SPECIALISED TEST PROCEDURES - VACUUM TEST FOR AIR ELIMINATORS INSTALLED UPSTREAM OF THE PUMP

APPLICATION

This procedure is used when performing accuracy tests on any measuring systems that incorporate an air eliminator or deaerator of the type that is designed to be installed upstream of the pump.

Examples of such measuring systems may be encountered in chemical operations measuring products such as:

- concrete additives or liquid fertilizers, etc.; and
- in the milk industry where they are commonly referred to as a Type E Systems or Vacuum Air Elimination Systems designed for receiving and pick-up applications.

PURPOSE

Vacuum tests are performed on a system to establish if air enters into the system. The inability to hold a vacuum under test conditions indicates a leak in the system which may draw in (and probably entrain) air and may cause significant measurement errors.

LEGISLATIVE REFERENCES

Not applicable. Refer to installation requirements as per manufacturer’s instructions and/or the applicable Notice of Approval.

PROCEDURE

Note: A valid inspection cannot be carried out if a vacuum leak exists on the vacuum side of a receiving or pick up metering system.

- Ensure that an operating vacuum gauge is installed on the suction side of the system.
SPECIALISED TEST PROCEDURES - VACUUM TEST FOR AIR ELIMINATORS INSTALLED UPSTREAM OF THE PUMP

- Open the valve on the feed tank. Let the liquid fill the suction line and deaerator.
- To fill the system, turn it on and start liquid flowing through it normally.
- Ensure that the deaerator vent does not leak during the test. The float operated valve may not maintain a vacuum. Check valves are present in some vents, whereas others have a threaded fitting which must be turned shut.
- Shut the pump off. Close the feed tank valves. Start the pump.
- When product flow stops and vacuum reaches its peak, turn off the pump.
- Watch the vacuum gauge. The vacuum indicated should maintain its peak value to within ± 3.4 kPa (0.5 psi) for at least two minutes.
- If vacuum holds, carefully open the feed tank valves to release vacuum and proceed with the normal tests. If the vacuum does not hold, investigate the cause(s). The system must be fixed before proceeding with the normal tests.
EFFECT OF VACUUM LEAKS

Almost all of the air which leaks into the suction side of a metering system will become entrained in the liquid. Once entrained, air can be very difficult to remove and will most likely result in being measured as product. Large slugs of air are more easily removed by the deaerator. There are many locations where air can leak into the system, some more serious than others.

Consequences of Vacuum Leaks

Air leaking into the upper dry area of a vacuum deaerator, above the inlet, will probably not become entrained in the liquid and will only cause periodic stoppage of the pump whenever the liquid level in the deaerator becomes low enough to activate the float switch.

Vacuum will also be lost if the check valve at the pump outlet, or the compartment valve to a full compartment leaks liquid. Neither of these leaks will allow air in and, consequently, will not influence measurement.

Once the system is inspected and reassembled, check for reverse flow after a truck is unloaded. Typically, this type of measuring system has two check valves. It is quite unlikely both would leak enough to effect measurement between tests (the meter registers usually cannot be reversed).
SPECIALISED TEST PROCEDURES - VACUUM TEST FOR AIR ELIMINATORS INSTALLED UPSTREAM OF THE PUMP

Areas where vacuum leaks will definitely result in air entrainment are hose wall leaks, loose hose fittings, faulty fitting gaskets, valve stem packing, truck pump leaks (drive shaft seal, housing gasket), pipe and pipe fittings.

The most critical area in which vacuum leaks can occur in these type of systems is after the deaerator, more precisely, the fittings between the pump and the deaerator, and the pump seal. Any air entering these areas cannot be removed and will definitely affect measurement.

DETECTION AND CORRECTION OF VACUUM LEAKS

Most leaks can be stopped by simply tightening threaded connections, hose clamps, the deaerator cover seal, the deaerator vent, or valve packing, etc.

With the pump turned off, gravity head will sometimes cause liquid to drip from the more obvious leaks. Some leaks will only show up under vacuum and can be located through the process of elimination by sequentially isolating all of the potential problem areas.

Install a blanking plate or valve starting at the truck and working back: truck pump, receiving hose, deaerator inlet, pump (a vacuum gauge must be installed and enough pipe retained to keep the pump primed).

Leakage stopped by closing the meter control valve indicates a check valve leak.
MEASUREMENT CANADA’S POSITION ON VACUUM TESTING

Measurement Canada’s responsibility is to perform a vacuum test. It is the responsibility of the device owner to locate and repair leaks before a valid inspection can be performed. However, expertise is not always available at the plant and instead of cancelling a scheduled inspection, which requires time and travel expenses, it might be to the inspector’s advantage to do a quick check with the owner’s assistance. The problem may be quickly identified and rectified.

REVISION 1

Revised various sections to be applicable for any measuring system that incorporates an air eliminator or deaerator of the type that is designed to be installed before (upstream of) the pump.

REVISION 2

Digital gauges versus bourdon tube gauges are capable of detecting very small changes in vacuum and therefore, providing a range for the gauge reading was necessary. The procedure was revised to add the statement allowing for a range in the peak vacuum, i.e., ± 3.4 kPa (0.5 psi).