Incident Summary #II-1458612-2022 (#30234) (FINAL)

SUPPORTING INFORMATION	Incident Date		October 27, 2022
	Location		Saltspring Island, BC
	Regulated industry sector		Electrical - Low voltage electrical system (30V to 750V)
	Impact – Injury	Qty injuries	0
		Injury description	none
		Injury rating	None
	Impact – Damage	Damage description	Smoke, arcing and melting of metal and melted breaker in main distribution panel
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		Breaker for heat pump branch circuit overheated and melted. Main buss in distribution panel also melted.
INVESTIGATION CONCLUSIONS	Site, system and components		**Site:** Single family dwelling 3900 square feet approximately 13 years old. 200-Amp / 240-Volt overhead service with 200-Amp combination distribution panel located in utility room within dwelling. **Components:** • Combination distribution panel 200-Amp / 240-Volt (Photo 1 and 2) • Two push-on type quad breakers with two 15-Amp circuits and one two-pole 40-Amp circuit • #8 AWG 2 wire NMD90 copper conductors rated for 50-Amps • 3R rated local disconnect • 60-Amp rated heat pump (Photo 4) • 100-Amp / 240-Volt sub panel **Normal Operation:** Main 200 Amp breaker is connected to buss of distribution panel by two bolts. Two pole 40 Amp quad breaker is pushed onto buss making a physical connection between breaker and buss. This breaker protects the branch circuit conductors and heat pump.
	Failure scenario(s)		A heat pump was connected to a branch circuit NMD90 #8 AWG copper conductors terminated to a 40-Amp two pole breaker. The heat pump manufacturer (Photo 4) requires a minimum circuit ampacity of 36-Amps and breaker size of 60-Amps. The heat pump breaker had been tripping in August and September 2022 and reset by the homeowner. The homeowner obtained services of a refrigeration company.

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	The refrigeration company diagnosed a faulty compressor motor and replaced it with a new one. The heat pump breaker continued to trip and be reset after motor had been replaced.
Facts and evidence	**Homeowner statement:** • Heat pump breaker had been tripping on an ongoing basis • They had been away and returned home and turned heat up to 21 degrees C **Refrigeration company statement:** • September 12, 2022, replaced compressor motor in heat pump as it had shorted to ground • Breaker in panel had tripped • Reset breaker and system operated as expected **Safety Officer observations:** • Heat pump manufacturer specifications requires 60-Amp breaker • 40-Amp two pole breaker was installed for heat pump • Minimum conductor was sized correctly for heat pump • Push on quad breaker with two pole 40-Amp circuit melted (Photo 3) • Distribution panel buss melted at location of breaker • Remainder of panel buss undamaged • Push on quad breaker with two pole 40-Amp for hot tub on same buss location as heat pump (Photo 5)
Causes and contributing factors	It is possible that the breaker being under sized for the heat pump requirement contributed to the failure of the equipment. The repeated resetting of the breaker and the new compressor motor also may have contributed to the failure. Having both Quad 40-Amp breakers for heating loads (Heat pump and Hot tub) on the same buss location may have also contributed to the failure of the equipment. It is also possible that the push on style breaker was making poor contact due to a loose-fitting connection to the buss. It is most likely that a combination of all the above situations resulted in the ultimate failure of the electrical equipment.

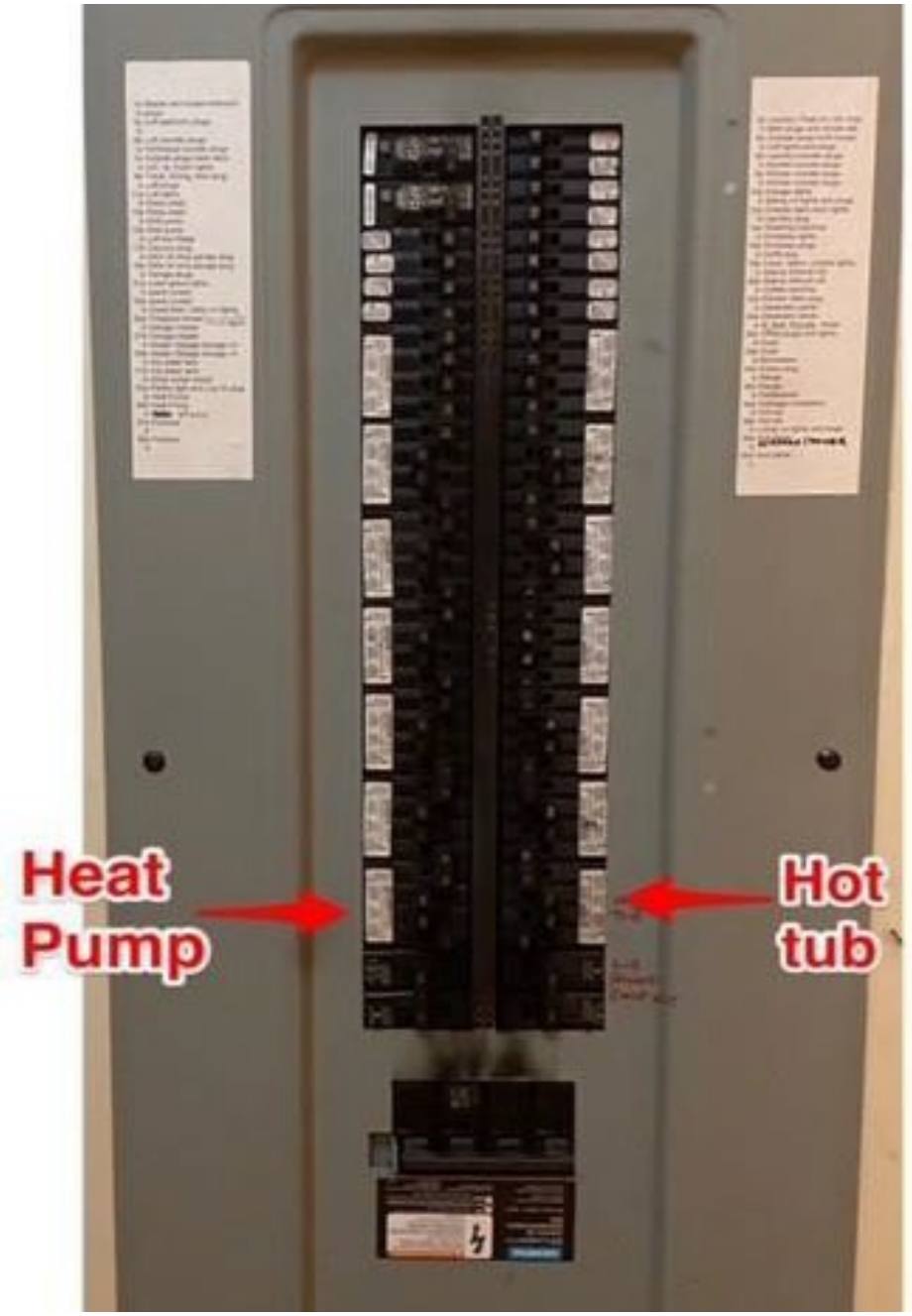

Photo 1 – 200-Amp combination distribution panel. Smoke damage visible above main 200-Amp breaker

Photo 2 - Back side of cover from distribution panel with smoke damage

Photo 3 - Quad 2 pole 40-Amp heat pump breaker

Photo 4 - Heat pump nameplate with breaker size requirement and minimum circuit ampacity

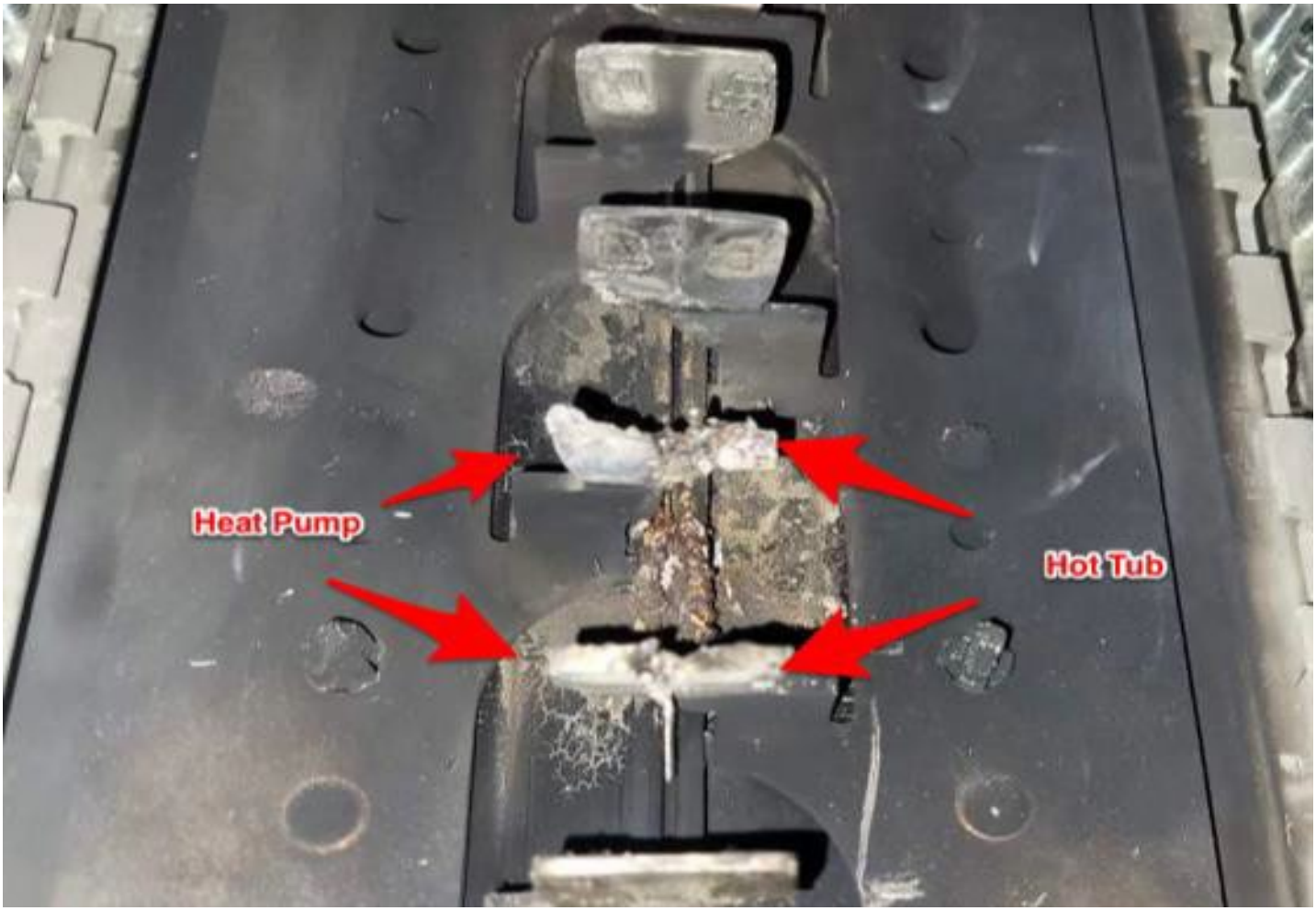

Photo 5 - Location of Heat pump and Hot tub breakers on main buss