Incident Summary #II-1266942-2021 (#24374) (FINAL)

SUPPORTING INFORMATION	Incident Date		October 9, 2021
	Location		Kamloops, BC.
	Regulated industry sector		Electrical - Low voltage electrical system (30V to 750V)
	Impact – Injury	Qty injuries	0
		Injury description	Not applicable
		Injury rating	N/A
	Impact – Damage	Damage description	An existing electrical power distribution system re-connected to a new Master Control Center system caused the new MCC connection between the buss and bucket to fail upon energization at the new MCC location.
		Damage rating	Minor
	Incident rating		Minor
	Incident overview		Electricians were performing a routine power down, relocate/replacement of power cable feeders from an existing Power distribution center (PDC) to a new Motor Control Center (MCC) location, replacing an existing aging MCC. When the existing PDC was energized by the new MCC system, immediately there was a fault that occurred and the new breaker in the new MCC bucket flashed over ** and caused the main MCC 600amp breaker protecting the buss equipment to trip out. This caused damage to the new MCC bucket and subsequent bussing system within the MCC. ** Flashover is a thermally driven event during which every surface exposed to thermal radiation in a compartment or enclosed space rapidly and simultaneously ignites. Signs of flashover include: High heat conditions or flaming combustion overhead.
INVESTIGATION CONCLUSIONS	Site, system and components		The Motor Control Center (MCC) is a large steel enclosure encompassing a group of buss-bars sized to carry the power to individual Power Distribution Centers (PDC). (*see Figure 1*) Within the MCC enclosure are multiple individual enclosures known as buckets, housing individual disconnecting and over-current protection devices (*see figure 2*). These MCC buckets are a factory-built assembly of a molded case circuit breakers bolted to a re-moveable frame, of which the bucket frame jaw assembly (*see figure 3*) can then be attached to the MCC busbar structure (*see figure 4*). These buckets range from 60 to 400amps in size. This particular one that had the fault occur was in a 200amp bucket, housing a 200amp 3-pole breaker (*see figure 5*).

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	Once the distribution cables attach to the breaker, and all the components are plugged in together, the procedure is to turn the switch to the bucket into the closed (ON) position. This engages the breaker and allows power to flow from the buss-bar assembly within the MCC to the power distribution center (PDC).
Failure scenario(s)	The on-site electricians ensured the PDC system was in an open state (OFF). The on-site electricians performed testing of the existing PDC equipment, including the new cables and new MCC terminating kit on the load side. The MCC, in particular the 200amp switch was also tested in an energized state prior to connecting the existing PDC. At the MCC, one of the electricians turned the power on and verified the MCC 200amp breaker had the correct voltage output on the load side. Tests were Phase to Ground and phase to phase. The results of the respective tests were a pass, and the next step was for the existing PDC to be terminated and re-energized by the new MCC. When the MCC 200amp switch closed, the MCC 200amp breaker engaged as required. The electricians then went over to the PDC system and proceeded to engage this system. Immediately upon closing the PDC switch (turning it on), the 200amp bucket in the new MCC experienced the arc-over event. The MCC bucket encompassed this arcing event, containing the arcing within the bucket. The main 600amp breaker of the MCC, proceeded to open as a result of the arcing event.
Facts and evidence	Following an Interview with the Lead electrician and the on-site maintenance electrician. All installation practices, including following standard operating procedures and the donning of approved personal protective equipment was followed accurately. Unclear on the events leading up to the incident as to why the new 200amp bucket in the new MCC failed, the on-site maintenance electrician directed the electrical installation contractor to begin the immediate repair of the MCC and get the existing PDC back up and running, temporarily back to the original MCC. The damaged 200amp MCC bucket was removed from the New MCC and inspected. It was during this removal procedure that the lead electrician performed an inspection, and that it was seen that 2x phases of the line side terminals of the 200amp molded case circuit breaker were found loose and that the conductors from the breaker terminals to the frame jaw assembly were not effectively tightened/torqued (frame terminals were tight) (*see figure 3*).

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	When the electricians energized the MCC 200amp breaker without the PDC load connected, the test readings revealed 600volts phase to phase and 347volts phase to ground. Upon energizing with a load, potentially caused the breaker line side terminal, 2x phase conductors that were not tightened to their respective terminals** to arc over (*see figure 6*). ** When a conductor carries a load, it requires a solid connection wherever multiple components intersect. If that connection point is loose, arcing may occur at the loose connection resulting in increasing heat, resistance and current.
Causes and contributing factors	It is highly probable that the factory built MCC bucket/breaker assembly was assembled, having the terminal connections of that particular circuit breaker bucket not being adequately torqued/tightened.

Figure 1 – MCC enclosure backside

Figure 1 – MCC enclosure Front view

Figure 2 – MCC Bucket front view with breaker inside.

MCC enclosure front view with bucket removed, revealing where the breaker attaches to the buss assembly.

Figure 3 – MCC Bucket rear view showing what components attach to the buss assembly.

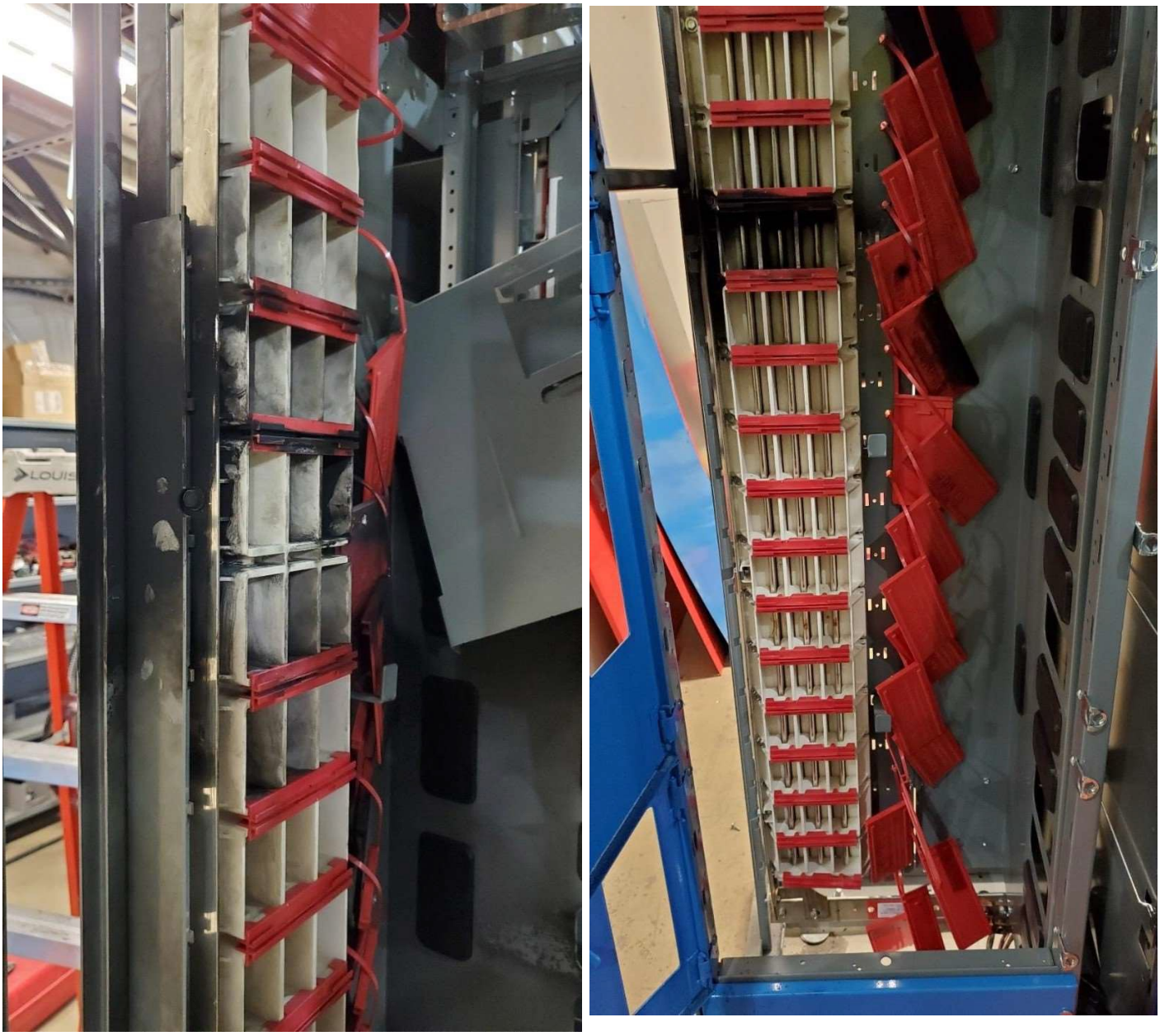

Figure 4 – MCC Buss-bar assembly located within the MCC enclosure behind the buckets.

LINE side connections from manufacturer take place within this compartment here.

Figure 5 – MCC Bucket 200amp 3-pole molded case circuit breaker.

LOAD side connections from the Duty Holder take place within this compartment here on the load side of the breaker.

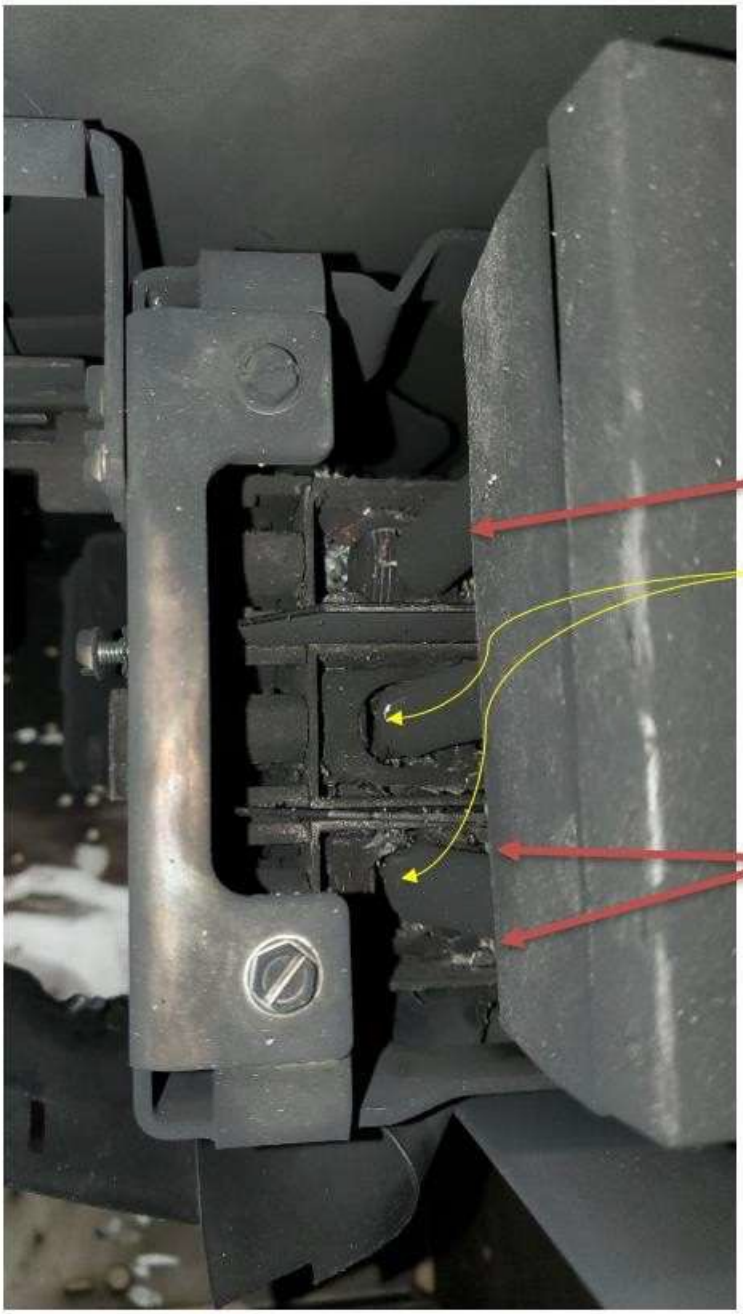

Figure 6 – MCC Bucket 200amp 3-pole molded case circuit breaker.

Line side factory installed connections.

Of the 3 phases, as found, this one remained torqued tight.

These 2 were found too not be tight.

As seen, there are no "welding" marks indicative of a short circuit condition, just terminal alloy destruction.