ATTACHMENT C

Consumers Power Company
Palisades Plant
Docket 50-255

MOVATS - SWITCH ADJUSTMENT POLICIES & JUSTIFICATIONS

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Switch Adjustment Policies
And Justifications

This phase of the program defines the technical basis for establishing torque and limit switch setpoints. A given control switch may be set to a number of possible positions. The most appropriate setting will be selected and switch setting procedures revised after a review of the valve function, operator and valve design and over Plant policies. The following are the setpoint methods and technical justifications that will be considered for implementation during the control circuit review process. In each case, the method to be used by Palisades on most valves will be identified.

II-A Open Torque Switches

The open torque switch acts to alert Plant personnel of mechanical problems with the valve or operator. The torque switch also provides some element of protection if the open limit switch fails to open. Historical data has shown that open limit switch failures are extremely rare.

Typically, the open torque switch is set to actuate at a thrust value above the calculated unseating load (including maximum design differential pressure loads). During valve unseating, the initial load peak (cracking load) may be of a high enough level to cause the torque switch to trip. Because of this peak, the torque switch must be electrically bypassed during this phase of valve operations.

One acceptable approach (already evaluated by Palisades as a viable approach) is to eliminate the open torque switch from the control circuit. From a maintenance point of view, the "alerting" function of the open torque switch trip is not necessary if valve/operator condition is monitored using some other means to provide adequate indication of developing mechanical degradations (ie, MOVATS MCC System).

As an alternative (already evaluated by Palisades), the open torque switch will be wired into the control circuit and set to trip at a value greater than the load calculated for valve unseating. To establish the torque switch setpoint, the opening thrust value for full differential pressure conditions must be established accurately.

II-B Open Limit Switches

The open limit switch must be adjusted to prevent inadvertent backseating of the valve. (Conditions and precautions to be observed when intentionally backseating a valve electrically are addressed in the discussion of open torque switch settings.)

Typically, the open limit switch will be set at approximately 90 percent of stroke from the close-to-open position. It is recognized that the amount of stem travel after limit switch trip is influenced by the inertia of the MOV assembly, valve design and delay in motor contactor drop out after actuation of the open limit switch. Therefore, a specific setpoint for the open limit switch cannot be established. Instead, the following process will be used:

> The limit switch will be set initially for 90-92 percent of the full open stroke. The valve will then be cycled open and allowed to trip electrically. Plant personnel will then place the operator in manual and continue to open the valve using the handwheel. If the valve can be opened an additional amount past the coastdown position, it can be assumed that the valve has hit the backseat. In the unlikely event that the valve has inadvertently backseated, a MOVATS signature analysis test will be conducted and the stem loading and subsequent stem stress levels will be evaluated. The limit switch setting will then be reduced in two percent increments and the valve will be cycled and checked until it is verified that the disc is not coasting into the backseat.

II-C Close-To-Open Torque Bypass Limit Switch

The close-to-open torque bypass limit switch prevents torque switch actuation during the high loading condition normally experienced when the valve disc is "cracked" from its seat (Tc - see Figure 2). From an operational standpoint, many switch settings are acceptable, depending on utility operating and maintenance policies. Operator loading conditions during the opening cycle must be examined to understand technical justifications for each acceptable setting.

Figure 1 shows a typical stem thrust and control switch actuation signature for a valve going from the close-to-open position with zero differential pressure across the valve. Figure 2 is the same basic signature modified to show bypass switch actuation at 5-10 percent of valve stroke (based on stem movement). Historically, it is believed that the 5-10 percent switch setting would encompass the initial valve unseating. After the valve began to pass fluid, the high loading conditions would decrease rapidly. This theory was generally accepted even though full pressure and flow data were not available to validate such an assumption.

Figure 3 depicts a thrust signature from the same valve shown in Figure 2. The changes in the signature characteristics result from differential pressure across the valve. With the typical bypass switch setting of 5-10 percent of stroke, it is clear that the torque switch may not be bypassed during the full unseating process. However, Figure 3 demonstrates that the "cracking load" (Tc) occurrs early enough in the open cycle that the 5-10 percent bypass encompasses this loading condition.

Data from tests with full and partial differential pressure conditions (Table 1) indicates that the cracking load condition occurs at less than one percent of valve stroke for globe and gate valves, even though the loading condition during unseating does not begin to decrease until as must at 15 percent of stroke.

Based on analysis of test data, the following are acceptable settings for the close-to-open torque bypass limit switch:

1. Three percent of total valve stroke as measured from the point of stem motion. The three percent value ensures that cracking has occurred at the time of switch actuation though unseating may not be complete. To use the three percent setting, the open torque switch must be set in accordance with recommendations contained in Section II-A.

2. Five to ten percent of stroke will provide some additional margin for added stem loads due to buildup of foreign materials on the valve seat, etc. Bypass switch actuation will occur during or at the completion of valve unseating under differential pressure conditions.

3. The approach generally to be used by Palisades will be to use 20-25 percent of stroke to ensure that the entire unseating is bypassed. The advantages of this approach are the same as 1 and 2 above. In addition, the valve will most likely perform its intended function even if the torque switch is set improperly. If this option is selected, it should be recognized that the closed light will illuminate when the valve is 20-25 percent open on operators equipped with two-rotor limit switches. Operationally, this condition can be justified for many applications. Of course, the 20-25 percent setting will not affect position indicating lights if operators are equipped with four-rotor limit switches and the indicating light limit switches are on different rotors then the close-to-open torque bypass limit switch (which will be the case at Palisades).

4. Ninety to 98 percent of stroke will have the same advantages as 1 through 3 above and will preclude stoppage of valve travel if large mechanical loads are encountered anytime during the opening stroke. Ninety to 98 percent of stroke will still provide back up for the open limit switch.

5. One hundred percent Bypass - With this option, the open torque switch is wired completely out of the opening circuit, thereby negating the need for the bypass switch (see II-A, Open Torque Switches, for guidance on this condition).

II-D Open Indication Limit Switch

See Phase II in body of this enclosure.

II-E Close Torque Switch

The closing torque switch ensures that sufficient loads are delivered to the valve stem to provide leak tight closure of the valve. Although certain types of valves and/or unusual closing requirements may dictate use of a limit switch for valve closure, the torque switch is the most common method for control during the closing stroke.

As with the open torque switch, the closed torque switch setting must be calculated accurately. To establish the torque switch setpoint, the closing thrust value for full differential pressure conditions must be established accurately.

The equations were developed by MOVATS and validated using full and partial pressure testing data. When the closing stem thrust has been established, the margins for operator, valve and instrumentation variations (previously described) are applied to determine the target closed torque switch setting.

As will be discussed in Phase III, the equations will not be relied upon if sufficient industry full or partial pressure test data is not available at the time of the Plant test to validate the equation being used for thrust calculations. The present MOVATS database does not include sufficient test results to validate MOVATS closing thrust equations for flex and solid wedge gates or globe valves with orifice diameters less than 1.75 inches of greater than 2.0 inches. Therefore, the testing program at Palisades will include differential pressure testing in the closing direction of representative valves. Utilizing this data, specific equations will be developed. The equations will be considered accurate for a particular valve if pressure test data is provided by four valves of the same type and size or 20 valves of the same type.

When closing a valve, the final loading condition may be significantly higher than the closed torque switch trip setpoint. This difference is due to the inertia effects of the operator and valve assembly as well as variations in the motor contract drop-out time. Closing a valve without flow and pressure will result in the highest closure forces and the final forces must be evaluated against the operator and valve manufacturer's thrust limits.

II-F Closed Limit Switches

For valves that are controlled using a limit switch during closure, the final closure forces must be examined closely. These forces can vary widely depending on inertia, contactor drop-out time and valve design.

Signature analysis techniques will be used to verify that the closure forces are acceptable when compared with operator and valve manufacturer's limits. In the long range program, any significant changes in contactor drop-out time will be noted and the impact on final stem loads will be monitored and evaluated.

II-G Closed Indication Limit Switch

See Phase II in body of enclosure.

II-H Open-To-Close Torque Bypass Limit Switches

Typically, the open-to-close torque bypass limit switch is of no operational concern because large hammerblow loading conditions do not occur during the initial phases of the closing cycle. For this reason, no specific requirements are placed on this switch setting relative to the valve stroke. Unless some other need is identified for positioning of this switch, the position that results from coastdown of the motor after open limit switch actuation will be accepted.

II-I Control Of Butterfly Valves

The guidelines of setting butterfly valve limit switches (and torque switches, where applicable) will be basically the same as previously discussed for other types of valves. There is one notable exception.

Normally, butterfly valves do not employ torque bypass switches. Bypass switches for the open torque switch will be considered when all of the following conditions exist:

1. Normal operating position of the valve is closed.

2. The safety position of the valve is open.

3. The valve is in a sea water of water environment such that foreign material build-up effects are negligible.

If all of the above conditions exist, then the open torque switch will be wired out of the control circuit or the close-to-open torque bypass limit switch will be set for approximately 98 percent of stroke.