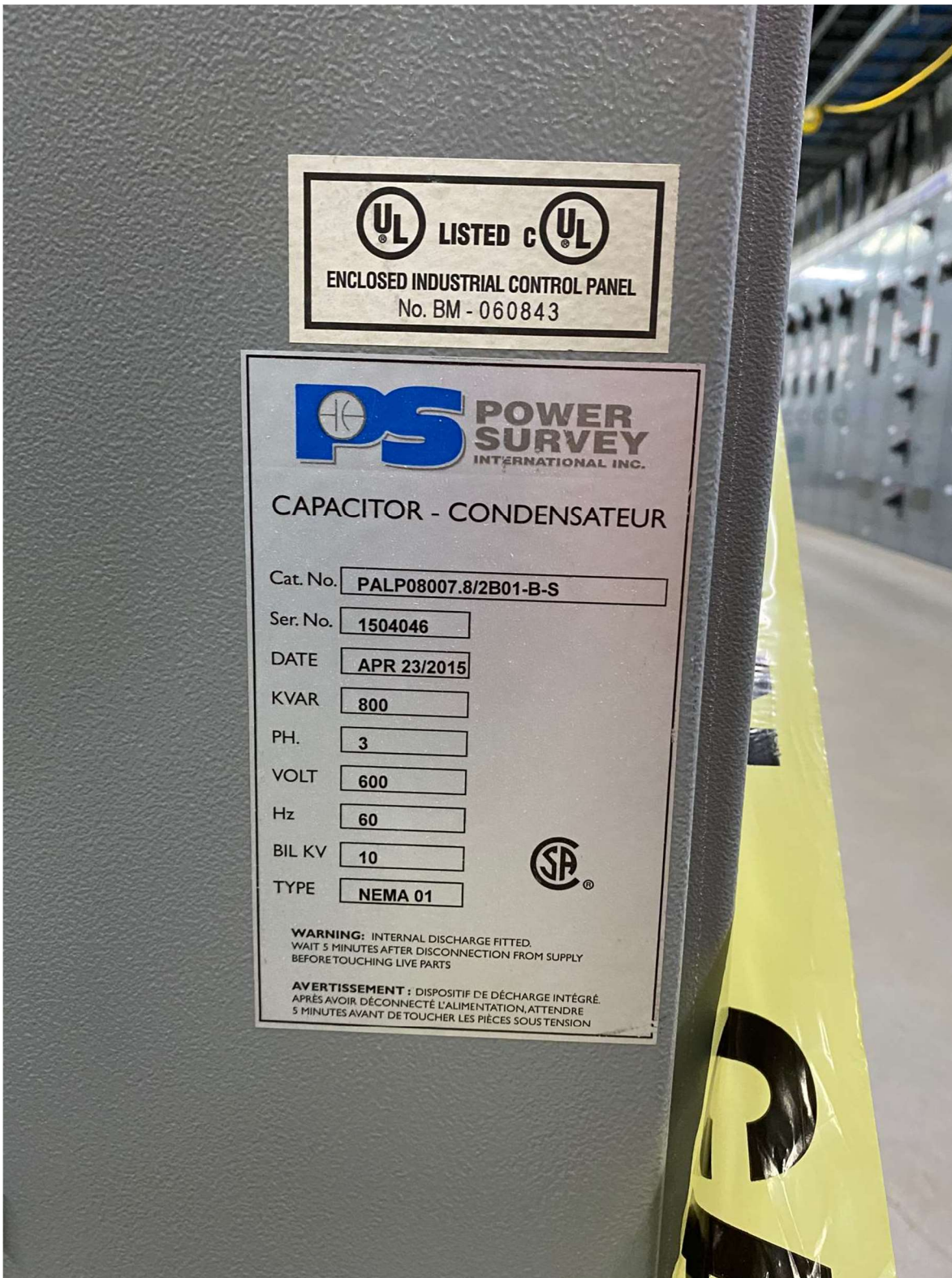


Incident Summary #II-1235312-2021 (#23370) (FINAL)

SUPPORTING INFORMATION	Incident Date	August 10, 2021	
	Location	Coldstream, BC	
	Regulated industry sector	Electrical - Low voltage electrical system (30V to 750V)	
	Impact	Qty injuries	0
		Injury description	N/A
	Damage	Injury rating	None
		Damage description	A termination between a fuse and insulated stand off and electrical components in a capacitor bank were destroyed. Burn marks and evidence of an arc flash event occurred inside the capacitor bank enclosure.
		Damage rating	Moderate
Incident rating	Moderate		
Incident overview	A termination to a fuse protecting a single capacitor in a capacitor bank overheated and caused heat stress to a fuse. This heat stress eventually caused the fuse to fail which damage to the electrical components inside the capacitor bank enclosure. This caused the main breaker to the facility to trip.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>A pellet plant manufacturing facility uses a capacitor bank to correct the plants power factor when large 3 phase motors are started and stopped. This capacitor bank monitors the power factor and automatically brings capacitors on and offline as needed to correct the power factor.</p> <p>The capacitor bank enclosure has multiple 3 phase capacitors installed in it. Each individual capacitor is installed on a common buss bar and is fused individually with 3 separate fuses from this common buss bar. The whole enclosure was engineered for this purpose and bears an approval mark.</p>	
	Failure scenario(s)	<p>A single fuse protecting one phase of a capacitor appears to have been subject to heat stress, failed and an arc flash event occurred inside the capacitor enclosure, subsequently damaging electrical components inside and taking the capacitor and facility offline.</p> <p>The device that was used to secure the fuse is an insulated stand off, not a rated fuse holder. This insulated stand off is typically used to separate buss bars in electrical equipment or provide isolation to a ground bar where needed in other installations.</p> <p>The capacitor that this fuse protects is brought on and offline multiple times and is the most frequently used capacitor in the bank aiding to the heat stress put on the termination of the fuse to the insulated stand off.</p> <p>The continual operation of the capacitor and subsequent heating to the termination point on the fuse and insulated stand off, which was unable to dissipate the heat</p>	

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	<p>properly, eventually the fuse failed, and an arc flash event occurred inside the capacitor bank enclosure.</p>
<p>Facts and evidence</p>	<p><u>Maintenance Staff Statements:</u></p> <ul style="list-style-type: none"> -Witness reports hearing a very loud bang noise and the main-breaker to the facility tripped to OFF position. -Upon investigation by the maintenance staff, capacitor bank #8's center fuse and connection were destroyed and the blackened area of equipment surrounding the destroyed fuse extends in area approx. 1/2 Meter square. -Maintenance staff then noticed plexiglass fuse divider is melted and folded in towards the destroyed fuse. -Insulated stand off and fuse terminations appear to be affected by intense heating. -Some pitting and arc-flash / plasma event damage is visible on the horizontal buss bars. <p><u>Capacitor Bank Enclosure:</u></p> <ul style="list-style-type: none"> -When a capacitor is brought online it has a large inrush of current which stresses the electrical equipment and aids to the heating of the termination points in the system. -The insulated stand off used to secure the fuse did not have voltage or current ratings for the intended use, like a rated fuse holder. -The fuse was bolted to the insulated stand off using regular steel hardware which does not dissipate the heat like copper material that is used in a rated fuse holder. -The surface area in contact between the insulated stand off and the fuse is limited to a small area which will affect the heating/cooling of this connection when the capacitor is brought on and offline. -The bolt and hardware that was used to secure the fuse to the insulated stand off was melted in place and fused together which was unable to be taken apart. -This capacitor is brought on and offline more frequently than the other capacitors in the enclosure adding to the stress on the termination point, limiting cooling time. -The plexiglass fuse divider installed between the group of fuses to the capacitor showed signs of heat stress, visibly melted when observed.
<p>Causes and contributing factors</p>	<p>The failure of the fuse and subsequent arc flash event was likely caused by overheating of the termination point of the fuse to the insulated stand off. This caused heat stress on the fuse which eventually failed.</p> <p>The insulated stand off connections were not rated to be a fuse holder. The surface area where the fuse bolted to the insulated stand off was limited. The steel hardware that was used to attach the components heats quickly and dissipates heat poorly.</p> <p>The failure was limited to the capacitor that was the most frequently used.</p>



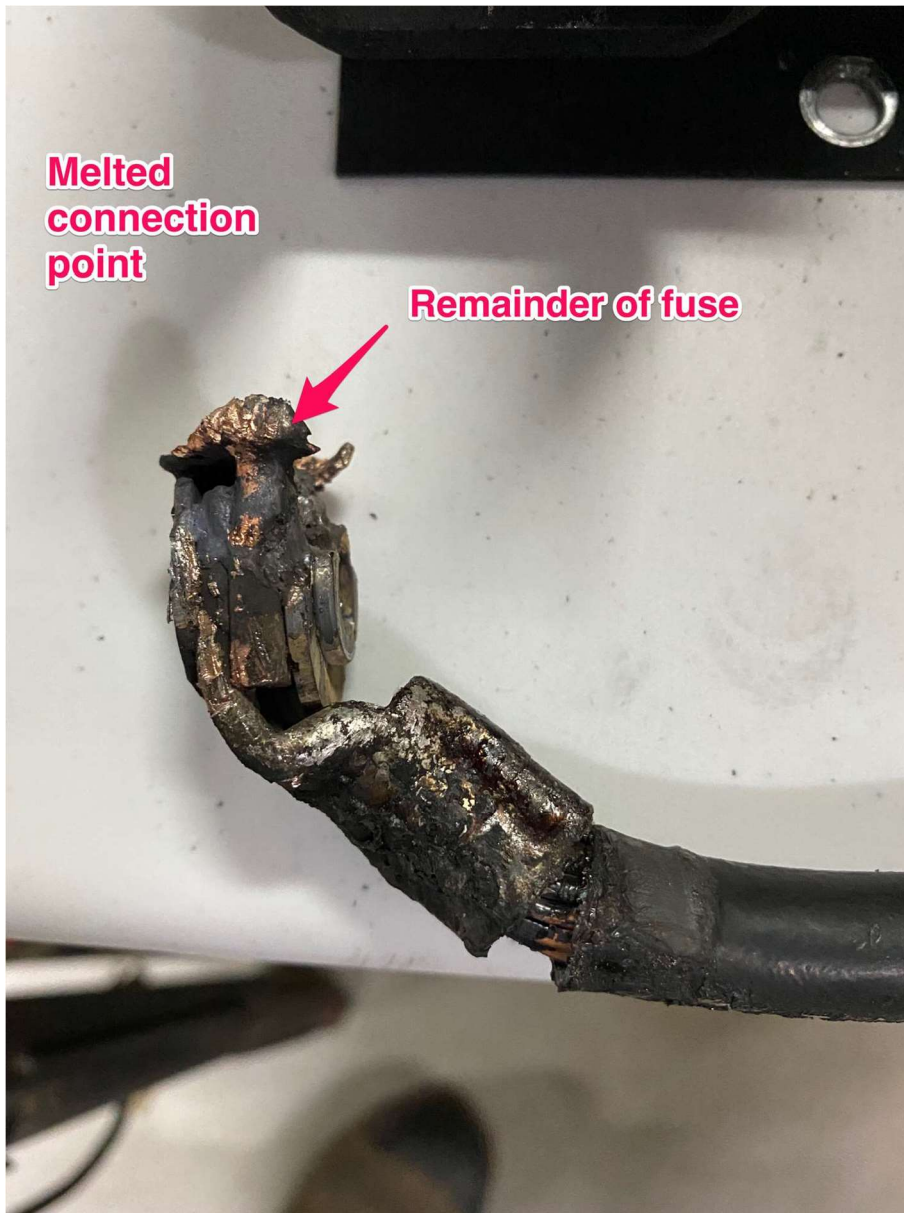
Capacitor bank specs/certification.



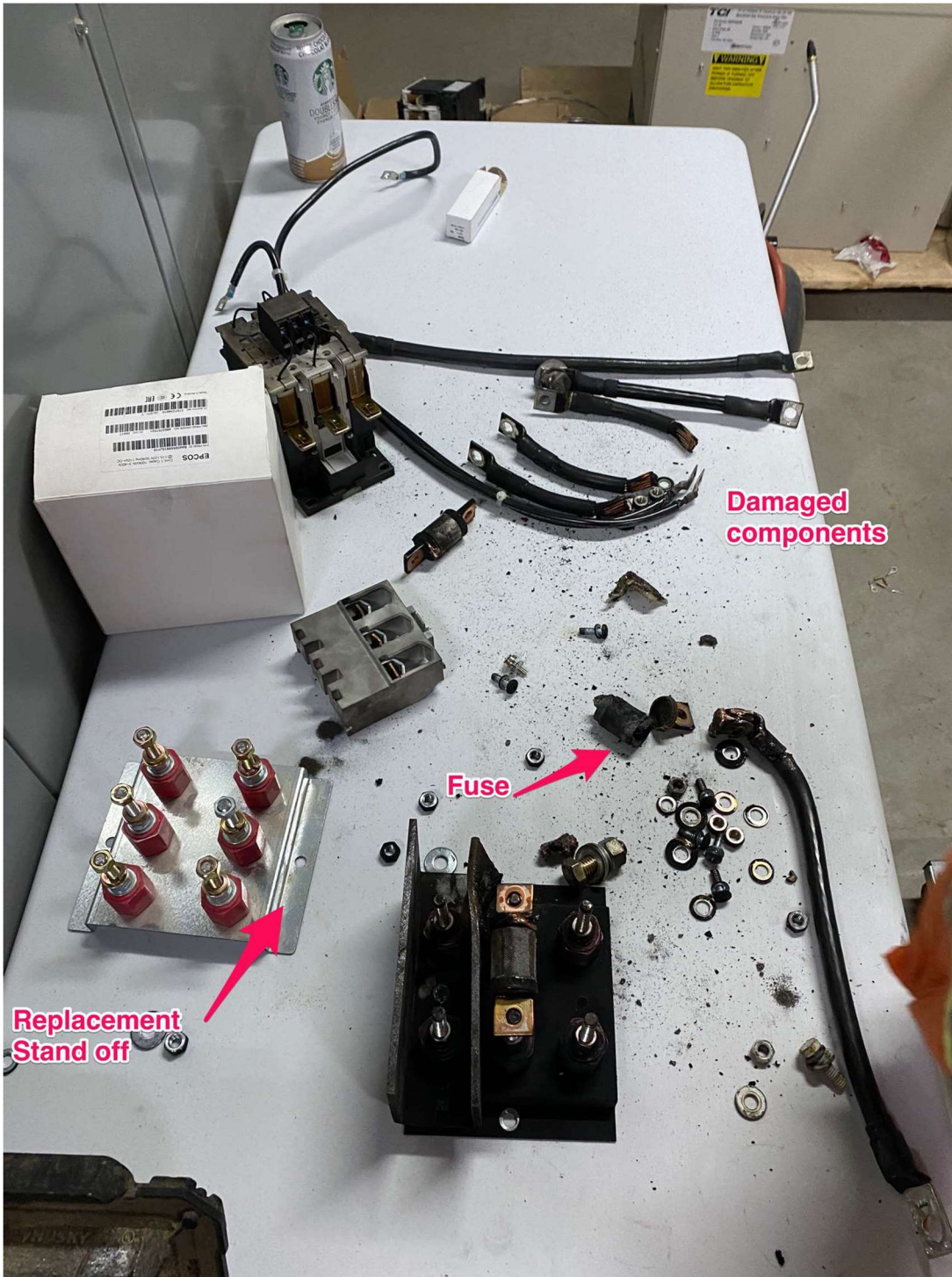
Interior view of damaged capacitor bank.



Melted plexiglass divider and termination.



Melted connection point.



Damaged components.