VALVE NEWS & VIEWS

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Fetterolf welcomes Dean Parker as this month's guest author/contributor to Valve News & Views. Dean is the Manager-Technical Services, Compression Packing, Coltec Industries, Garlock Mechanical Packing Division, Sodus, NY. He presents the Garlock testing program, created after a cross-industry survey as to the various operating conditions valve packing can see in actual service.

Valve-Stem Packing Standard Emission Test Procedure

By Dean Parker, Garlock

In order to properly evaluate different styles and materials for valve stem packing, a standard test procedure should be created and used. The test procedure should recognize the reasons why a specific packing is successful or unsuccessful considering variables such as temperature, pressure, stem material and finish, body design, and medium in the system. The test should cut a cross section of industry applications which may require thermal cycling and sealing against very light liquids and gasses and hazardous or toxic materials.

Garlock has developed the STANDARD EMISSION TEST PROCEDURE (SETP) which clearly determines the characteristics of any type of valve stem packing. The procedure was established through in-depth surveys throughout industry.

The SETP parameters are as follows:

- 750°F thermal cycling
- 500 psi internal pressure
- 3 complete thermal cycles in 72-hour test period
- 1500 cycles net (3000 passes through the packing)
- 100% Helium test medium

Of the parameters listed, the *three thermal cycles* and *100% Helium test medium* have proven to be the most demanding. Helium was chosen as the test medium as it is the second smallest molecule and can easily penetrate the voids in the sealing material and escape to the atmosphere. (Hydrogen is the smallest molecule but is too volatile and too dangerous to consider).

Thermal cycling, from ambient temperature to 750°F and back down to ambient, is the most demanding of the parameters listed, for both the valve components as well as the valve stem packing. As the process temperatures vary, the valve components expand and contract, and the packing material must be capable of moving with them. If the packing cannot compensate with the movement of the valve components (stem and stuffing box), there will be leakage around the valve stem to the atmosphere.

Graphite has thermal properties similar to most steels and has good temperature and pressure characteristics, which react very much the same way as steel valve materials would react under variable process conditions. This makes graphite the most logical choice for asbestos replacement for fluid and vapor sealing.

To begin the SETP procedure, a 3800 psi pressure is applied to the packing gland containing die-formed packing rings or 5000 psi gland pressure for spool packing sets. The internal pressure is increased to 500 psi and the stem leakage rate is recorded using a Helium "sniffer". The temperature is then increased and maintained at 750°F, and the leakage rate is recorded. The 1500 valve stem cycles now begins (500 per day) and the leakage rates are recorded every 250 cycles. Should the leakage exceed 500 ppm at any time during the

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Some Things To Think About

Someone asked Einstein what was the source of his creativity. He said "I get my best ideas anywhere among the B's—the bed, the bath, the bus."

When you spend your time looking down on people, don't expect to be looked up to.

While superior product quality and value remain critical factors for success in the marketplace, the ability to attract and keep customers increasingly depends upon outstanding service.

—L.D. DeSimone, Chairman and CEO, 3M Company

There's no place where success comes before work except in the dictionary.

No business basks in the sunshine all the time. Profits swell, then shrink. Customers come and go. Best sellers end up on the discount rack.

—Tom Brown, Industry Week

Garlock Standard Emission Test Procedure

Media:	Helium or 17% methane/83% Nitrogen
Temperature:	Ambient to 750°F
Pressure:	0 to 500 psi
Stem Actuation:	500 cycles/day for 3 days; cycling to occur during hot-pressurized periods
Duration:	Three days, yielding three complete thermal cycles: day 4 — final checks & disassembly

EQUIPMENT

Elevated Temperature/Pressure Test Fixture
1" x 3/4" x 4-5/8" Motor Operated Valve
Duff-Norton 10-ton Actuator
Mark Products #9822 Helium Detector or Foxboro OVA-108 Hydrocarbon Detector

PROCEDURE (see figure 1)

1. Install packing per manufacturer's recommendations
2. Conduct A List checks
3. Pressurize system to 500 psi with Helium
4. Conduct B List checks
5. Increase temperature to 750°F
6. Conduct C List checks
7. Actuate valve through 250 stem cycles and record actuation force values
8. Conduct C list checks
9. Repeat step 7
10. Conduct C List checks
11. Remove system temperature and pressure and allow valve to cool overnight
12. Repeat steps 2 through 11 for Days 2 and 3
13. Conduct A List checks at start of Day 4
14. Using system pressure, carefully remove packing set, record observations on packing condition — integrity, and condition of sealing surfaces (stem, stuffing box bore, gland follower) for wear, debris build-up, etc.

A List
- Record bolt torque and yoke gap
- Actuate stem five cycles, record actuation force on 1 st. & 5 cycles
- Determine % compression

B List
- Check emission level (see note)
- Record bolt torque

C List
- Check emission level
- Record bolt torque and yoke gap
- Actuate valve through five cycles and record actuation force values on 1st & 5th cycles
- Check emission level

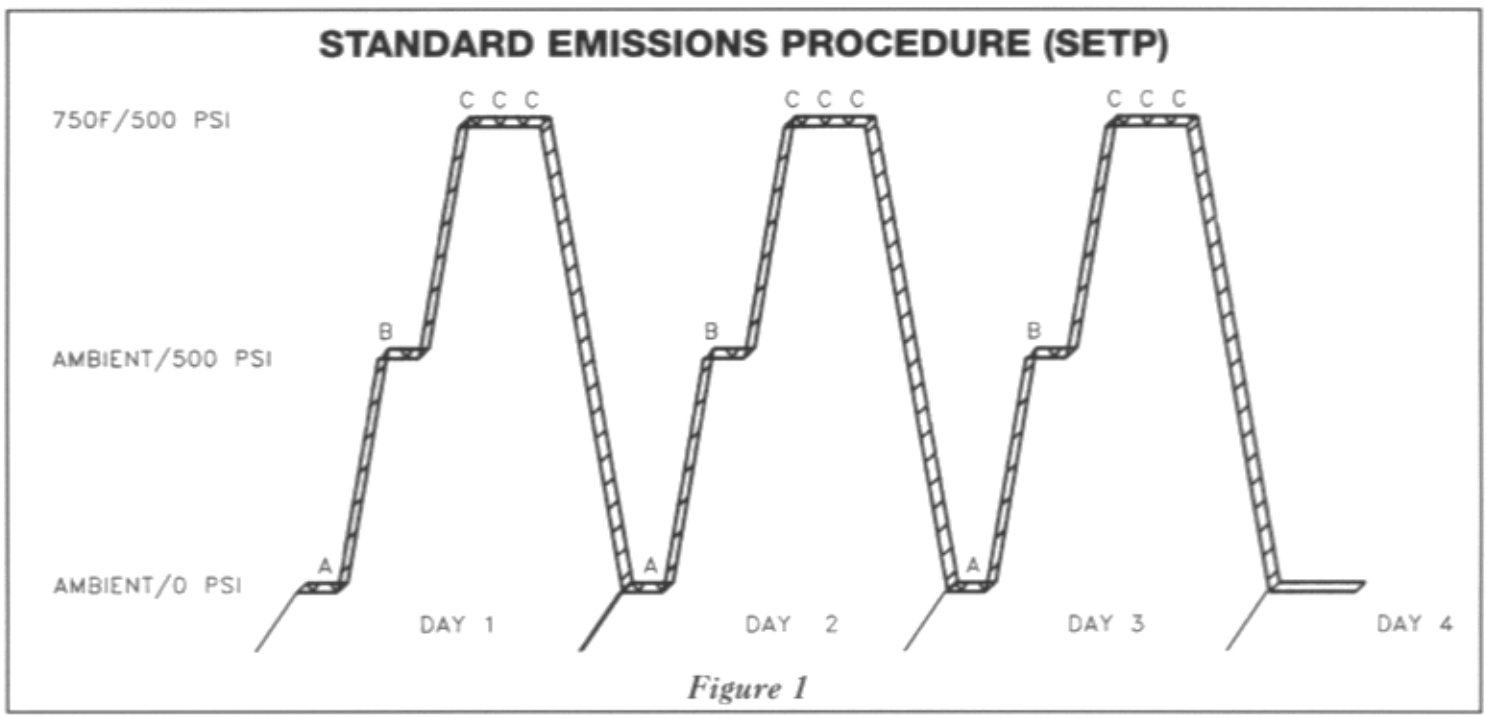

Figure 1

NOTES

A. Bolt torque not to exceed 95 ft-lbs.
B. Emission level-goal <500 ppm.
C. Should emission levels exceed 500 ppm during any of the emission level checks, increase gland loading until either <500 ppm is achieved or bolt torque exceeds 95 ft-lbs, proceed to steps 11 and 14.

The above test will determine the following:
1. Stability under 750°F operating conditions
2. Stability under thermal cycling
3. Emission performance
4. Required compression guidelines
5. Volume loss stability
6. In-service consolidation
7. Stress relaxation characteristics

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Valve Stem Packing Standard Emission Test Procedure

three day test, additional torque is applied to the gland nuts to further compress the packing to bring the emissions rate back to below the 500 ppm level. Leakage rates, bolt torque, and percent of compression are all recorded. At the end of 500 cycles, the emission rates are again recorded, the pressure and temperature returned to ambient, and the first thermal cycle is completed. The next day, the same procedure is followed, and the same done on the third day to complete the test.

The two major benefits of the SETP are:

(1) The side-by-side testing and evaluation of different packing in identical situations. This allows the user to select the best possible packing for his particular application.

(2) The test will indicate the ability of the packing to meet the EPA 500 ppm limit for leakage and be used for emission control. This will also indicate the ability of the packing to withstand thermal cycling (or a plant shutdown and subsequent start up) and still seal below 500 ppm.

The Standard Emission Test Procedure indicates:

(1) Simultaneous high pressure and temperature (750°F and 500 psi) is the cause of many packing failures.

(2) Packing additives such as adhesives or lubricants to enhance sealability, appearance, or to assist in manufac turing usually will not withstand 750F.

(3) Some high temperature packing materials alone do not have the sealing or durability traits desired by the application.

(4) Many packings which seal initially will leak after thermal cycling (after being placed in process service).

Wire brushing and lubrication of the gland bolts will assist in the transfer of proper loading on the packing when bolt torque is increased. Also, flat washers under the gland bolts and gland follower are of help in distributing the load on the packing.

The SETP provides valve users, manufacturers, and packing manufacturers with a common procedure for the evaluation of packing materials. Leakage rates may be identified. Packing compression percentages and packing volume loss may also be determined through a testing procedure which closely simulates the conditions found in the chemical, petrochemical or power generation industries. ■

E.I. DuPont Company Revises Non-Destructive Testing Standards

The DuPont Company has revised its standards for "the semiquantitive detection of leaks when a high degree of leak-tight integrity is required." This new procedure, SG4.1T MASS SPECTROMETER — HELIUM LEAK TEST eliminates the use of Freon (an environmentally unfriendly medium) in testing.

Two methods are used:

1) Internal pressurization with helium.

2) Evacuation of a component and application of helium to the outside.

The new standard very carefully details the proper safety standards to be considered when using helium, including but not limited to proper gauging, relief valving, proper isolation, component damage, and helium collection in confined spaces.

Mass spectrometer instruments are used to ionize molecules drawn from leaking equipment under test. Helium ions are separated and the instrument displays a figure which is a function of the partial pressure of the helium drawn into the spectrometer tube.

The standard details the qualifications required of the personnel performing the test, both DuPont employees and contractors who may be certified by their employer, subject to DuPont audit.

The type of test equipment to be used is carefully detailed as to the manufacturer, make, and model number as well as calibration standards.

Drying requirements and cautionary statements are included.

In the testing of valves, the detector probe method is most widely used. Without going into the details of the actual test, the valve to be tested is charged with a mixture of helium gas, nitrogen or air to the lesser of its design pressure or 15 psig with a minimum of 10% helium. After proper calibration and a pressure soak of 30 minutes, the test surfaces are scanned by passing the detector tip within 1/8" of the surface at a rate not exceeding 1 in./sec. Observed leakage rates are corrected for the amount of helium used and a leakage rate less than 1×10^{-5} std.cm^3/sec is acceptable.

When testing valves to this new DuPont standard, Fetterolf draws a vacuum in the interior of the test valve and charges the valve with 100% helium. The detector probe method, is then used over welded joints, packing systems, and valve seats to test for leakage. Valve jackets are tested in the same manner. No leakage is tolerated during testing.

Fetterolf salutes The DuPont Company for authoring a practical, inexpensive, workable method of positive leak testing of pressure—containing components which gives positive results and is friendly to the environment. ■