

CONOCO CHEMICALS COMPANY
CONOCO INC.
P.O. Box 91, New Highway 25
Aberdeen, Mississippi 39730
Attn. Mr. V. Messick

August 23, 1984

RE: PRESSURE RELIEF VALVE TESTING RECOMMENDATIONS
CONOCO CHEMICALS, ABERDEEN, MISSISSIPPI

Dear Mr. Messick

It was a pleasure to have been able to visit you recently and participate in a portion of your pressure relief testing program. The result of this test program will be tremendously valuable in establishing accurate pressure relief valve settings as well as the necessary test and maintenance program you wish to achieve. Also it was evident that to maintain accurate pressure relief valve performance, testing and maintenance must be carefully monitored and applied according to prescribed procedures to yield the necessary performance. During my visit we discussed several of these points which I would like to elaborate on herein. These areas include test methods, equipment and pressure relief valve settings.

As you explained to me during my visit, in-situ or in-place testing of pressure relief valves has been a practice at your facility for quite some time. The valve I witnessed being tested (S/N 31670-A10) did relieve early (176 psig vs. a nameplate setting of 185 psig). During our discussions the comment was made that in-place testing results were usually very consistent with few valves ever being found out of set point tolerance. It is reasonable to expect that the in-place testing method employed did produce fairly consistent results however the test results may not be representative of the actual valve performance when compared to testing under full volume conditions. It is our recommendation that the valves in "reactor service" in your facility be removed and tested with the proper equipment under controlled conditions. The following discussion will illustrate the reasons for our position.



Re: Pressure Relief Valve Testing

Since you well recognize the impracticality of testing all pressure relief valves on their respective mountings the test method which is substituted must simulate the actual conditions reasonably well to insure close agreement between the test bench settings and the pressure relief valves response once installed and called upon to function. This becomes more difficult to achieve when the valve size is large or the set pressure is high. In these cases the test stand or test bench must have sufficient internal volume and flow rate to establish the set pressure by popping the valve. The definition of the set pressure must be clearly understood. ANSI B95.1 defines the set pressure as "...the value of increasing inlet static pressure at which a pressure relief valve displays one of the operational characteristics as defined under opening pressure, popping pressure, or start-to-leak pressure". Popping pressure is further defined as "... the value of increasing inlet static pressure at which the disk moves in the opening direction at a faster rate as compared with the corresponding movement at higher or lower pressures. It applies only to safety or safety-relief valves on compressible fluid service". Simmer is often mis-judged as the set pressure. The simmer is defined as "...the audible or visible escape of fluid between the seat and disk at an inlet static pressure below the popping pressure and at no measureable capacity. It applies to safety or safety relief valves on compressible fluid service."

Utilization of improper techniques or faulty test equipment will introduce serious errors in the setting and adjustment of pressure relief valves. In-place testing techniques often rely on simmer as the indication of the set pressure. Depending on the valve condition and ring setting the difference between the simmer pressure and the set pressure may exceed 5%.



Re: Pressure Relief Valve Testing

In-place testing has several disadvantages with installations such as you have:

- 1) The volume beneath the valve is small and does not allow for a good pop action.
- 2) The pressure source (usually a nitrogen bottle) offers limited flow ability to achieve the pop action. The typical pressure regulator used with a nitrogen bottle is also detrimental in setting pressure relief valves.
- 3) Because small hoses or tubes are used to connect the pressure source to the space below the valve, accurate static pressure is not observed.
- 4) Determination of the seat tightness of the valve after set pressure testing is very difficult to perform and often avoided because of the vent stack arrangement.

These factors can all be eliminated by the removal of the pressure relief valve and bench testing with suitably designed equipment. This method will achieve accurate and reliable results. The test bench should have 1.5 cubic feet nominal internal volume and allow essentially unrestricted connection of the pressure relief valve to the test bench. Static pressure should be monitored and an adequate pressure source should be connected to achieve proper pop action.

To further aid you in developing the pressure relief valve maintenance program I have attached the following reference literature:

Guide for Inspection of Refinery Equipment - API
Chapter XVI Pressure Relieving Devices

Teledyne Farris Publications 183C and 282C

ANSI B95.1 Terminology for Pressure Relief Devices



Re: Pressure Relief Valve Testing

In API Chapter XVI your attention is drawn to paragraph 16.7.2 regarding the test bench. Please also refer to paragraph 16.8.3.1 which discusses the testing of pressure relief valves in-place. The Teledyne Farris publications will assist in illustrating appropriate test equipment. Only the use of Modular or Universal type test stands would be appropriate in your application.

My closing comments concern the actual setting of the pressure relief valves. As you have had the benefit of testing in-place with the full vessel volume behind the valve, blowdown ring setting thus obtained should be specified over approximate factory settings. For the 26QA12-120 6X8 safety relief valve tested in my presence the final blowdown ring setting of 30 notches produced about 4% blowdown when the set pressure was adjusted in the range of 180 psig. This setting would apply to the 8X10 safety relief valves similarly installed at the same pressure.

I trust this information will be useful in formulating your maintenance program. I appreciate your patience in waiting for this reply. If you have any questions regarding this matter please do not hesitate to contact me.

Eng.Corr.

Very truly yours,
Teledyne Farris Engineering



E.C. Cullie
Manager of Engineering

