



DESIGNING INNOVATIVE VACUUM
GAUGES AND CONTROLLERS FOR
OVER 30 YEARS

WHITE PAPER THREADED PIPE CONNECTIONS IN VACUUM SYSTEMS

ABSTRACT: Pipe thread is a universal connection type, and is used extensively in large scale industrial, manufacturing, and medical processes because it is a low cost solution when you need to connect many vacuum systems in sequence. Threaded pipe can provide economical and reliable service if it is properly installed.

A **pipe** is used mainly to convey substances which can flow such as liquids and gases including: slurries, powders, and masses of small solids. Pipe joints are dynamic: they experience vibration, changing pressures and changing temperatures, all of which put stress on threads and lead to leakage and expensive repairs; therefore proper installation is imperative.

PROBLEM: Many times in industrial manufacturing processes, threaded pipe is used with vacuum pumps and rough vacuum systems which are subject to vacuum pressure. Proper pipe installation is even more important when pipe connections are under vacuum pressure. In addition, leaks are not readily apparent because the products used in vacuum systems are in a gaseous state. Leaks that occur in vacuum systems at the connection site are typically so small that only vacuum gauges can identify it. However, by following a few guidelines threaded pipe is an economical option that can be used successfully in vacuum systems—connections can be leak-free in pressures down to 10^{-4} Torr or better.

Leaking Threaded Joint Connections: Although threaded, pipe and pipe fittings also have tapered ends. This facilitates mechanical connection, but it does little for joint sealing. Clockwise assembly of pipe components forces the tapered male ends further into the female threads, and with reasonable torque applied the joints will remain fixed.



Once a pipe connection is firmly seated, further tightening of the joint does little to improve the connection and over tightening rarely fixes a leaking joint.

TYPES OF SEALANTS NOT TO USE IN VACUUM SYSTEMS

Sealant of some form must be applied prior to assembly to make leak-free pipe connections.

Plumbing-type sealants such as pipe 'dope' or liquid Teflon sealants *should not* be used in vacuum systems.

Although reliable for water or positive-pressure installations, *common thread sealants can creep* when used in vacuum piping *causing joints that degrade with use.*

Small pipe joints: Quality thread tape makes a reliable seal and affords easy disassembly if required. Military-grade Teflon tape in narrow-widths such as that available from McMaster-Carr (P# 6802K22) have been used extensively in rough-vacuum with excellent results.

Those who wish to avoid tape or who want a more permanent type of joint should consider a sealant such as Loctite 567 or similar. This type of sealant is anaerobic, which means that the joint seal actually improves in use with reduced system pressures. Apply sealant fully to the male threads (male threads, only) with a firm brush prior to assembly.

Large-diameter pipe fittings of 1" or bigger: Liquid-type sealants are your best choice. Larger fittings have increased thread surface area requiring more torque for assembly, and liquid sealants can help lubricate the joint threads and reduce thread damage or stripped joints. As above, apply sealant to male threads before making connection.

REMEMBER

Pipes nomenclature follows a trade-size convention.

Pipes and fittings are *denoted by interior dimensions* of the pipe, not the measured outside dimensions.



GUIDELINES FOR PROPER THREADED PIPE CONNECTIONS IN VACUUM SYSTEMS TO MAKE RELIABLE, WELL-SEALED JOINTS:

- Use forged, otherwise referred to as 'high pressure' fittings, when available
 - Galvanized or lesser-quality cast pipe and fittings often have a lower-class thread fit which can result in poor connections
- Clean pipe ends and fittings before use, to eliminate 'chips'—which are fragments of metal remaining from the machining process
 - Use a wire brush on male threads and compressed air on female threads
- Use fittings of similar materials when making complex joints, e.g. brass to brass, stainless to stainless, etc
 - Male threads in harder materials such as 316 stainless have a tendency to gall female threads in softer materials such as brass
- Avoid 'breaking' joints once sealed and tightened
 - If the need to loosen a joint arises, completely remove the fitting and re-apply sealant before further assembly.
- For best pumping performance, use pipe sized to that of the pump inlet
 - If you must reduce pipe diameters, keep the reduced plumbing as far downstream from the vacuum pump as possible.

SUMMARY

Many times in industrial manufacturing processes, threaded pipe is used with vacuum pumps and rough vacuum systems which are subject to pressure. Leaks can occur at the point of connection if proper techniques are not followed.

Leaks are not readily apparent and usually so small that only vacuum gauges can identify them.

By following five simple guidelines, threaded pipe is an economical option that can be used successfully in vacuum systems and connections can be leak-free in pressures down to 10^{-4} Torr or better.

Got a vacuum related problem that you would like to solve? Contact Us

We would love to help!