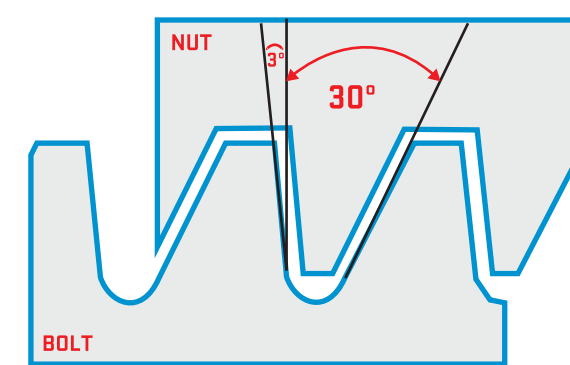
#### Knuckle thread

Rd DIN 405 / DIN 20400



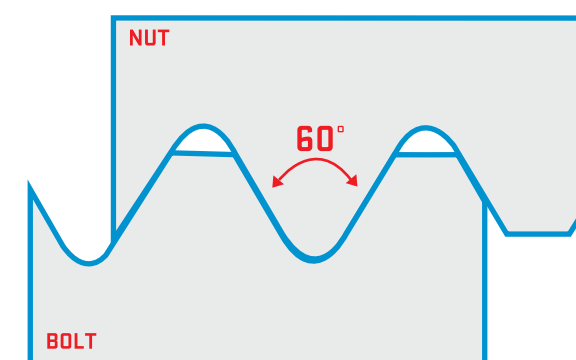
#### Buttress thread

S DIN 513 / DIN 514



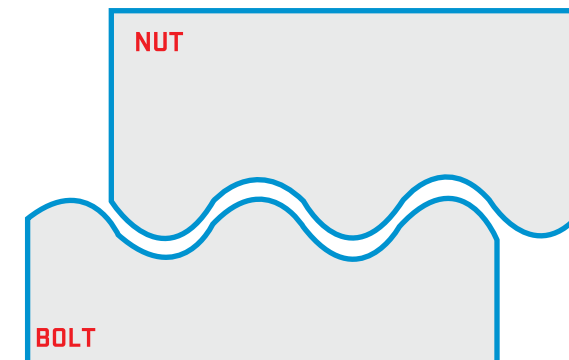
#### Cycle thread

Fg DIN 79012



#### Edison thread

E DIN 40400



Contact our sales engineers to receive detailed product information.  
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