

Workplace Health and Safety Bulletin



Purging of Fired Heater Coils Using Steam (Winterizing)

What happened?

Recently a serious injury occurred to a chemical truck operator's assistant when a diesel fired heater was being "winterized" by purging the internal heater's coils using a process called "steaming out the coils". The seat of the diesel fired heater's external outlet valve failed, releasing a jet of steam that propelled the operator's assistant into a nearby truck's bumper resulting in serious head injuries and steam burns.

Occupational Health and Safety (OHS) investigation findings

There are many types of equipment used in oilfield and oil and gas plant settings that use fired heaters to raise the temperature of fluids being circulated for processes such as chemical cleaning of exchangers. Fired heaters are a component of chemical trucks, face heating units and/or hot oilers that also include holding tanks, piping and valve assemblies and pumps. During winter months, the coils within the fired heaters need to be kept from freezing as the circulation medium can turn to ice in cold weather and rupture the coils and piping.

Winterizing methods – Problems associated with each method

Method 1 — Circulating an anti-freeze solution into the heating coils

This method requires transporting additional fluids with the heating unit and disposing or recycling these fluids each time the coils are winterized. The chemical composition of the antifreeze solution may not be compatible with heating fluids used so additional flushing of the system may be required at each use.

Method 2 — Purging of the heater coils with air

This method requires the use of a large volume of air to displace the fluids in the heating coils. Such a large volume of air may not be available in field locations.

Method 3 — Steaming out the heater coils

This method requires the heater to be fired without the circulation pumps operating to create steam pressure within the coils which will drive out any fluids in the coils and dry out the coils.

Method 3 was used at the time the incident occurred. It appears this method is sometimes used by a number of industry users of chemical trucks.

Problems and hazards using Method 3 (Steaming out the coils)

1. Fired heaters are usually not designed to create steam pressure and the piping and valve components may not be compatible for high heat or steam pressure. Any vessels that create steam need to follow the *Alberta Pressure Equipment Safety Regulation* and have certification through the Alberta Boilers Safety Association.
2. Many fired heaters do not have pressure release mechanisms built into the heater assembly or may not be fitted with pressure gauges at the operator's control station because they are manufactures for only circulating fluids and heating them during circulation, not creating high heat or steam pressure.

3. Some manufacturers do not expect the fired heater operators to create steam; therefore do not include safety warnings or precautions regarding production of steam in their operator's manuals.
4. Some manufacturers do not have an operator's manual for their fired heaters.
5. Many companies just buy the basic heater assembly and install their own valves and piping circuitry without properly engineered systems.
6. Many equipment owners do not label the valves and piping associated with the complex configuration of the heating and pumping systems. This leaves many operators unfamiliar with the piping system and prone to making errors with the various operations of the equipment.

Applicable Occupational Health and Safety Legislation

1. The manufacturer/supplier of the equipment must anticipate all work site use situations and integrate safety mechanisms with the machinery, supply an operations manual outlining the limitations of the equipment and outline parameters of equipment use. [*OHS Act*, Section 2 (3), (4)]
2. The employer using the equipment must maintain the equipment so as not to compromise the health and safety of workers using the equipment. The employer must ensure the equipment can perform the function for which it was designed and must ensure the equipment is of adequate strength for its purpose and is free from defect. [*OHS Regulation*, Section 12]
3. The workers operating the pumping equipment, including fired heater, must be competent in operating the equipment. Some manufacturers of the equipment provide training for operators. [*OHS Regulation*, Section 13]
4. The employer must ensure that the workers operating the pumping equipment, including fired heater, must be trained in all aspects of the equipment outlined in the *OHS Regulations*. As noted in 3, some manufacturers provide operator training for their equipment. [*OHS Regulation*, Section 15]
5. Prior to starting a task (such as winterizing a heater), a hazard assessment must be completed. This encourages workers to be aware of the hazards and potential serious outcomes of not eliminating or controlling hazards. [*OHS Code*, Section 7]

6. The employer must ensure the equipment is designed for the use, is assembled, started, operated and maintained according to specifications set out in the OHS Code or those of the manufacturer or by the specifications of a professional engineer. [OHS Code, Section 12]
7. The employer must ensure that all controls of machinery being used are suitably identified to indicate the nature or function of the control. [OHS Code, Section 368]

The owner of the chemical truck that was involved in this incident discontinued the process of “steaming out the heater”. The fired heater assembly was modified according to the following recommendations of a professional engineer:

- Install a flow switch to shut down the fire in the heater if the flow in the coils is stopped. This would prevent steam from building in the coils.
- Install pressure gauges for the operator to be able to monitor pressure inside the heater coil assembly during operation.
- Install a pressure relief valve to automatically release, to a safe location, any fluids that become pressurized to a point that could cause a failure of any of the heater’s piping or components.
- Labelling on all valves and piping associated with the heater assembly.
- Additional training for the operators of fired heaters.

The manufacturer of the fired heater produced a manual for purchasers indicating precautions needed for users of the heater. The manufacturer is in the process of having their equipment available with safety features installed if the end user intends to use the heater in a manner that could produce high pressures. The manufacturer has contacted all purchasers of their heaters and made them aware of precautions required with use of the heater and safety equipment available to install on the heater assemblies they own.

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