

Incident Summary #II-1657916-2024 (#43177) (FINAL)

SUPPORTING INFORMATION	Incident Date	January 7, 2024	
	Location	Whistler	
	Regulated industry sector	Electrical - Low voltage electrical system (30V to 1000V)	
	Impact	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Damage	Damage description	Interior cabin of a towable recreational vehicle was damaged by fire as well as associated heat and smoke.
		Damage rating	Major
	Incident rating	Major	
Incident overview	A modified extension cord plugged into a 120V outlet located inside of a RV, used to power a portable space heater, ignited nearby combustible material. The resulting fire spread within the interior cabin of the RV, which caused fire, heat, and smoke damage. The RV was vacant at the time of the fire. The RV was deemed unsalvageable due to the damage caused by the fire.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>The portable electric space heater, which was in-use when the fire started, had a nameplate rating of 120V and 1500W (Image 1). This heater was provided with a two-prong corded plug-end.</p> <p>At the time of the fire, the portable heater was connected to a modified extension cord. The factory installed receptacle-end of the extension cord had been cut off and replaced with an aftermarket receptacle-end.</p> <p>The modified extension cord was plugged into a 120V 15A general purpose receptacle provided by the RV manufacturer within the interior cabin of the RV. The 120V 15A receptacle was fed from a circuit protected by a 15A 1P circuit breaker installed within the RV manufacturer provided power control centre. That circuit breaker was designed to provide short circuit and overload protection but did not include arc-fault protection.</p>	
	Failure scenario(s)	<p>The aftermarket receptacle-end that was installed on the extension cord includes internal conductor terminations consisting of set-screw compression terminals for the line (i.e. 'hot'), neutral and bonding conductors. As a result of incorrect termination, a loose or high resistance connection was created, which resulted in electrical arcing at the point of termination. An electrical arc can generate temperatures between 2,800 to 19,000 degrees Celsius.</p> <p>The general purpose 120V 15A receptacle that the portable space heater and modified extension cord were connected to was protected by circuit breaker having over current and short circuit protection, but not arc-fault protection. The incorrectly installed aftermarket receptacle-end caused high temperature arcing within the receptacle-end body, which did not trip the circuit breaker.</p> <p>The aftermarket receptacle-end was located under an upholstered couch and close enough to ignite the fabric. As the connected space heater drew enough current</p>	

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	<p>during prolonged operation, the heat from repeated arcing at the termination point within the receptacle-end ignited the fabric of the upholstered couch and started a fire.</p>
<p>Facts and evidence</p>	<p>Based on interview statements from the RV occupant, at the time of the fire the portable electric heater was placed on the floor of the RV interior cabin. The modified extension cord was also placed on the floor, with the aftermarket receptacle-end situated in close proximity to a built-in upholstered couch.</p> <p>The point of origin for the fire appears to have been at the upholstered couch (Image 2), based on the observed fire damage during the site investigation.</p> <p>The portable heater plug-end that was inserted into the aftermarket receptacle-end installed on the extension cord was observed to have charring on the line voltage prong (Image 3). The plastic around the charred prong of the plug-end appeared partially melted (Image 3).</p> <p>The aftermarket receptacle-end (Image 4) was observed to be melted around the line voltage termination point, to the extent that a hole had been melted through the plastic receptacle body, exposing a portion of the line voltage terminal (Image 5, Image 6).</p> <p>Removal of the remaining receptacle-end housing to expose the interior termination points showed that the line voltage terminal was charred, along with significant localized melting of components around that terminal. The line voltage conductor that had previously been terminated under that termination point had been completely melted away, and no conductor remained within the termination (Image 7).</p> <p>The RV occupant confirmed that the 15A 1P circuit breaker protecting the general-purpose receptacle circuit to which the heater and extension cord were connected did not trip during the fire and was observed to still be in the 'ON' position at the time of the investigation (Image 8).</p>
<p>Causes and contributing factors</p>	<p>It is very likely that the line voltage conductor of the extension cord was improperly terminated to the aftermarket receptacle-end, resulting in repeated arcing. Because the circuit breaker protecting the 120V receptacle that the portable heater and modified extension cord were connected to did not have arc-fault protection, it's probable that repeated arcing resulted in the observed melting of that receptacle-end.</p> <p>It is also very likely that the aftermarket receptacle-end was laying on the floor of the RV underneath the upholstered couch at the time the fire started.</p> <p>After the receptacle-end had partially melted away around the line voltage terminal, continued arcing likely generated enough heat to ignite the nearby upholstered couch.</p>



Image 1 - Exemplar image of the portable heater model in use at the time of the fire.



Image 2 - Upholstered couch, which appears to have been the point of origine for the fire.



Image 3 - Portable heater plug-end showing charring on the line voltage prong, as well as localized melting of the plastic receptacle body around that prong.



Image 4 - Aftermarket receptacle-end.



Image 5 - Localized melting of receptacle-end.



Image 6 - Melting around line voltage terminal.



Image 7 - Localized melting inside the receptacle-end.

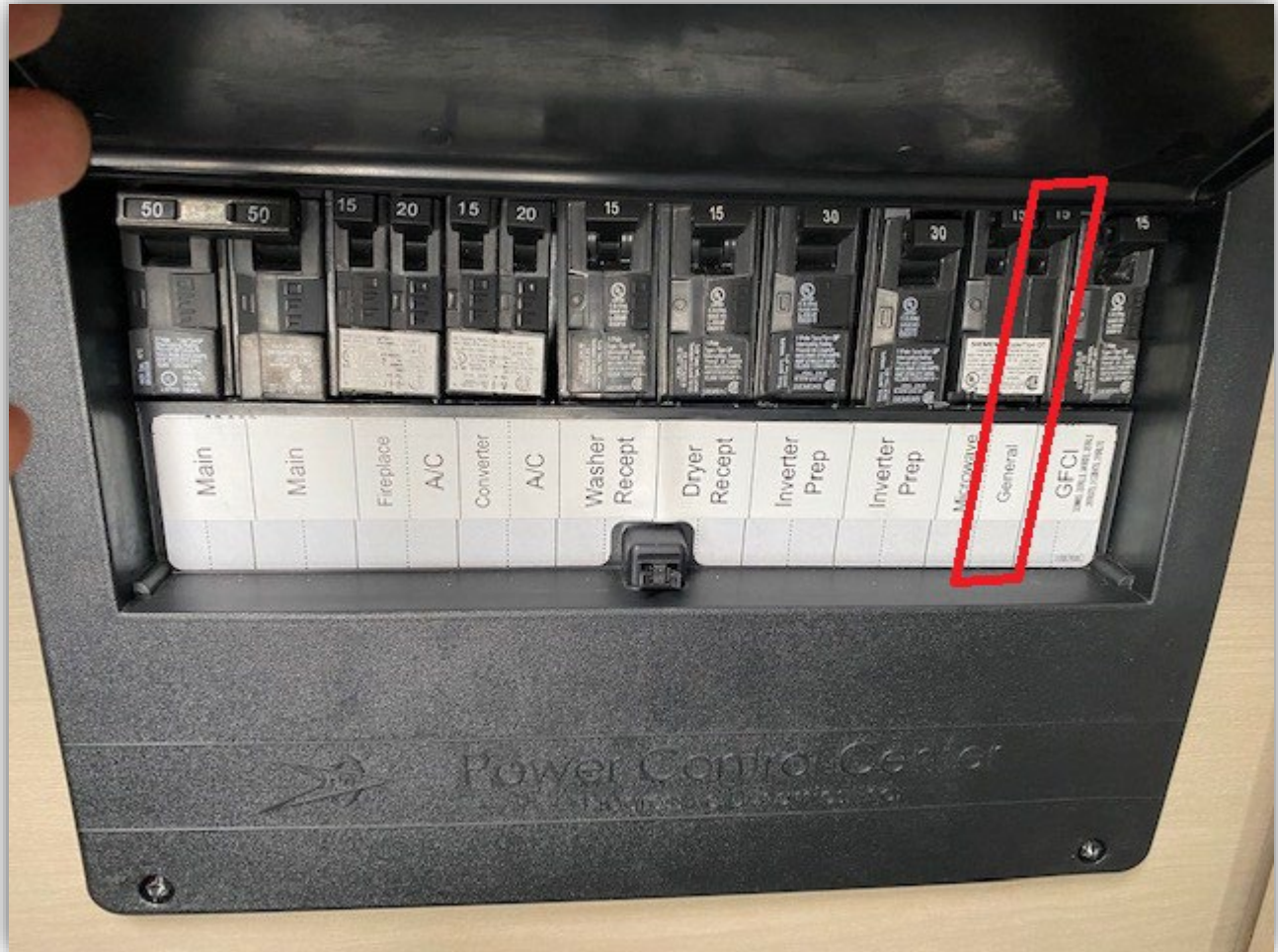


Image 8 - The 15A 1P circuit breaker protecting the general-purpose receptacle circuit to which the heater and extension cord were connected. Shown to still be in the 'ON' position at the time of the investigation.