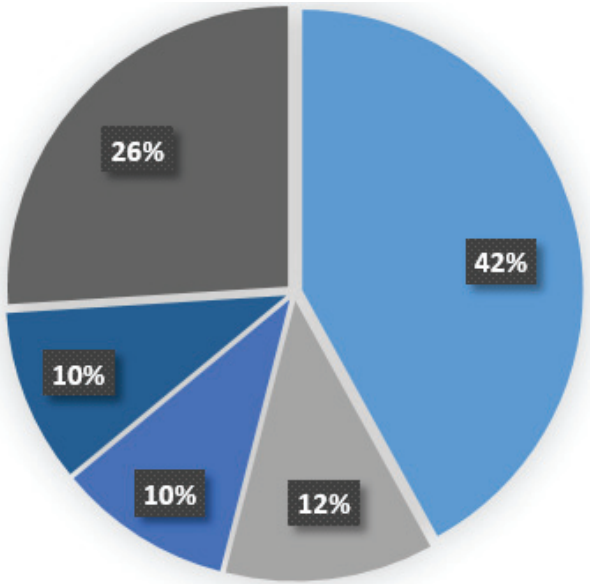
# White paper
# Energy efficiency in pneumatic connections – a technical comparison with conventional thread types


**Increasing energy prices, rising cost pressures and a growing awareness of climate protection have turned energy efficiency into a key business topic. Pneumatic systems offer attractive potential savings in this respect. The key to success lies in taking a comprehensive look at pneumatic systems and their respective components. When we talk pneumatics, we focus on the importance of efficient use of compressed air. There are many ways to save energy and reduce costs in compressed air systems:**

- **Correct component sizing**
- **Reduce the pressure level**
- **Reduce tubing length**
- **Reduce pressure losses and compressed air leakage**

**It is the latter that continues to be an opportunity throughout a systems life-cycle and has the greatest potential savings.**




| | |
|---|---|
| 42% | Locating and eliminating leaks |
| 26% | Design of the pneumatic system including multi pressure network |
| 10% | Waste heat recovery |
| 10% | Compressors with variable motor speed |
| 12% | Other measures |

**Source: "Compressed Air Systems in the European Union" by the Fraunhofer Institute ISL**

**One of the simplest areas that have a direct relationship to compressed air pressure loss and leakage are the pneumatic connections. Pneumatic connections or fittings are available in many different sizes, shapes and thread types. Selected properly, thread types can play a role in a more efficient system design.**

**This white paper contains information on:**

- **Threads for pneumatic connections**
- **A comparison between G-thread and R-thread**
- **Energy savings and cost reduction with G-thread fittings**

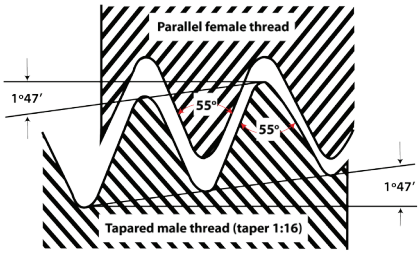
## Threads for pneumatic connections

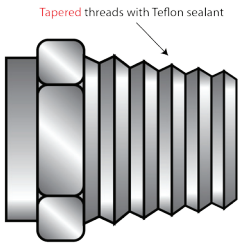
From a global perspective, small or compact pneumatic components are commonly designed with metric (M) type port threads. Usually, this concerns the sizes M3, M5 and increasingly also the size M7. Sizes for metric threads are stated in millimeters [mm]. Larger pneumatic components are commonly designed with Whitworth pipe threads. The size on Whitworth pipe threads are stated in inches. Inch threads in pneumatics start with the size 1/8". These pipe threads are then subdivided into two different designs (G-thread or R-thread). Metric and G male thread fittings are ideal for connecting supply air to pneumatic actuators. Male R thread fittings will also work but due to the tapered design have some disadvantages. Refer to the "Energy savings and cost reduction with G-thread fittings" section of this white paper.


## A comparison between G-thread and R-thread

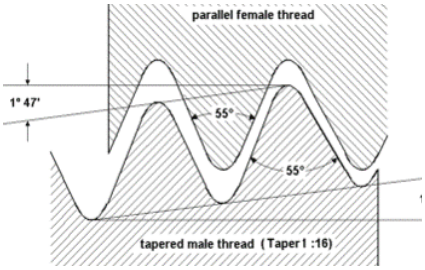
G-threads have a parallel form in accordance with EN-ISO 228-1. R-threads have a tapered form in accordance with EN 10226. In the case of a thread size 1/8", for example, the threads are specified as G1/8 or R1/8.

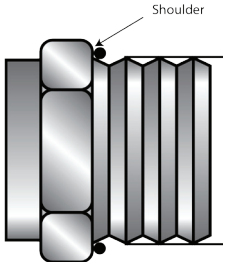
**"R" Thread – ISO 7-1/ British Standard Pipe Tapered** (BSPT): "R" threads are made pressure tight by using the threads (wedging) to make a pressure tight seal. This thread type consists of taper external and parallel internal designs.




**"G" Thread - ISO 228-1/ British Standard Pipe Parallel (BSPP):**
"G" threads are made pressure tight by compressing an appropriate seal between two tightening surfaces (shoulder seal) located outside the thread area. The thread is for holding power only. This thread type consists of parallel internal and parallel external designs.

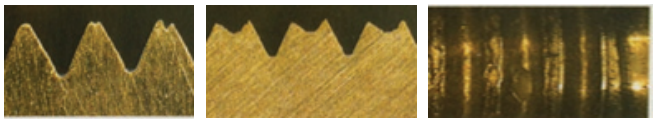


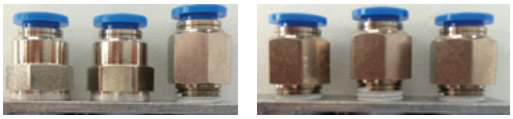
**Rules for Compatibility:**
The following rules must be adhered to when using a combination of G and R-threads: Male G-threads (parallel) can only be screwed into female G-threads. Male R-threads (tapered) can be screwed into female G or R-threads.

## Energy savings and cost reduction with G-thread fittings

| | Features of G-thread fittings | Advantage against R- and NPT-threads fittings | Benefits |
|---|---|---|---|
| **Tightening torque** | It is possible to define a tightening torque. | While tightening an R-thread fitting, you rely on a rule of thumb to find the point, where no leakage would occur. Therefore the probability, that there is no leakage after tightening the fitting, is higher by using a G-thread fitting. | • Reduction of energy costs<br>• Easier to install<br>• Save time during tightening<br>• Reliability, as there is no leakage |
| **Sealing O-ring** | Contrary to R-thread fittings, G-threads fittings seal with a sealing o-ring. | Thread irregularities can be disregarded when using G-thread fittings as the thread compression is not the sole sealing mechanism. **(Fig. 1)** | • Reliability, as there is no leakage<br>• More efficient energy consumption |
| **Repeatability and consistency** | The screw-in depth is consistent and repeatable. | If you tighten a couple of fittings in a row, all have the same height. **(Fig. 2)** | • Better visual appearance<br>• Does not prompt question – Are these all tightened? |
| **Connection with polymer threads** | It is possible to screw a G-thread fittings in polymer. | By using an R-thread fitting in this case, the fitting could destroy the female polymer thread. | • Avoidance of damages<br>• Wider range of applications<br>• Fewer inventory items reduces overhead costs |
| **Multiple uses** | Multiple uses of G-thread fittings are possible. | An R-thread fitting can only be used 4-5 times before the thread is deformed to the point where it is unable to seal properly. | • After several times of un-installing a G-thread fitting, it is possible reuse and seal effectively<br>• Reuse saves money and reduces waste or scrap |



**(Fig. 1)**



**(Fig. 2)**

To summarize, the design of the G-thread provides many features that make it ideal for pneumatic connections. Defined tightening torque, sealing o-rings and repeatability on installation are a few of the features that provide clear performance advantages. These advantages translate into benefits in the areas of energy savings and cost reductions.

## Festo pneumatic fittings available in G thread

Push-in fittings NPQH

Push-in fittings NPQM, metal, standard

Quick Star push-in fittings, mini series QSM ★

Quick Star push-in fittings, standard series QS ★

Quick Star QS-V0, weld spatter resistant