Relief from leaking relief valves!

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The heating season seems so far away as I am writing this article. It won't be long though before those thermostats start calling for heat. Several boilers will be firing for the first time this season. This reminds me of an interesting problem job that I visited at the end of last heating season.

I was traveling with a field supervisor friend of mine for a large oil dealer and he was taking me to look at a couple of troublesome jobs. One of the jobs was an apartment building that was experiencing all kinds of heating problems. We met the superintendent of the building and he showed us the way to the boiler room. It consisted of three oil boilers piped in a reverse-return arrangement. One large system pump ran constantly through all three boilers and out to the system. Each apartment had its own thermostat and zone valve. The complaint was that all the units on the top floor, (the 6th floor), were constantly hearing gurgling noises, the terminal units were getting air-bound, and on the colder days they couldn't get the rooms over 62°F.

The pump was located on the return pumping towards the boilers and the diaphragm expansion tank. When a pump is located on the return, the pressure differential it develops will show up as a drop in the static pressure of the system. In this commercial system, the pump was large enough so that when it turned on it lowered the pressure to the point of pulling air back into the terminal units on the top floor. This was causing the gurgling and air-binding problems. The fuel oil dealer that originally delivered oil and serviced the equipment at this property was called in by the management company to solve the problem. Their solution was to raise the fill pressure setting on the automatic pressure-reducing valve. This stopped the gurgling and air-binding problems. How? By over-pressurizing the system's fill pressure, when the pump turned on and lowered the system's pressure, it was still above 0 psig. Air no longer was "sucked" back into the system. Unfortunately, like so many things in a heating contractor's life, when they solved the first problem, they created another one! When they raised the fill pressure to offset the pump's effect, they brought the fill pressure up close to the relief valve's rating. Once the boilers fired and started to heat the water, the pressure increased rapidly and the relief valves opened, dumping gallons of water onto the boiler room floor. What I found fascinating is what the original oil dealer did to solve this new problem. They *changed* the relief valves to a higher-pressure rating! This of course stopped the relief valves from dumping water onto the floor. Unfortunately, the boiler manufacturer had already decided that his boilers were only rated for a certain working pressure and no higher! By changing the relief valves on the boilers, the oil dealer assumed all the liability of those boilers if anything should ever happen. The real solution to the problem was to simply locate the system pump on the supply, so that it was *pumping away* from the diaphragm tank. Located there, the pump would cause an increase in the system's pressure throughout the entire system, preventing any more air problems. My friend suggested this remedy to the management company.

Driving away from the job, we thought about all the different reasons that would cause a relief valve to open and dump water onto the floor. We came up with ten common (and not so common) reasons...

1. Waterlogged Steel Compression Tank—some heating systems still use the older steel compression tanks as their method for absorbing the system water that expands when heated. If for some reason the tank loses it's volume of air, it will be replaced with an equal amount of water. Unfortunately, water isn't compressible so when the boiler fires, the expanding water tries to enter the tank and causes an immediate increase in pressure. This in turn causes the relief valve to discharge this excessive pressure build up.
2. Pressure Reducing Valve is left Opened or Fails Open— most systems today use a pressure reducing valve to fill and pressurize a system. If scale or minerals build up on its seat, it may fail in the open position. Also, most of these valves have a manual by-pass feature to fast-fill a system. If the by-pass valve is accidentally left open it will expose the system to street pressure, which normally exceeds the boiler's pressure relief valve rating.
3. Diaphragm Tank loses its air charge—the air cushion in these style tanks is separated from the system by some type of membrane. Unfortunately, the membrane is permeable, which allows a small portion of the air to permeate through this membrane into the system where it is vented out. As this occurs, the PRV notices a drop in system pressure and rightfully does his job of adding water to maintain the appropriate system pressure. Of course the diaphragm tank is slowly losing its cushion of air and finally one day, when the boiler heats up the water, the relief valve discharges onto the floor.
4. Undersized Expansion Tanks—these tanks, whether the "old" steel or the diaphragm style *have* to be sized correctly to do their job. If someone installs an undersized tank, the volume of water in the system will be too great for the tank to handle. This will cause an immediate rise in pressure and the relief valve will open.

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5. Undercharged Diaphragm Tank—it is very important that not only is the tank sized correctly, the pre-charge of air in the tank *must* match the system's fill pressure. If the air charge doesn't, then cold water will be allowed to enter the tank before the boiler even heats the water. This will give the same effect as if the tank was undersized.

6. A tankless coil, which produces domestic hot water, is located inside the boiler. Eventually these coils can develop leaks from corrosion and aggressive water. Once this happens, the boiler and its relief valve are exposed to the pressure of the cold water line. Normally this pressure exceeds the valve's rating and the relief valve opens.

7. If the boiler has a faulty aquastat, it will allow the boiler water to reach excessive temperatures. This causes the water to expand beyond the recommended range of tank sizing guides. The result is a rise in pressure beyond the relief valve's capacity, causing it to open.

8. If the system's static fill pressure requirements approach the boiler's relief valve setting, every time the boiler fires, the relief valve will open. It is very important that when selecting a boiler for applications in tall buildings, the maximum pressure allowed by the boiler manufacturer must be greater than that required by the system's fill pressure.

9. Improper location of the expansion tank and system pump can cause the relief valve to discharge. If someone installs the expansion tank *and* a high head system pump on the return, the pump's pressure differential will be added to the system's fill pressure. These two pressures, when added together, may exceed the relief valve's setting.

10. Systems that incorporate high head pumps and pressure differential valves can possibly cause a relief valve to discharge. In the spring and fall, when most of the zone valves in the system are closed, the pressure differential valve opens to prevent the circulator from building up excessive head pressure. Unfortunately, this pump head is now directed toward the boiler and relief valve. If this head pressure, combined with the system's static pressure exceeds the relief valve, it will open.

If you have any comments or questions, please call me at 1-800-423-7187 or e-mail me at gcarey@fiainc.com. ❑

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Buying and selling an oil company

The accounting firm Gray, Gray & Gray, and the law firm of Robinson & Cole, presented a unique scripted presentation on the Art & Science of Buying and Selling an Oilheat Business.

The participants created a mythical oil company (Sullivan Oil). David A. Garbus and Chris Foster, both of Robinson & Cole, played the roles of corporate attorney and environmental attorney, respectively, for Sullivan Oil, while Joe Ciccarello, of Gray, Gray & Gray, acted as Sullivan's accountant.

Representing a potential buyer (mythical Mid-State Oil) were Samuel Mullin and Earl Phillips, Jr., of Robinson & Cole (again as corporate and environmental attorneys) and Jim DeLeo of Gray, Gray & Gray as the accountant. Outside consultants were represented by Michael Koppel (Gray, Gray & Gray) and Peter Moser (Robinson & Cole) on employment issues.

The discussion shifted from Sullivan Oil to Mid-State back to Sullivan, with commentary by the consultants. During the presentation, strategies and planning issues on both sides of the deal, including pricing, tax planning, environmental matters and risk allocation were all discussed in detail.

The actual "dance" as it was called, covered the buyer's proposal, the seller's proposal, stock or asset sale considerations, various due diligence and environmental liability considerations, and the transaction. Compromise is a given in these situations and the teams showed how a final price was achieved, with give and take on both sides. The presentation was to the point, detailed and presented in an interesting, dramatic format that enhanced the clarity of a complex issue.

Filters, Pumps and Nozzles, oh my!

On Wednesday, Gar-Ber's John Berg took technical symposium attendees down to the micron level in his discussion of deceptively simple (but intricate) oil filter technology. He also discussed how to locate filters effectively, pointing out, for example, that a single line fuel system will run only the amount of fuel the customer uses in a year through the filter; a two pipe system, he said, because it recirculates the oil, sends much more oil through the filter during the same heating season. How much? If the burner only uses 600 gallons, the filter will have had the equivalent of 9000 gallons run through it in that same heating season. He suggested a one-pipe system if at all possible.

Bruce Marshall, of Suntec, provided the same type of detailed information on pumps, the next step in the chain, he said. Marshall pointed out areas where there could be problems that are not readily apparent, such as the proper shape of strainer gaskets. In some instances, for example, oil could go around the strainer because square gaskets can actually provide a gap, and the oil takes the route of less resistance.

He covered numerous other issues that affect pumps, including vacuum calculations, cavitation, air or water in the pump and oil safety valves.

The last presenter, Charles Bursey, of Hago Nozzles, discussed the things that can affect nozzle performance. He reviewed the anatomy of the typical nozzle, explaining that they are precision instruments. The typical slot on a .30 nozzle, for example, is one half the diameter of a human hair.

With the trend toward higher pressure, which reduces droplet size and creates a finer mist, he said, cleaner fuel and good filtration are absolutely essential. Bursey showed how a number of factors can contribute to nozzle contamination, including particulates in the fuel, slot agglutination, oil temperature, viscosity of oil and even electrodes that can melt the nozzle during operation. "Do nozzles fail? Not without help!" he concluded.

The next major conference and expo will be held in 2005.