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TECHNICAL BULLETIN

Review Date: 01/18/2012
Original Date: 09/25/1996
Document ID: NTB-0996-01

NIBCO® F-869B Automatic Steam Stop Check Operation

An increased number of calls received by Technical Services this year indicates some operators are attempting to use the NIBCO F-869-B automatic steam stop check valve for purposes other than what it was originally designed.

It is good to look at the original purpose for the existence of this valve in multiple boiler installations. The intent was to provide a simple device to prevent steam from going back into a boiler in the event of an unscheduled boiler shut down. (This could be caused by a number of automatic shutdown safety features or catastrophic failure). In simple shutdown situations a waterlogged boiler could be created. This happens when steam comes back into the shut down boiler. Once there, the steam condenses back into water, eventually filling the boiler with water.

The operation of this valve is simple. When the handwheel is open all the way it is in the check position. As steam is generated in the boiler, in sufficient volume (flow), the flow pushes on the disc, raising it off the seat, opening the valve, allowing steam to pass. As long as the flow continues in sufficient volume the disc will stay up, keeping the valve open. If the flow slows down and stops, the disc will fall by gravity, closing the valve, preventing steam from going back into the boiler.

A problem can be caused when high turn down ratios are used. The output (flow) can drop below the operating range of the valve. As an example, if a 4” valve is being used with 10,000 lbs./hr. output (flow) with 10:1 turn down ratio, this means when the boiler is turned down it is operating at 1000 lbs./hr. output. This is below the recommended minimum of 3740 lbs./hr. The condition that now exists is the same as a valve that is oversized.

Attached is an article that addresses oversizing along with its inherent problems.

Oversizing Often the Culprit in Valve Misfunctions

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When an automatic, steam stop-check valve in a multiple boiler system appears to be malfunctioning, it seems logical to replace the valve and return the system to service. But often, the problem lies not in the valve, but in an error at the design stage when valves are specified. More often than not, valves are oversized for the actual demand; they are sized either incorrectly or to accommodate pipe sizes for future facility expansions. While the latter seems like a good idea, oversizing causes improper operation, resulting in excessive seat wear, valve leaks and even complete failure.

Typically, an automatic, steam stop-check valve is selected to handle a boiler system's maximum output, ignoring routine needs. Seasonal fluctuations in heat demand and computer-controlled boiler modulation with high turn-down ratios create a similar situation. The result is an oversized valve that performs poorly and wears prematurely.

For example, the design sequence for a new hospital starts on the drawing board, where the required steam supply-line size is specified by calculating maximum demand. The engineer decides a three-boiler installation feeding a common header will work best.

A boiler manufacturer typically sizes the boiler-discharge nozzle for maximum output. Assume the nozzle is six inches. An automatic, steam stop-check is placed on top of each boiler. Each boiler is then piped to a common header, all in six-inch size, following the boiler manufacturer's lead.

Too Much for Too Little

Unfortunately this does not mean six inches is the proper size for the stop-check valve. The boiler outlet nozzle is merely for the boiler's maximum achievable output. Maximum output also might be calculated by the engineer to include an addition to the building in five years. What this means is that for five years, the valve will be oversized for the system's actual requirements, no matter what minor corrective actions are taken. There is simply too much valve for too little steam.

Hospital equipment, which is taken into consideration in establishing operating requirements, might include items such as steam tables in the cafeteria, heating equipment, laundry facilities and sterilizing equipment. When equipment needs are totaled, the theoretical demand is 12,000 pounds per hour at peak demand.

Operating pressure is 120 psi, based on the equipment selected. The boilers are rated 250 horsepower each, maximum. During the sizing process, steam supply and demand are converted to pounds per hour. To convert horsepower to pounds per hour, multiply 250 (boiler horsepower) by 34.5 to arrive at a maximum steam output of 8,625 pounds per hour per boiler. The combined total supply for three boilers is approximately 26,000 pounds per hour.

Chattering Problem

Obviously, this is far in excess of the actual 12,000 pounds-per hour demand. Although a single boiler's output is less than the actual demand, generally two boilers will be on line and one boiler on standby. To prevent steam from backing up into the second on-line boiler, the valve's disc continually opens and closes. The disc makes a "chattering" sound as it repeatedly rises and falls. This is more than an annoyance; it is the first hint of operating trouble.

Over time, the rising and falling action also causes damage to the seat and disc. Seat leakage eventually results, allowing steam to re-enter the boiler. If not corrected, the consequence is an unusable waterlogged boiler.

There is only one way to size an automatic, steam stop-check valve properly. It involves going back to the design stage. The load should be calculated in pounds per hour. Current needs should be the basis of these calculations, even if demand is likely to change later. Anything other than current actual demand values must be ignored.

Solving the problem is simple. Select a suitable valve with the correct operating range from a manufacturer's sizing information. A dampening adjustment can significantly lessen wear caused by impact against the valve seat.

This can eliminate the need for a single-stage, parallel, reduction station, the only other viable solution to oversizing. This costly method uses two valve sizes to meet both minimum and maximum demand periods.

As the project progresses, the contractor follows the drawings and instructions from the engineer. The job is completed and turned over to the hospital. That's where the trouble begins.

As indicated, problems experienced with malfunctioning automatic, steam stop-check valves often are preventable. The key is to specify the proper type and size of valve at the design stage so problems won't develop later on.