

Incident Summary #II-1349384-2022 (#26792) (FINAL)

SUPPORTING INFORMATION	Incident Date		March 27, 2022	
	Location		Invermere BC	
	Regulated industry sector		Electrical - Low voltage electrical system (30V to 750V)	
	Impact	Injury	Qty injuries	0
			Injury description	N/A
			Injury rating	None
	Damage	Damage	Damage description	Commercial hot water tank was damaged beyond repair due to an electrical fire contained within the electrical components of hot water tank unit.
			Damage rating	Moderate
	Incident rating		Moderate	
Incident overview		A commercial hot water tank located in mechanical room of lodge had a fire that was contained within the electronic control module of unit. A Fire alarm triggered, and an overcurrent device tripped. The fire had extinguished itself by the time maintenance personnel attended area. Damage had left the unit beyond repair. No damage occurred beyond unit.		

INVESTIGATION CONCLUSIONS	Site, system and components		<p>A commercial hot water tank (HWT) has an electronic control module. This module contains all the electrical connections and internal wiring in the hot water tank unit. The internal wiring of the hot water tank unit is designed with a thermostat that controls the temperature of the water inside the tank, the heating mechanism such as an element stays on until the water reaches a set temperature, then a thermostat acts as a switch and will disconnect the power to the elements. There are 3 heating elements in this hot water tank unit.</p> <p>The field installed wiring and hot water tank unit are protected by an electrical overcurrent device that is capable of automatically opening the electric circuit under both predetermined overload and short circuit conditions.</p>
	Failure scenario(s)		A high resistance connection created an arcing condition at the termination point of heating element #2 in the hot water tank electronic control module. The arcing condition resulted in an elevated temperature at the termination point. The elevated temperature eventually exceeded the temperature rating of the conductor insulation and component temperature termination ratings resulting in damage to the conductors and eventually an electric fire incident. The overcurrent device tripped disconnecting all incoming power to hot water tank unit. The fire was contained due to tripping/ opening of the overcurrent device and self extinguished.
	Facts and evidence		<p>It was observed that the fire damage was mostly contained to the hot water tank unit except for smoke discoloration damage on exterior of unit where the electronic control module unit cover fastens onto the hot water tank unit.</p> <p>Upon removal of electrical control module cover and insulating from the point of origin it was discovered the damage to be concentrated at the termination screws of</p>

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	<p>heating element #2. The bulk of the damage, melting and component disfiguration is in this area. A white ash like substance remains around the termination points on this element indicating where the fire was burning the hottest.</p> <p>Smoke and fire debris damage observed throughout the entirety of the electrical control module of hot water tank unit.</p> <p>Upstream from the hot water tank is a heavy-duty safety switch located within site of the hot water tank unit. The safety switch was found locked in the open/off position.</p> <p>In an adjacent room is the main distribution equipment/ panel board for the building. This panel board houses the breaker overcurrent device for the hot water tank. The overcurrent device was in the tripped/open position.</p> <p>The field wired electrical cable was installed from the load side of the hot water tank unit overcurrent device in the main distribution panel, to the local safety switch disconnect, and then from the safety switch disconnect to the hot water tank unit. All terminations where complete.</p> <p>All components of this electrical circuit were found to be correctly sized.</p>
Causes and contributing factors	<p>It is very likely that overtime due to the thermal effects of the hot water tank unit that the heating element #2 termination point(s) where the conductors electrically connect to the heating element became loose. This very likely created an arcing condition which weakened the affected materials and in time created an electrical fire and a short circuit condition.</p>



Photo 1 - Heating Element #2 point of origin damage



Photo 2 - Factor wired portion of HWT with majority of damage to middle heating element #2.

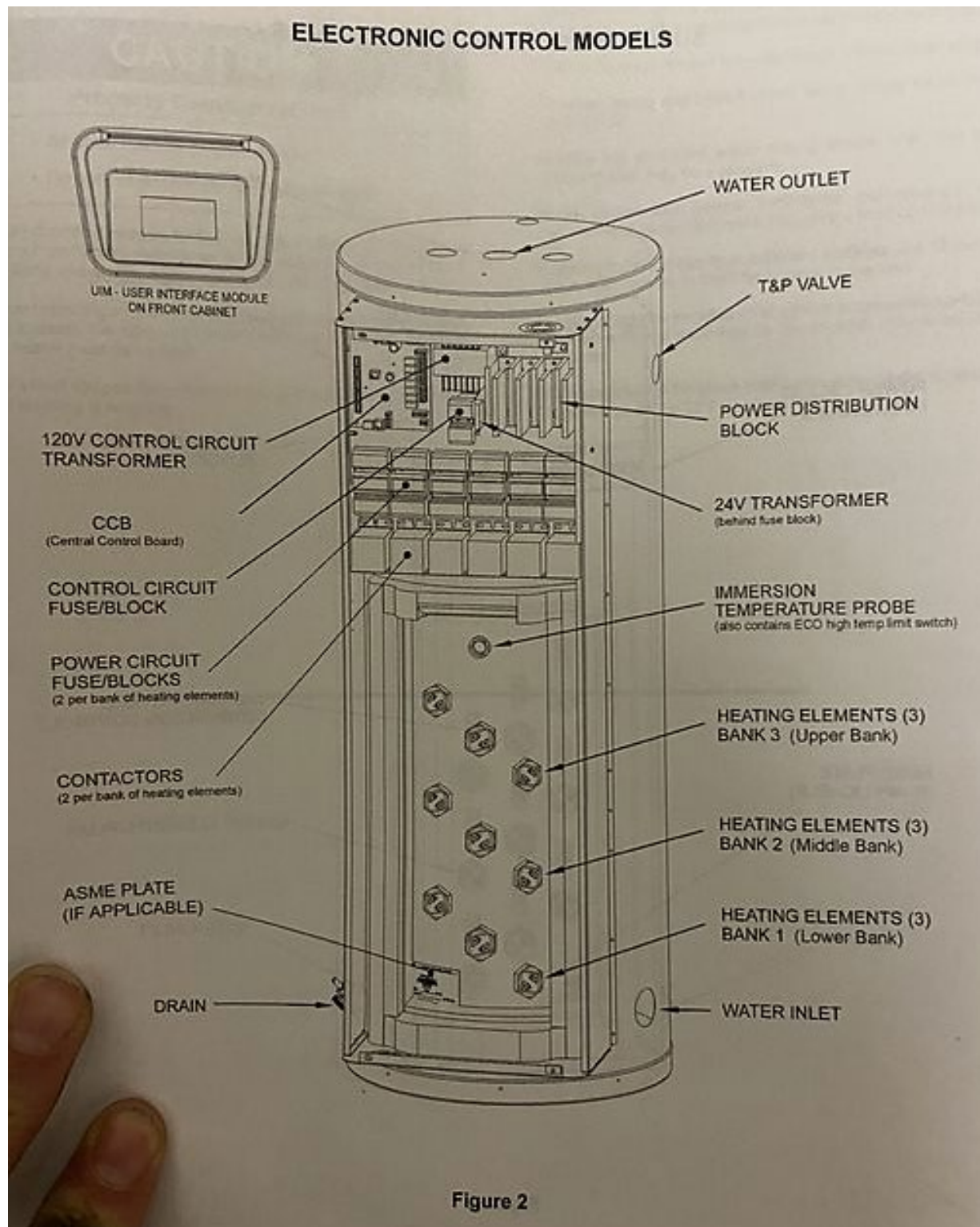


Photo 3 - Electronic control module diagram



Photo 4 - Control block where incoming power terminates, located at the top of control module. Smoke and minor heat damage otherwise unaffected.



Photo 5 - HWT as found after fire. No clean up done. (BLUE) Smoke damage on the hot water tank above the control panel (RED).