DRESSER INDUSTRIES
Industrial Valve & Instrument Division
P.O. Box 1430
Alexandria, LA
March 29, 1976

Mr. W. W. Cotter
Metropolitan Edison Company
Three Mile Island Nuclear Station
P.O. Box 480
Middletown, PA 17057

Dear Mr. Cotter:

After a pretty frustrating week which culminated with the unsuccessful test of valve RC-RV2 (Electromatic) on Saturday evening (unsuccessful being a relative term, the 10 bubbles/minute achieved would be normally acceptable), Mr. Preuett, our serviceman, has returned to base at Alexandria.

I have elected to remain at the Unit in an attempt to improve our coordination and work flow and in particular to insure that the facilities and equipment required are available when Preuett returns with the new RC-RV1 disc.

The attached memoranda will hopefully assist in clarification of our problems and requirements, and written additions will be made to cover operation schedules when these can be formulated.

I suggest that an early meeting of all concerned be held to define other problems. Those present should include yourself, Jim Shetler, Bill Light and the supervisor assigned to the project by Crouse, Steve Loden.

Very truly yours,

F. P. Bolger
Sr. Project Engineer

FPB/pmb

Attach.

cc: H. Bailey
T. R. Bordelon (Dresser)
J. J. Colitz
W. E. Potts
M. A. Shatto
J. Shetler
D. M. Shovlin
W. Light

BTW
~~Deft. Exh. For ID~~ 447
Plf. Exh. in EV
Catherine Cook CC
Doyle Reporting, Inc. 2/19/82

TESTING PROCEDURES AND EQUIPMENT

1.0 RC-RV2 Electromatic P. R. Valve Type 2½ - 31533VX

There has apparently been confusion between this valve and the procedure (written by F. P. Bolger dated 2/27/76) for testing the Pressurizer Valves RC-RV1.

The 31533VX valve is completely different from the spring loaded types such as the 31739 (RC-RV1). The disc is held closed by steam pressure instead of a heavy return spring. When pressure enters the valve the disc is forced onto its seat, the higher the pressure the tighter it seals. A pilot valve is used to open this valve. An electrical signal usually from a pressure switch but also from manual control, operates a large electro magnet. This causes a plunger to strike a lever which opens a small pilot disc and allows pressure to bleed from the main valve. The force holding the main disc closed becomes unbalanced and the main valve opens. Therefore, it can be seen that this valve can be opened at any pressure simply by energizing the solenoid. There is no set pressure as such, except for whatever pressure the controls are set to.

2.0 Because this valve relies on pressure to reseat or close, it is difficult to test if there is insufficient volume of air or steam to maintain pressure after it has been opened. Consider the action:

a. Pressure holding the valve closed is relieved by the pilot and the main disc drops and the valve is open to atmosphere.

b. The solenoid is de-energized and the pilot valve closes allowing pressure to build up behind the disc.

c. This pressure lifts the main disc giving it velocity, as it moves it creates a larger volume behind it with a consequential reduction in pressure.

d. However, although the forcing pressure is reduced the momentum of the disc keeps it moving until it strikes the seat.

e. The system elasticity causes rebound unless the pressure force has increased sufficiently to dampen it.

f. This rebound may, and usually does, damage the seat. The ideal situation is for the steam inlet to be the same size as the disc diameter but valve design limitation prevents this. It is, however, extremely desirable that the pipe supplying pressure should at least be as large as the valve inlet and it should be connected to a tank or reservoir of some volume at close proximity.

3.0. RC-RV1 A and B Pressurizer Safety Valves Type 31739

A similar test stand is required for quite different reasons when testing the spring loaded type valves 31730 and 3700 (pressurizer and main steam). Here the disc is returned to the seat under the action of a heavy spring. In normal service, the closing action is comparatively slow, virtually following the steam pressure drop.

If the volume of steam or air supplied to valve when it is open is less than sufficient to maintain pressure to balance the spring force then the valve closes. The quicker this pressure deteriorate the faster the closing action. The natural frequency of the return spring system is in the region of 30 c.p.s. and so it can be seen that if the valve is allowed to close without restriction extremely high impact velocities are attained. I believe that a very large percentage of the seat and disc damage found on these types of valves can be attributed to use of faulty test stands where air flow is too small.

Another reason for a large air flow to the valve is to cause sufficient lift to allow the valve components to self align and produce a good reseating action.

4.0 The existing test stand does not satisfy any of these criteria and was designed, I believe, to use water to obtain pressure control. Since our new procedure for the RV1 valves requires the valve to be heated, it would be detrimental to inject cold water into the test system. Only dry N_2 or air should be used.

The system as assembled has a 8" schedule 160 cylinder about four feet long connected to the test flange by 3/8" diameter stainless steel tube about seven feet long. A pressure gauge is connected to the cylinder. A 6000 psig N_2 bottle supplies gas to the cylinder. It is certain that the pressure reading in the cylinder immediately the valve opens, will not be the pressure under the valve disc, since flow velocity will be very high, probably sonic. This situation is a potential source of valve chatter and consequential seat damage.

5.0 I strongly suggest that a new test rig be designed and made before we attempt further testing. The existing could be modified by welding in a 2" schedule 160 pipe nipple and connecting this to a similar nipple on the test flange. The cylinder would lay under the test stand. A sketch is attached. The available test gauge is marked "Water Only". We need an air gauge, properly calibrated, and having our 2500 psig test pressure in the middle third of the dial range.

6.0 Electromatic Test Procedure

6.1 Before connecting N_2 system to test flange, blow out to expel all impurities. Utmost care is necessary during fabrication and assembly of test stand to prevent accumulation of dirt.

6.2 Check operation of electrical system. Clean contacts of holding coil switch. These contacts get burned and spark eroded. The purpose of the switch is to short out the bottom solenoid coil until the solenoid plunger has overcome the pilot valve resistance. When the plunger reaches the end of its travel, it opens this switch, which allows current to pass through the bottom coil and

increases the electrical resistance of the solenoid so reducing the holding current required. If this switch does not work, the coil may overheat and fail. Do not confuse this switch with the "Unimax" micro-switch which is for warning light operation. There may be a capacitor across the holding coil switch to prevent arcing.

6.3 Note, the existing test flange does not properly match the inlet flange of the electromatic valve. A special gasket has been made to seal the joint but this should be regarded as makeshift and the flange should be altered for future testing. The test flange is square and is not a code flange and so no attempt to torque the stud nuts to the normal valves should be made. Leakage is not being checked at this joint as it does not relate to valve tightness in any way. Excess leakage must be avoided to reduce N_2 loss. These remarks also apply to pipework leaks.

6.4 With the N_2 supply connected, raise system pressure to 2300 psig. Pop the valve by energizing the solenoid. Note, ear protection is required and test engineer should warn all adjacent personnel before the pop. This operation should seat the valve and test complete system.

6.5 Pour test fluid (water) into outlet of valve to cover seat area. Watch for bubbles. No bubbles visible for five minutes is required leak tightness level.

6.6 This test for leak tightness is severe and disc may have to be removed and relapped if the required level is not achieved. Difficulty in obtaining this degree of tightness should be recorded and the final test which is repeated in the reactor building should reflect and take into consideration these difficulties.

6.7 After satisfactory testing in the reactor building, the valve should be immediately mounted on the 7900 gate valve in the pressurizer system. This valve should be closed and not opened until steam pressure is approximately 1000 psig. The RV2 valve will then close quickly, otherwise steam residue may damage the seat if it hangs partly open. It is good practice to pop this valve once about 1500 psig to insure good seating.

7.0 The availability of tools and equipment together with improvised operating instructions have impeded our work flow considerably during the past week.

I offer the following as an attempt to more clearly define the test requirements and as a basis of discussion between B&W, Met-Ed, and Crouse.

7.1 Test Stand. This is complicated and needs discussion. I have already outlined some suggestion. Presumably hydraulic testing will be required. It must be portable to allow movement between work shop and reactor building and back probably.

7.2 Heating Facilities. These consist of heating coils, insulation, power supplies, temperature measurement and control. The rate of temperature increase has been found to be extremely critical and a valve recently tested for Duke Power required seven hours to stabilize. I think we can reach say 100-130°F fairly quickly and then go very slowly to 200°F. Holding the temperature constant may be difficult and the slightest variation will cause bubbles which may not be leakage. This needs discussion.

7.3 Lifting and Handling Equipment. The spring loaded safety valve RC-RV1 weighs about 850 lbs. and the electronic about 200 lbs. Total lifting clearance to get the valve on the test stand is about 10 feet (check).

Tightening and adjusting the compression screw to achieve the set pressure is difficult. An air operated impact wrench is desirable but the wrench must be long enough to clear the spindle. If a wrench extended by a piece of pipe is used, the test stand may fall over or a man may slip. Radiation hazard.

7.4 Small tools and measuring equipment. These are the areas which have wasted time. I intend to discuss these and list them in detail.

8.0 Schedule

I think the governing factor is the test stand. Until this is discussed and agreed, no schedule can be formulated.

The information we have puts the RC-RV1 disc here on Friday, April 2, 1976. So, I would tentatively aim at having our facility operational by say Monday April 5, 1976.

F. P. BOLGER