

## Incident Summary (Reference #5624387)

SUPPORTING INFORMATION	Incident Date	Oct. 10, 2017	
	Location	North Vancouver	
	Regulated industry sector	Gas	
	Impact	Qty injuries	0
		Injury description	NA
		Injury rating	NA
	Damage	Damage description	Refractory and controls on atmospheric boiler damaged beyond repair
		Damage rating	Major
	Incident rating	Moderate	
Incident overview	<i>An atmospheric 960,000 btuh boiler serving a multi residential high rise overfired to the extent that the internal refractory (high temperature insulation lining the boiler's combustion chamber) was damaged and all of the boiler control wiring melted, causing significant damage to the boiler as well as water damage to the building that resulted from the sprinkler system being activated.</i>		
INVESTIGATION CONCLUSIONS	Site, system and components	<i>The gas fired atmospheric boiler provided building heat and domestic hot water to a high rise multi-residential building. When a call for heat is initiated by the building management system the boiler will turn on and fire until the heat load is satisfied, at which point the boiler will turn off. When a call for heat is initiated a number of safety devices must be verified before the boiler will fire. These devices include an operating limit, a high temperature limit, a low water cut-off and a flow switch. If any these safety devices detect an unsafe condition they will not supply electrical power to the gas valve and the boiler will not fire ie.no flow or low water level. If the safety devices do not detect an unsafe condition, 24 volt power will be supplied to the pilot gas valve through an ignition module and the spark ignitor will light the pilot gas. Once the pilot flame has been established, 24 volt power will be delivered to the main gas valve, which will open and allow the main burner to ignite. Once the call for heat has been satisfied, or if one of the safety devices trips, the 24 volt power supply to the main gas valve and pilot gas valve will be de-energized and they will close, extinguishing both pilot and main flame.</i>	
	Failure scenario(s)	<i>The gas valve remained in the open position, enabling the main flame to run, even when safeties and limits were satisfied. The safety devices on the boiler (operating limit, high limit, and flow switch and low-water cut-off) were found to be operational by a qualified gas-fitter. In order for the gas valve to remain open it would need to either be mechanically stuck in the open position or 24 volt power would need to be applied to the gas valve. The boiler continued to run until the refractory on the inside of the boiler began to crystalize and the external wiring was melted.</i>	

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<p>Facts and evidence</p>	<p><i>The gas valve remained in the open position when numerous safety devices should have prevented it from operating. Because the safety devices were verified by a qualified gas-fitter as operational and the wiring and electrical components were damaged it is not possible to prove that the electrical wiring was a contributing factor. The inlet gas pressure was verified by a qualified gas-fitter as correct and within the maximum allowable gas pressure for the appliance. A small piece of metal was found in the piping downstream of the gas valve which may have been lodged in the gas valve seat, preventing it from closing but there is no conclusive evidence to support this. The wiring and 24 volt ignition module were heat damaged beyond verification but the wiring of the ignition module and gas valve appears to be correct.</i></p>
<p>Causes and contributing factors</p>	<p><i>The failure of the boiler was likely the result of a mechanical or electrical failure of the gas valve or associated wiring. Due to the damage sustained by the boiler, verification could not be performed. Apart from a piece of metal found in the downstream piping there is no evidence supporting a mechanical failure of the gas valve. It is also possible that the wiring of the 24 volt circuit was compromised, which could have bypassed the safeties and allowed the boiler to run continuously. The evidence is inconclusive due to the damage sustained by the boiler.</i></p>

Photos or diagrams (if necessary)



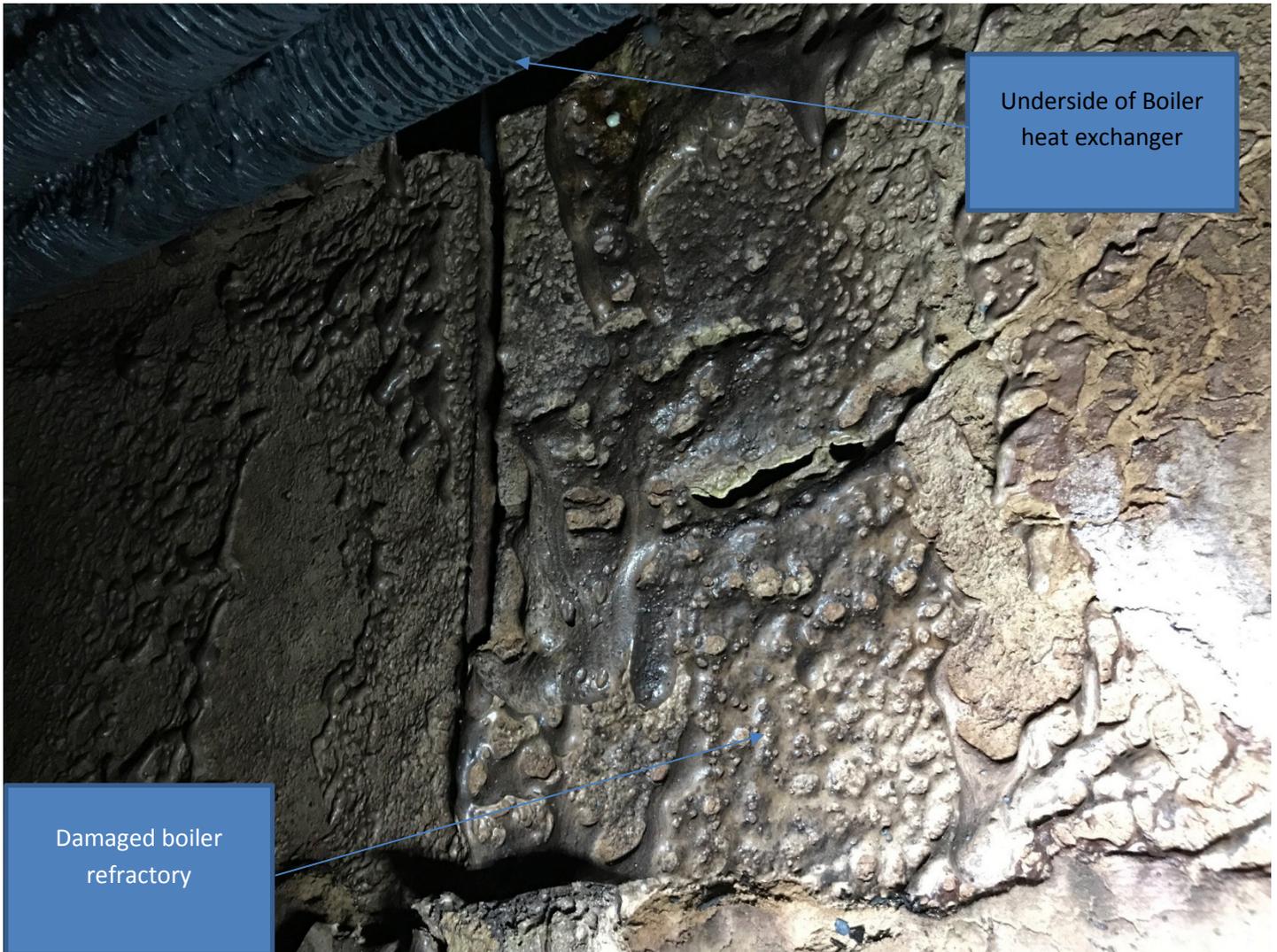




Honeywell 2 stage gas valve



Underside of Boiler  
heat exchanger





Heat damaged boiler  
shell