

AN Fittings versus JIC Fittings

AN Fittings :

AN fittings are a [flare fitting](#), using 37° [flared](#) tubing to form a metal-metal seal.

The **AN thread** is a particular type of fitting used to connect flexible hoses and rigid metal tubing that carry fluid. It is a US military-derived specification stemming from a joint standard agreed upon by the Army and Navy, hence AN. The standard is sometimes mistakenly referred to as "Air Force-Navy", but it dates back to World War Two, before there *was* a separate US Air Force.

The fitting featured a 37 degree mating angle which provided superior sealing compared to the common 45 degree fittings and used a higher class of thread quality. Eventually the AN fittings saw widespread military use and a multiple manufacturers began producing the fittings, leading to quality problems. The Joint Industries Council (JIC), an industry organization, sought to standardize the specifications on this type of fitting and created the "JIC" fitting standard, a 37 degree fitting with a slightly lower class of thread quality than the military AN version. The SAE went on to adopt the JIC standard as well. As a result JIC or SAE 37 degree fittings are perfectly interchangeable with AN fittings, and while this may not be acceptable for military aviation use, for automotive use there is no downside other than perhaps mismatched color coordination as JIC fittings are not available in the pretty anodize aluminum colors. However this may be a worthy tradeoff considering the JIC fittings are a fraction of the price of their true "AN" counterparts

The fittings and adapters seal on the seat and cone, and any sealant can cause a poor seat and, therefore, a leak. A lubricating oil should be used instead of a sealant. Only tapered pipe (NPT) threads require a sealant.

AN sizes range from -2 (dash two) to -32 in irregular steps, with each step equating to the OD (outside diameter) of the tubing in 1/16" increments. Therefore, a -8 AN size would be equal to 1/2" OD tube ($8 \times 1/16 = 1/2$). However, this system does not specify the ID (inside diameter) of the tubing because the tube wall can vary in thickness. Each AN size also uses its own standard thread size.

The charts below shows the fitting sizes, the (accepted) equivalent size and the hoses' real inside diameter, and some general uses for the various sizes. Note the General Uses is a guideline only is not meant to be all inclusive; you could use a -32 (2") fuel line if you really wanted to.

When selecting a fitting supplier, each recommend you use only their hoses for their fittings. Also some hoses are to be used with specific type fittings. I suggest you do just that to bypass any fitment or application problems.

Fitting Size	Equivalent - O.D. vs. I.D.	General Uses
-2	1/8" - 0.125	oil pressure/fuel pressure/vacuum
-3	3/16" - 0.188 (5/32" id - .15625)	oil pressure/fuel pressure/vacuum
-4	1/4" - 0.250 (7/32" id - .2185)	oil pressure/fuel pressure/vacuum
-6	3/8" - 0.375 (11/32" id - .34375)	fuel/transmission/power steering
-8	1/2" - 0.500 - (7/16" id - .4375)	power steering/fuel/transmission/heater hose
-10	5/8" - 0.625 (9/16" id - .5625)	fuel/heater hose
-12	3/4" - 0.750 (11/16" id - .6875)	heater/hose
-16	1" - 1.00 - (7/8" id - .875)	
-20	1 1/4" - 1.250 (1 1/8" id - 1.125)	radiator hose
-24	1 1/2" - 1.500 (1 3/8" id - 1.375)	radiator hose
-32	2" - 2.00	radiator hose

Size comparison

AN size	-2	-3	-4	-5	-6	-8	-10	-12	-16	-20	-24	-28	-32
Tube OD (Hose ID)	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1-1/4"	1-1/2"	1-3/4"	2"
SAE thread size	5/16- 24	3/8- 24	7/16- 20	1/2- 20	9/16- 18	3/4- 16	7/8- 14	1-1/16- 12	1-5/16- 12	1-5/8- 12	1-7/8- 12	2-1/4- 12	2-1/2- 12
Pipe thread size (NPT)		1/8- 27	1/4-18		3/8-18	1/2- 14		3/4-14					

JIC Fittings:

JIC fittings, or [SAE J514](#), or MIL-F-18866, are a type of [flare fitting](#) having 37-degree flare seating surfaces and are widely used in [hydraulic](#) applications. The SAE J514 standard replaces the MS16142 mil-spec standard; some tooling is still listed under the old mil-spec name. JIC fittings are similar in size and threading to [AN](#) fittings. 45-degree flare SAE fittings are similar in thread, but not angle and are not interchangeable.

JIC fitting systems have three components that make a tubing assembly: body, nut, and sleeve, and depend upon metal-to-metal contact between the finished surface of the fitting nose and the inside diameter of the flared tubing to make a seal. Common materials of construction include [stainless steel](#), forging [brass](#), machining brass, [Monel](#), and [nickel-copper](#) alloys.

As the fitting nose is installed on the flared tubing, they are held together by the fitting sleeve, which distributes the [compressing](#) load from the nut as it is threaded onto the fitting body. The sleeve extends to the back of the nut, which provides additional support for the tubing, and reduces longitudinal load on the fitting nose.

What is the difference between aircraft AN and JIC fittings



One of these fittings is 40% weaker than the other, can you tell which one it is?

"AN flare and 37 degree industrial flare function identically. In many cases they appear to be functionally interchangeable, but they are not"

(quote from Parker Aerospace Fitting Solutions Series No.11)

Aircraft AN fittings are manufactured to MIL-F-5509 per AN (Air Force - Navy Aeronautical Standard) and AND (Air Force - Navy Aeronautical Design Standard).

Industrial 37 degree flare fittings are manufactured to meet SAE J514/ISO-8434-2. Straight threads are per MIL-S-8879C now SAE-AS8879.

The most notable difference between these standards are in the threads. AN fittings use a increased root radius thread ("J" thread) and a tighter tolerance (Class 3) to achieve a 40% increase in fatigue strength and 10% increase in shear strength (thread tensile stress area of 110.76 compared to 103.20 mm²). This difference is stated in the thread designation, For example:

AN Fitting: 1/2-20 UNJF-3B

Industrial: 1/2-20 UNF-2B

These two fittings function the same, they look the same, AND the industrial version is much less expensive to manufacturer. The problem is that the industrial version is 40% weaker.

There is a an Airworthiness Directive (90-04-06) involving breaking of the aluminum propeller governor fitting on Lycoming engines. The aluminum AN fitting was used successfully for decades before they started breaking. The justice department brought charges against a company that was selling these fittings as AN when they were in fact industrial. Sometimes the higher strength serves an important purpose.

Aircraft are vibrating structures, much more so than most industrial applications. Vibration fatigues the threads, so aircraft hardware uses a modified thread form and tighter tolerance to increase fatigue strength. This is true not only for AN fittings but also for AN and NAS bolts, and installed hose "B" nut fittings. These aircraft hardware items are also UNJF-3A/3B whereas the industrial is UNF-2A/B.

How do you tell them apart?

You cannot visually see a tolerance or an increased root radius. These are measured with special equipment. Some fittings sold as "AN" are industrial grade.

What about AN marking?

MIL-P-5509D requires that all flared tube fittings and nuts shall be marked with the letters AN or MS and the manufacturer's identification or trademark. Sleeves must be trademarked. Letters AN or MS on sleeves are optional. I have found fittings marked "AN" that do not meet AN tolerances (Class 2 instead of Class 3).

Tapered Pipe Threads

Tapered pipe threads for aerospace are ANPT whereas the commercial version of a tapered pipe thread is NPT. ANPT specifications, formerly MIL-P-7105B are now part of SAE AS571051. ANPT is essentially a NPT thread with extensive testing, gauging, sampling, NDT, and other quality control requirements. ANPT threads are required to meet two additional gaging methods, the L2 and the 6-step.

Inspection

MIL-F-5509D for flared aircraft fittings has extensive quality assurance provisions, including sampling for NDT tests, sampling for destructive tests, Lot identification, and Material Certification, Tensile strength tests, Finish tests.

How can you protect yourself?

Aircraft AN fitting is more expensive so it will not be the least expensive fitting. The least expensive fitting is almost guaranteed to be industrial.

Instead of ordering "AN Fittings" - specify conformance to MIL-F-5509 or specify sizing to UNJF-3B/3A. Purchase from aircraft sources rather than sources that sell industrial/aircraft.

What if it doesn't matter?

It always matters if you order and pay for aircraft "AN" quality and standards and receive something inferior. If you don't need "AN" quality, and the industrial version suits your purpose, then fine. Order as a 37 degree (JIC) or Parker Triple-Lok.

How to inspect?

You can determine if a fitting is an AN fitting and not industrial by seeing if it meets Class 3 (aerospace) size tolerance. Measure the pitch diameter using a thread micrometer. The pitch diameter determines whether the part meets Class 3A (aerospace) or 2A (commercial). An adequate thread micrometer costs approximately \$150.00.

Using AN:

A half-dozen companies make AN fittings, hose, and line and most all of it is interchangeable except for certain proprietary "push on" type hoses and fittings. Always check the manufacturers information before purchasing hose or hose ends to make sure it is compatible. The AN side will always be 37°, it is the hose side that can vary depending on manufacturer designs. AN components come in easy to understand sizes, all divisible by 16 for easy conversion into fractions of one inch. For example, a -8AN (dash 8 AN) hose is 8/16" inner diameter, or 1/2" inch. AN is generally available in -4 to -12, and larger specialty sizes.

When selecting AN you must determine if you need to use hard line or soft line (generally Teflon, rubber, or special material with a steel braided or other protective sheath) or a combination of both. Hard line is not specific to AN, and this can be aluminum or steel and can be sourced from any hardware supply store. In other words 1/2" aluminum tubing is compatible with -8AN fittings. Soft line is AN specific because it needs to mate properly with the hose ends. So please make sure you select the right hose and end fittings that match. When selecting soft line be sure to use hose material that is compatible with the fluid and pressure you plan to run through it.