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To: All Interested Parties

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Subject: Thermal Fluid Heating Devices

Because thermal fluid heating devices are somewhat unique, some confusion exists as to what jurisdictional requirements pertain to the application of these types of devices, as well as issues relevant to their use and inspection.

To start with, in terms of the definitions contained in our rules (680 IAC), these devices are considered Power Boilers. This interpretation of Indiana Rules was recently re-confirmed by the Indiana Boiler and Pressure Vessel Rules Board. As such, internal inspections are required to be made annually, to the extent that the design permits. Another consideration is that if a thermal fluid heating device is certified in accordance with ASME Section I (Power Boiler Code), that means that for each piping system, out to the terminating boundaries for that piping system as defined in ASME Section I, the piping and fittings are required to be certified by an organization holding the requisite ASME Certificate of Authorization (either an 'S' or 'PP' certificate holder).

In recent years, the Indiana Boiler and Pressure Vessel Rules Board has required (generally) that the owner / user of such a vessel apply for and obtain a variance, in order to enable such a device to be used legally in the state of Indiana. One of the primary considerations upon which that requirement was based revolves around the issue of over pressure protection.

Historically, most of these types of devices have been certified in accordance with the requirements of ASME Section I, the "Power Boiler Code". This fact becomes problematic because of the following issues:

- A. Section I requires the vessel to be equipped with an over pressure protective device (safety valve or safety relief valve) that is designed and certified in accordance with the requirements of ASME Section I. Evidence of this is the presence of the Section I “V” symbol stamping (along with the other code required markings) on the data plate of the safety valve.
- B. The Section I certification criteria is based on relief of water as a vapor. If the unit utilizes a thermal fluid whose vapors have thermal properties different from those of water (and I would think that this would be true of virtually *all* thermal fluids), then it cannot be demonstrated by recourse to the boiler data plate / stampings, and safety valve data plate / markings alone, that a safety valve rated in either pounds of steam per hour, or BTU’s per hour will be adequate to protect the boiler, as those ratings are based upon the thermal properties of water.
- C. In a Section I steam boiler, or high temperature water boiler, it is expected that the valve will always be relieving units of vapor, because a fluid (water) is being utilized at a temperature that exceeds its atmospheric boiling point. In the case of thermal fluids, some are used at a temperature that exceeds their atmospheric boiling point, and which will therefore relieve as a vapor. In these cases, rating the safety valve in terms of how many units of that particular vapor it will relieve in a given period of time, at a given relief pressure/temperature, is reasonable and logical. Conversely, *some* of the thermal fluids that are commercially available are used at temperatures *well below* their atmospheric boiling points. In these cases, the safety valve or safety relief valve that they are equipped with will be relieving a liquid, and not a vapor, and ASME Section I makes no provision for certifying a relief valve to relieve a liquid, rated in gallons per minute.
- D. For these reasons, if the heater is certified in accordance with ASME Section I, it will automatically require a variance so that the Rules Board can verify the adequacy of the over pressure protection that is used in a given application.
- E. In many cases, the most common remedy is to utilize an ASME Section VIII Division 1 “UV” marked relief valve that can be capacity certified in terms of whatever relief units are necessary. However, once the ‘UV’ marked valve is installed, the installation will no longer conform/comply with ASME Section I (which permits only ‘V’ marked valves to be used). For this reason, the vessel would no longer comply with our rule that states that all new installations shall comply with the standards that we reference, and at that point a variance is required to legitimize its use.
- F. By mandating the requirements noted in (D) & (E) above, the Indiana Boiler and Pressure Vessel Rules Board is able to assure that a given thermal fluid heating device is adequately protected from reasonably expected potential sources of over pressure.
- G. In *all* cases, it is necessary to determine the number of units of vapor or liquid that the relief valve or safety relief valve will be required to relieve. To accomplish this, calculations have to be performed based on the specific fluid being used, at whatever maximum temperature the fluid can realistically see, and based on the maximum thermal input that the thermal fluid heater is realistically capable of imparting to that

specific thermal fluid being heated.

- H. In evaluating the credible sources of over pressure that have to be protected against, it will normally be necessary to involve the manufacturer of the thermal fluid heating device, if sufficient thermal design data is not already available. The thermal data developed would need to include the number of units (pounds, etc) of a vapor that could be produced in a given period of time based on the criteria noted in (G) above, or in the case of a fluid that will relieve as a liquid, the number of gallons per minute that the valve would have to be able to relieve under various conditions, to prevent catastrophic pressures from developing. The conditions that would have to be evaluated for liquid relief include increases in volume/pressure attributable to expansion of the fluid because of thermal input, hydrostatic loads, and/or hydraulic loads imposed by pumping or piping configurations, again based on the properties of a specific fluid (unique viscosity, specific gravity, etc.)
- I. In determining the adequacy of the specific safety valve or safety relief valve selected for a given application, it will normally be necessary to involve the manufacturer of the safety valve or safety relief valve so that calculations can be completed to establish the flow capacity in the case of that particular valve model, at a specific maximum temperature and pressure, based upon the unique viscosity, specific gravity, etc., of the actual fluid intended to be used in service.
- J. It is also true that if a thermal fluid is used other than the specific fluid for which original justification was made as spelled out in (A) through (I) above, those same considerations would be required to be addressed for the new fluid being used.
- K. Because the policy spelled out above has only been definitively established within the last decade, there are undoubtedly a significant number of fluid heating vessels in service for which a variance was not sought, and where the issues discussed herein have not been addressed, or where at least it cannot be objectively demonstrated that they have been addressed. While it is not our intent at this time to require the owner/user of a thermal fluid heater to seek a variance from the Rules Board so many years (potentially) after the fact, in such cases, I do think that the issues that caused the Board to begin requiring variances for these sorts of vessels in the first place are no less valid and important, and should be addressed in the case of thermal fluid heating devices in use where a variance was not sought.
- L. It should also be pointed out that the Boiler and Pressure Vessel Safety Division makes a distinction between vessels that were installed, inspected and registered with us prior to the policy outlined above being adopted, and vessels that were placed in service prior to that time, that were not inspected and registered with us as required by our rules. For vessels that were installed in Indiana prior to the policy being adopted, but that were not registered with this division, and had not received a Certificate of Inspection at that time, a variance would be required to legitimize their use.

In performing periodic inspections of these types of devices, once they are approved and registered, in addition to those elements that normally comprise a good internal or external inspection, the following additional elements should be given due consideration.

Part of what is looked at should include;

1. Reviewing the documentation that establishes the required safety valve relief capacity.
2. Reviewing the documentation demonstrating that the original safety valve or safety relief valve application was adequate.
3. Verifying that the installed safety valve or safety relief valve is the same or identical to the valve that was originally demonstrated to be adequate (manufacturer, model, size, etc), or if a different valve is being used, verifying that calculations have been done by the manufacturer of the new valve based on the properties of the specific thermal fluid being used, and that the new valve will adequately protect the vessel as described in A-H above. It should be further understood that in the case of vessels being used by virtue of a variance being granted, where a specific safety valve or safety relief valve application was part of the variance, changing to a different model or manufacturer of safety or relief valve would necessitate the variance being revisited by the Rules Board. Consideration should also be given to the manner in which continued performance of the safety valve or safety relief valve can be objectively demonstrated. This generally means that on a periodic basis, the safety valve or safety relief valve is re-certified by an organization that is authorized to perform this function.
4. Verifying that the thermal fluid being used is the same as that upon which the evaluation outline in A-H above was based. It should also be understood that in the case of thermal fluid heating vessels being used by virtue of a variance being granted, required relief parameters are dependent upon the thermal properties of the specific fluid being used, and therefore, changing to a different thermal fluid or thermal fluid manufacturer would necessitate the variance being revisited by the Rules Board, as was true of any change to the safety valve or safety relief valve as noted in paragraph 3 above.
  
5. It is also important to verify that there is a program in place to regularly and periodically test the fluid, and document the results of that testing. This becomes increasingly important because over time, the fluid will tend to break down, potentially pick up contaminants, etc. Testing that is done needs to be sufficiently comprehensive to determine that changes to its chemistry, volatility and density, are identified, as well as detecting the presence of solid or fluid contaminants. It is also possible, depending on the specific application, for contaminants to be corrosive, reactive or deposit forming in nature. Therefore, it becomes extremely important to evaluate the results of testing that is done in order to determine what (if any) actions are necessary to restore the fluid and/or system to pre-established acceptable parameters. Testing of the fluid should be sufficiently frequent so as to assure that problems are discovered in their early stages of development.