Member of the ELAFLEX Group

Best Practice for NPT Thread Sealing

Investigation Report

Report Date: 12 August 2020
Investigation Number: IR257
Investigated By: Kyle Fetherston

Reason for investigation:
A customer has identified that the thread sealing method used in our instruction manuals differs from what they use and asked if we could advise on the best practice for sealing Stainless Steel NPT threads.

Investigation Summary
The investigation and testing have demonstrated that a correctly tightened NPT fitting with correctly applied PTFE Thread tape provides adequate sealing at temperatures from -40°C to +85°C, at pressures up to 410 bar. It can also be repositioned slightly without leakage occurring and pressurised immediately after installation.

PTFE thread tape also provides suitable lubrication to prevent galling in stainless steel threads, provided it is applied in such a way that it covers all the threads of the male fitting. If galling is still a concern, or tape will not be applied to all threads, a thread sealant with PTFE such as Loctite 567 may be applied over the top of the tape.

Where practicable, yellow, gas rated, PTFE tape should be used in CNG systems. The higher density of gas rated PTFE tape provides the peace of mind that the threads are adequately sealed, and its yellow colouring provides a recognisable sign that the fitting is carrying natural gas.

Investigation Results:
From talking to companies, and searching websites and online forums, it appears that most fitters use the method that was taught to them by the person who trained them.

Some fitters recommend using tape only, some recommend anaerobic sealant or dope only. Some recommend dope over tape, tape over dope, or dope, followed by tape, followed by dope.

The general consensus seems to be “We do it this way because we always have, and it works”.

Articles retrieved from the websites of Plant Engineering, Australian Mining and Luoke Adhesives all state that PTFE tape is designed for the lubrication of threads, rather than sealing, and that for NPT threads carrying high pressure gas, anaerobic thread sealant is recommended.

One of our customers stated:

“For the thread sealing, we do it in the sequence you describe, sealant-then-tape-then-sealant. (compressor assembly uses a Loctite thread locker for sealant, the refuelling assembly uses a white PTFE paste for sealant). The other difference is the type of tape used, whether there are stainless steel parts or carbon steel parts. These procedures have been in place for a number of years, but there is certainly room for improvement.”

"Interestingly, after the problems with galling the SS fittings going into the SS Oasis connector body, that you saw, we tried thread tape with some of the Loctite 771 anti-seize compound, and it installed easily and sealed well up to about 6000 psig, so we released the equipment to ship. We are looking into revising our procedure since this appears to be an improvement."

An article written by Paul Fry, from CAC gas and instrumentation states:

"For most speciality gas applications, thread tape is preferred due to the inert nature of the material and there is no need for 'drying time' as there is with liquid sealants."

He goes on the state that the method recommended for tape application is 2-3 winds of tape followed by tightening the fitting finger tight and then finishing by turning another 2-3 full turns with a wrench.

Another customer stated:

"I have used the same system for many years now and have had great results. I start with about 2 wraps of the following Teflon tape: ***McMaster-Carr High-Density Thread Sealant Tape***

I buy it in yellow so I can easily verify that the right tape is being used for high pressure gas. I then apply a LIGHT coat of Loctite 562 paste over the tape.

Finally, Probably the hardest part of making a good seal is to convince my guys not to over-tighten! Especially when working with stainless in ½" or less, the tendency is to over-tighten and once you do, you've got no choice but to throw those parts away and start over."

Articles retrieved from the websites of Plant Engineering, Australian Mining and Luoke Adhesives suggest that Dope is not recommended for high pressures and is known to shrink away from the threads and crack over time and with heat cycling. Also, it does not have the low temperature and lubricating properties of anaerobic sealers. For this reason, the remainder of the report will focus on the use of PTFE tape and/or Anaerobic sealant.

Tape

Tape is generally easier for a technician to carry with them, cheaper and less messy than sealant pastes. It has an infinite shelf life, unlike sealant pastes.

There is information out there which states that tape is essentially only a lubricant, not a sealant (though it does clog the thread, causing some sealing). However, there are many fitters and companies currently using tape who have not witnessed any issues.

From Luoke Adhesives website:
"Strictly speaking, Teflon tape is not a thread sealant. The tape may have the effect of clogging the thread path, but it does not actually adhere to surfaces as a true sealant should. During installation, the tape must be carefully wrapped in the direction of the threads or it unravels and tears."

If using tape, it is best to use a tape that is specified for use with gas, as these are less porous and thicker than liquid sealing tapes.

There are various brands of gas tape. Three readily available examples are:

- AW TITASEAL
- McMaster-Carr High-Density Thread Sealant Tape
- Blue-Monster gas-guard

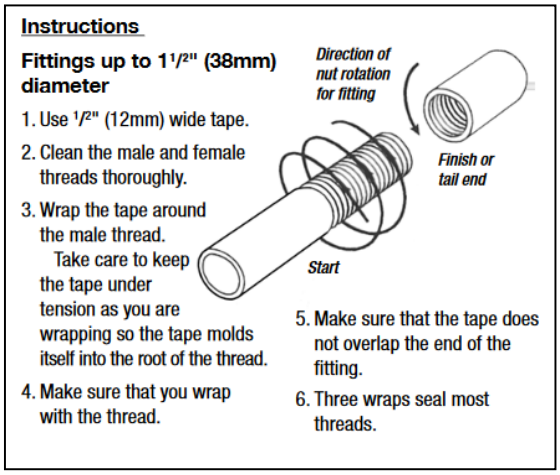
Gas tapes are PTFE of around 0.1mm thickness that has not been pre-stretched and are often coloured yellow to identify that the fittings contain natural gas.

The primary market for these tapes is in natural gas systems for houses. Interestingly, although they all specify different pressure ratings (TITASEAL = 20 bar, Blue-Monster = 300 bar, McMaster-Carr = 690 bar) they are made of the same material and thickness, which suggests that the pressure ratings of thread tape allude only to the pressure that a manufacturer has tested them to, which, given that many tapes are sold for use in home gas lines, is often lower pressure than what is required in NGV's.

This is supported by the fact that the tape tested (AW TITASEAL), though rated to 20 bar, proved to be leak free at 410 bar, at temperatures from -40°C to +85°C.

Thread tape will only seal well if it is correctly applied, and the fitting is correctly tightened. The image below shows the correct method of wrapping with thread sealing tape. 3-4 turns of tape are all that is required.

How to use tape, from the Blue-Monster website:



ASME B1.20.1 does not specify a tightening torque for NPT fittings. This is because the torque applied to correctly tighten an NPT fitting will vary with thread quality, material and which type of sealant is applied. Generally, correct tightening is achieved by first tightening finger tight (until the thread seats), followed by 1.5 – 2.5 full turns with a wrench.

Anaerobic thread sealer

Articles retrieved from the websites of Plant Engineering, Australian Mining and Luoke Adhesives suggest that for NPT threads carrying high pressure fluids such as CNG, the optimum method for thread sealing is an anaerobic, Dimethacrylate Ester based sealant applied to the male thread by itself only with no tape needed.

Often, anaerobic sealants contain lubricants such as PTFE to ensure that fittings remain un-doable by hand tools and minimise the risk of galling. They also eliminate the potential for pieces of thread tape to be applied over the end of the threads, causing them to break off and clog valves and filters.

Some common brands of anaerobic sealant are:

- Loctite – Various compounds for various pipe materials and conditions, LOCTITE 567 was chosen for the testing detailed in this report as it is recommended for stainless steel.
- Swagelok SWAK
- Hernon Dripstop 940
- GASOILA FAS-SEAL ATS

All brands of anaerobic sealant are advertised as being capable of sealing 10000 PSIG after curing.

From the website of Plant Engineering:

Anaerobic resin compounds

Anaerobic resin compounds use a different cure chemistry than solvent-based pipe dopes and do not contain solvents. The cure begins when the sealant is confined within the threads of the metal pipe connection and air is excluded. Without solvent content, the cured material does not shrink or crack, and maintains its sealing properties even after heat aging. Because of their chemistry, anaerobic resin compounds exhibit excellent temperature and solvent resistance.

Advantages. Anaerobic compounds fill the voids between pipe threads, creating a seal (Fig. 2). The compounds cure slowly, providing additional time to make adjustments to pipe system components without damaging the seal. Once cured, the compounds form a strong seal that resists the effects of temperature, pressure, solvents, and vibration. While some sealants produce bonds that make disassembly difficult, joints sealed with anaerobic resins can be taken apart with standard hand tools. Many anaerobic thread sealants contain Teflon or similar lubricants which aid assembly and reduce the potential for damage to pipe system components.

Disadvantages. Because of their chemical composition, compatibility of anaerobic resin compounds with plastic pipe and fittings should be verified before use. Although these compounds cure sufficiently for many immediate uses, a 24-hr period should be observed before activating high-pressure systems or allowing significant shock or vibration. Anaerobic resins can be difficult to remove from clothing or gloves.

Recommended uses. This class of sealants provides the strongest, longest-lasting seal presently available. They are recommended for temperatures up to 300 F, pressures up to 10,000 psi, and where vibration will be encountered. These sealants are the choice when installers must make minor adjustments to a piping system.
— Edited by Joseph L. Foszcz, Senior Editor, 847-390-2699, j.foszcz@cahners.com

From the website of Australian Mining:

Industry giants such as Bechtel Oil, Gas & Chemicals Inc. and Chevron have both realised the benefits of using LOCTITE© anaerobic thread sealants. Chevron sought LOCTITE© 567™ Thread Sealant to prevent the leaking of gasses with simultaneous high gas pressures and high temperatures, resulting in all samples passing the test with no leaks. Similarly, Bechtel required a thread sealant to perform as intended at liquid nitrogen temperatures, finding LOCTITE©565™ Thread Sealant to pass their test with no leaks.

One of the main benefits presented by manufacturers of anaerobic sealants is the ability to reposition the threaded connection within 24 hours after installation without damaging the seal. However, testing has shown that this is not always true.

The main downsides of anaerobic sealant are:

1. The parts to be sealed must be completely clean and free from oils. This is easy to achieve in a test lab but means extra work and extra solvents for a fitter to carry with them in the field.
2. Anaerobic sealant requires 24 hours of curing time before it can effectively seal against high pressure. This is inconvenient for technicians who are wanting to pressure test a system immediately after installation and can lead to costly downtime.
3. Whereas tape will last until the roll runs out, anaerobic sealant has a limited shelf life. In the case of the Loctite 567 which was used for the testing detailed in this report, the shelf life was one year.
4. Anaerobic sealant can be difficult to remove from clothing, tools and threads that need to be cleaned.

The use of an activator is recommended for non-reactive metals such as stainless steel; however, testing revealed that a leak free seal can be achieved with or without the use of the activator. In fact, testing revealed that the activator actually made the joint more susceptible to leakage when repositioned before curing.

Sealant is often criticised for being messier than tape. During testing in the Oasis laboratory, it was noted that the sealant was easy to apply and not particularly messy on application and tightening of the fitting. However, when undoing the fitting and trying to clean it for future use, the sealant proved extremely difficult to remove. A large amount of time and effort was spent returning the fittings to a near-clean condition.

Leakage Testing

Leakage testing was conducted in the Oasis laboratory to compare the following four methods for sealing NPT threads:

1. Gas rated PTFE tape (AW TITASEAL)
2. Anaerobic sealant (Loctite 567)
3. Anaerobic sealant (Loctite 567), with primer applied (Loctite 7649)
4. Anaerobic sealant, followed by PTFE tape, followed by Anaerobic sealant.

A further test was then performed to compare yellow, gas rated PTFE tape to white "plumbers" PTFE tape.

Method of Test

Each sealant was applied to an ½" NPT male thread as per specification (for details see test sheets in *Appendix B*). The fitting was then threaded together until finger tight and tightened a further 1.5 full turns, until "wrench tight".

The fitting was then subjected to the following test conditions:

(Test 1). The fitting was then tested for leakage immediately after connection at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 2). The fitting was then threaded back 1/8th of a turn (within 30min of connection) to simulate the aligning of a valve in the field and tested again for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 3). The fitting was then left for 24 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 4). The fitting was then conditioned at -40°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 5). The fitting was then conditioned at +85°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

Pass Criteria

The fitting is considered to have passed if leakage is less than 20ncc/hr.

Summary of Leakage Testing Results

The testing has shown that all of the methods examined are capable of adequately sealing a ½" NPT fitting to 410 bar at temperatures from -40°C to +85°C. Furthermore, the Anaerobic thread sealant was observed to prevent leakage at the tested pressures before fully cured.

The only leakages occurred when adjusting the fittings sealed with Anaerobic sealant within the first 30 minutes of installation.

The best results were achieved by the fittings sealed with PTFE tape only, and PTFE tape with sealant, suggesting that correctly applied PTFE tape is adequate for sealing NPT threads at the tested temperatures and pressures.

For comparison, the yellow gas rated PTFE tape (12mm wide, 0.1mm thick) was compared to white "plumbers" PTFE tape (12mm wide, 0.075mm thick). Both were observed to seal a 1" NPT fitting to 410 bar at room temperature. (See test sheet in *Appendix B* for details).

Galling Testing

Galling occurs when the increased pressure on the threads of a tightening fitting causes microscopic high points in the male and female threads to lock together, which results in material shearing from the threads.

Stainless steel threads are particularly prone to galling, so care must be taken to provide adequate lubrication when tightening and un-doing them.

Testing of both tape and anaerobic sealant with PTFE was performed in the Oasis Laboratory to determine their effectiveness as lubrication to prevent galling.

Method of Test

Yellow, gas rated PTFE thread tape, White "Plumbers" PTFE tape and Loctite 567 were each applied individually to the male end of a ¾" NPT thread.

The fitting was then threaded together with a female thread until finger tight and tightened a further 1.5-2 full turns, until "wrench tight".

The fitting was then undone, cleaned, inspected for damage, re-wrapped with tape or re-coated with Loctite, and tightened back into the female fitting again. This process was repeated 5 times. Results were recorded in the test sheet in *Appendix B*.

The fittings assembled with PTFE tape both exhibited galling on their first thread. The likely cause of this is that the first thread was not covered when wrapping with tape, to avoid overlapping the end of the fitting with the tape.

To prove this, another test was performed, using yellow, gas rated, PTFE tape. Care was taken to ensure that every thread was covered by the tape. No galling or damage was seen on this fitting. For results, see test sheet in *Appendix B*.

Summary of Galling Test Results

All the tested methods provide adequate protection from galling on stainless steel NPT threads.

When using PTFE tape, galling was evident on any threads not covered by the tape. This highlights the importance of carefully applying thread tape to ensure that all threads are covered, whilst still avoiding overlapping the end of the fitting with tape to avoid the potential for PTFE tape to break off and enter the gas stream.

Appendix A - Photos

Figure 1. AW TITASEAL PTFE thread tape

Figure 2. LOCTITE 567 Anaerobic Sealant


Figure 3. LOCTITE 567 with LOCTITE 7649 primer.


Figure 4. PTFE Thread tape and LOCTITE 567 sealant.

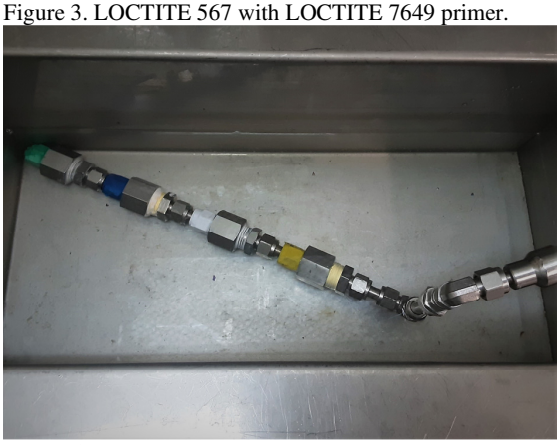


Figure 5. Fittings tested for leakage in water bath.

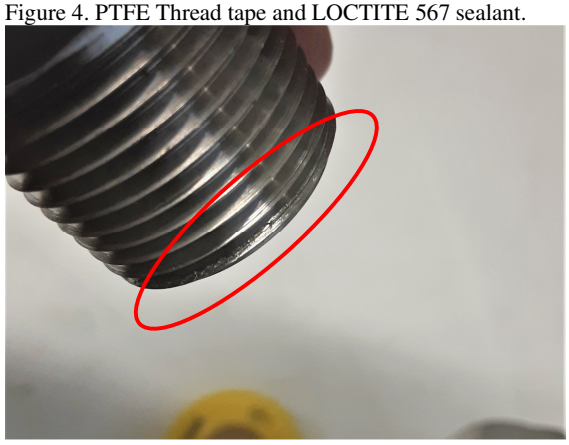


Figure 6. Galling on the first thread (circled) of the fitting after testing with gas-rated PTFE tape. This thread was not covered by the tape.

Figure 7. Tape applied to fitting ensuring coverage of all threads.

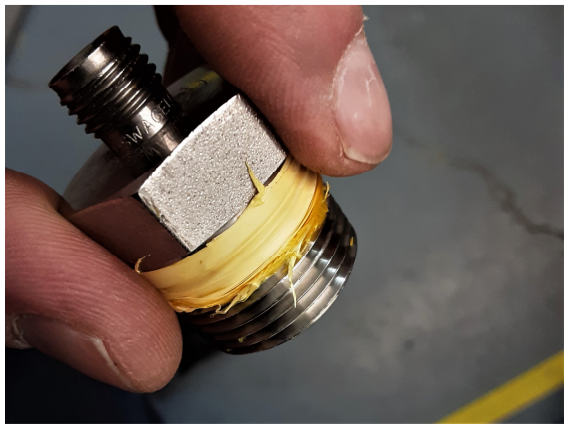


Figure 8. Thread after 5 installations with correctly applied PTFE tape.

Appendix B – Test sheets

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Test Sheet – NPT Thread Sealing with PTFE tape only.

Method of Test

Yellow, gas rated thread tape was applied to the male end of a ½" NPT thread by wrapping it in an anti-clockwise direction 4 times. The fitting was then threaded together until finger tight and tightened a further 1.5 full turns, as this is common practice.

(Test 1). The fitting was then tested for leakage immediately after connection at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 2). The fitting was then threaded back 1/8th of a turn (within 30min of connection) to simulate the aligning of a valve in the field and tested again for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 3). The fitting was then left for 24 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 4). The fitting was then conditioned at -40°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 5). The fitting was then conditioned at +85°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

Pass Criteria

The fitting is considered to have passed if leakage is less than 20ncc/hr.

Thread:	½" NPT	**Sealant:**	Gas rated PTFE tape, 0.1mm thickness

Test No	Gauge No	Pressure (bar)	Temp (°C)	Observations	Pass/ Fail	Test Date
1	SN3056	35-410	14.9	No leakage at all pressures	Pass	25/06/20
2	SN3056	35-410	14.9	No leakage at all pressures	Pass	25/06/20
3	SN3056	35-410	16.8	No leakage at all pressures	Pass	26/06/20
4	SN3056	35-410	-40	No leakage at all pressures	Pass	26/06/20
5	SN3056	35-410	85°C	No leakage at all pressures	Pass	26/06/20

"When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston
Signature:

Reviewed by: Hadyn Noteed
Signature:

Oasis
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Test Sheet – NPT Thread Sealing with Anaerobic sealant.

Method of Test

Loctite 567 pipe sealant was applied to the male end of a ½" NPT thread using the method specified by Loctite. The fitting was then threaded together until finger tight and tightened a further 1.5 turns, as this is common practice.

(Test 1). The fitting was then tested for leakage immediately after connection at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 2). The fitting was then threaded back 1/8th of a turn (within 30min of connection) to simulate the aligning of a valve in the field and tested again for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 3). The fitting was then cleaned and re-sealed (to negate any damage done by the previous testing) and left for 24 hours to cure. It was then tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 4). The fitting was then conditioned at -40°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 5). The fitting was then conditioned at +85°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

Pass Criteria

The fitting is considered to have passed if leakage is less than 20ncc/hr.

Thread:	½" NPT	**Sealant:**	Loctite 567

Test No	Gauge No	Pressure (bar)	Temp (°C)	Observations	Pass/ Fail	Test Date
1	5N3056	35-410	14.9	No leakage at all pressures	Pass	25/06/20
2	5N3056	35-410	14.9	Leakage at more than Failure rate at pressures above 350 bar	Fail	25/06/20
3	5N3056	35-410	16.8	No leakage at all pressures	Pass	26/06/20
4	5N3056	35-410	-40	No leakage at all pressures	Pass	26/06/20
5	5N3056	35-410	85	No leakage at all pressures	Pass	26/06/20

**When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.*

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston Reviewed by: Hayley Wood

Signature: Signature:

Oasis
Member of the ELAFLEX Group

Test Sheet – NPT Thread Sealing with Anaerobic sealant and primer.

Method of Test

Loctite 7649 primer was sprayed onto the male end of a ½" NPT thread using the method specified by Loctite. This was followed by the application of Loctite 567 pipe sealant to the thread, using the method specified by Loctite. The fitting was then threaded together until finger tight and tightened a further 1.5 turns, as this is common practice.

(Test 1). The fitting was then tested for leakage immediately after connection at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 2). The fitting was then threaded back 1/8th of a turn (within 30min of connection) to simulate the aligning of a valve in the field and tested again for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 3). The fitting was then cleaned and re-sealed (to negate any damage done by the previous testing) and left for 24 hours to cure. It was then tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 4). The fitting was then conditioned at -40°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 5). The fitting was then conditioned at +85°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

Pass Criteria

The fitting is considered to have passed if leakage is less than 20ncc/hr.

Thread:	½" NPT	**Sealant:**	Loctite 567 with Loctite 7649 Primer

Test No	Gauge No	Pressure (bar)	Temp (°C)	Observations	Pass/ Fail	Test Date
1	5N3056	35-410	14.9	No Leakage at all pressures	Pass	25/06/20
2	5N3056	35-410	14.9	Leakage at higher than Failure rate from 35-410 bar. Leakage increased with pressure.	Fail	25/06/20
3	5N3056	35-410	16.8	No Leakage at all pressures	Pass	26/06/20
4	5N3056	35-410	-40	No leakage at all pressures	Pass	26/06/20
5	5N3056	35-410	85	No Leakage at all pressures	Pass	26/06/20

*When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston

Signature: KFetherston

Reviewed by: Hadyn Nokes

Signature:

Oasis
Member of the ELAFLEX Group

Test Sheet – NPT Thread Sealing with PTFE tape and Anaerobic sealant.

Method of Test

Loctite 7649 primer was sprayed onto the male end of a ½" NPT thread using the method specified by Loctite. This was followed by the application of Loctite 567 pipe sealant to the thread, using the method specified by Loctite. Yellow, gas rated thread tape was then applied to the male end of a ½" NPT thread by wrapping it in an anti-clockwise direction 4 times. This was followed by another application of Loctite 567 pipe sealant to the thread, using the method specified by Loctite. The fitting was then threaded together until finger tight and tightened a further 1.5 full turns, as this is common practice.

(Test 1). The fitting was then tested for leakage immediately after connection at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 2). The fitting was then threaded back 1/8th of a turn (within 30min of connection) to simulate the aligning of a valve in the field and tested again for leakage at 35 bar, 100 bar, 200 bar and 410 bar.
(Test 3). The fitting was then left for 24 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 4). The fitting was then conditioned at -40°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

(Test 5). The fitting was then conditioned at +85°C for 2 hours and tested for leakage at 35 bar, 100 bar, 200 bar and 410 bar.

Pass Criteria

The fitting is considered to have passed if leakage is less than 20ncc/hr.

Thread:	½" NPT	**Sealant:**	Gas rated PTFE tape, 0.1mm thickness, and Loctite 567

Test No	Gauge No	Pressure (bar)	Temp (°C)	Observations	Pass/ Fail	Test Date
1	SN3056	35-410	14.9	No leakage at all pressures	Pass	25/06/20
2	SN3056	35-410	14.9	No leakage at all pressures	Pass	25/06/20
3	SN3056	35-410	16.8	No Leakage at all pressures	Pass	26/06/20
4	SN3056	35-410	-40	No Leakage at all pressures	Pass	26/06/20
5	SN3056	35-410	85	No leakage at all pressures	Pass	26/06/20

**When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.*

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston Reviewed by: Hadyn Nuttall

Signature: Signature:

Oasis
Member of the ELAFLEX Group

Test Sheet – NPT Thread Sealing, gas rated PTFE tape Vs plumbing rated PTFE tape

Method of Test

PTFE thread tape was applied to the male end of a 1" NPT thread by wrapping it in an anti-clockwise direction 4 times. The fitting was then threaded together until finger tight and tightened a further 2 full turns, as this is common practice.

The fitting was then tested for leakage at room temperature at pressures of 35 bar, 100 bar, 200 bar and 410 bar.

(Test 1). The fitting was sealed with Yellow, Gas rated PTFE tape.

(Test 2). The fitting was sealed with White "Plumbers" PTFE tape.

Pass Criteria

The fitting is considered to have passed if leakage is less than 20ncc/hr.

Thread:	1" NPT	**Sealant:**	Gas rated PTFE tape, 0.1mm thickness Plumbing rated PTFE tape, 0.075mm thickness

Test No	Gauge No	Pressure (bar)	Temp (°C)	Observations	Pass/ Fail	Test Date
1	5N3056	0-410	17	No leakage	Pass	03/07/20
2	5N3056	0-410	17	No leakage	Pass	03/07/20

**When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.*

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston Reviewed by: Hadyn Nutt

Signature: Signature:

Oasis
Member of the ELAFLEX Group

Test Sheet – NPT Thread resistance to Galling

Method of Test

Yellow, gas rated PTFE thread tape, White "Plumbers" PTFE tape and Loctite 567 were each applied individually to the male end of a ¼" NPT thread. The fitting was then threaded together with a female thread until finger tight and tightened a further 1.5-2 full turns, as is common practice. The fitting was then undone, cleaned, inspected for damage, re-wrapped with tape or re-coated with Loctite, and tightened back into the female fitting again. This process was repeated 5 times.

(Test 1). Yellow, gas rated PTFE tape.

(Test 2). White "Plumbers" PTFE tape.

(Test 3). Loctite 567 thread sealant.

Pass Criteria

The fitting is considered to have passed if no major damage or galling is present.

Thread:	¼" NPT	**Sealant:**	Gas rated PTFE tape, 0.1mm thickness Plumbers PTFE tape, 0.75mm thickness Loctite 567 anaerobic thread sealant.

Test No	Sealant	Observations	Pass/ Fail	Test Date
1	Yellow PTFE tape	Small amount of galling on first thread, which was not covered by tape.	Pass	07/07/20
2	White PTFE tape	Small amount of galling on first thread, which was not covered by tape.	Pass	07/07/20
3	Loctite 567	No evidence of galling.	Pass	07/07/20

*When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston Reviewed by: Hadyn Nesbeck

Signature: Signature:

Oasis
Member of the ELAFLEX Group

Test Sheet – NPT Thread resistance to Galling

Method of Test

Yellow, gas rated PTFE thread tape was applied the male end of a ¾" NPT thread. Care was taken to ensure that the tape covered every thread. The fitting was then threaded into a female thread until finger tight and tightened a further 2 full turns, as is common practice. The fitting was then undone, cleaned, inspected for damage, re-wrapped with tape, and tightened back into the female fitting again. This process was repeated 5 times.

Pass Criteria

The fitting is considered to have passed if no major damage or galling is present.

Thread:	¾" NPT	**Sealant:**	Gas rated PTFE tape, 0.1mm thickness

Test No	Sealant	Observations	Pass/ Fail	Test Date
1	AW TITASEAL PTFE TAPE	No Significant galling or damage present	Pass	12/08/2020
2	AW TITASEAL PTFE TAPE	No significant galling or damage Present	Pass	12/08/2020
3	AW TITASEAL PTFE TAPE	No significant galling or damage Present	Pass	12/08/2020
4	AW TITASEAL PTFE TAPE	No significant galling or damage present	Pass	12/08/2020
5	AW TITASEAL PTFE TAPE	No Significant galling or damage present	Pass	12/08/2020

*When signing off a test as the test witness you are signing that the test has been carried out to the standard as required and the required gauges used are in calibration at the time of the test.

Declaration

The product has been tested to the procedure stated above and all results have been accurately recorded.

Tested by: Kyle Fetherston

Signature:

Reviewed by: James Smyth

Signature:

Appendix C - Links

Vaccaro, S.J., *Guidelines For Choosing a Pipe Thread Sealant*., 1998., retrieved from https://www.plantengineering.com/articles/guidelines-for-choosing-a-pipe-thread-sealant/

Australian Mining https://www.australianmining.com.au/news/strong-under-pressure-anaerobic-thread-sealants-2/

Luoke Adhesives http://www.luokeadhesives.com/news/anaerobic-resin-compounds-vs-teflon-tape-vs-pipe-dope

McMaster-Carr High-Density Thread Sealant Tape https://www.mcmaster.com/44945K12

Blue-Monster Gas Guard https://cleanfit.com/blue-monster-gas-guard-ptfe-thread-seatl-tape.shtml

AW Titaseal https://www.austworld.com.au/category/119-titaseal

LOCTITE., *High pressure leak prevention –improved performance and reliability from anaerobic thread sealing compound*., 2016., retrieved from http://www.loctite-success.com.au/content/uag/oneloctite-campaign/australia/www/en/whitepapers/_jcr_content/par/download_5/file.res/High%20pressure%20leak%20prevention%20improved%20performance%20and%20reliability%20from%20anaerobic%20thread%20sealing%20compounds.pdf

Bolt Depot., Thread Galling., retrieved from https://www.boltdepot.com/fastener-information/materials-and-grades/thread-galling.aspx

Fry, P., Tapered Thread Fittings., 2017., retrieved from https://www.cacgas.com.au/blog/tapered-thread-fittings