Incident Summary #II-1672647-2024 (#44259) (FINAL)

SUPPORTING INFORMATION	Incident Date		February 12, 2024
	Location		Victoria, BC
	Regulated industry sector		Electrical - Low voltage electrical system (30 to 1000V)
	Impact – Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	Electrical fire in sub distribution switchboard resulting in catastrophic damage to sub distribution equipment. Unrepairable heat, smoke and electrical arc fault damage to fused switchboard.
		Damage rating	Major
	Incident rating		Major
	Incident overview		In the main electrical room on an older, multi-story commercial building consisting of newer office and clinics areas, a bus bar overheated and started an electrical fire in sub distribution switchboard. The safety features of the breaker protecting this board had been disabled and breaker did not trip to disconnect power supply feeding energy to the fault. The arc flash event eventually tripped a fuse on the high voltage side of the electrical system to de energize.
INVESTIGATION CONCLUSIONS	Site, system and components		This is an indoor, high voltage station with a transformer that feeds the sub distribution switch board with a 347/600-volt supply via bus duct connection. There are primary fuses protecting the high voltage transformer and the sub distribution switchboard is protected by a 1000-amp breaker, which then feeds a bus bar system integral to the switchboard. Fused switch sections are then tapped off the bus bar system with fusing to feed and protect distribution to other equipment throughout the building. There are external components to the 1000-amp breaker to enable current and fault sensing that need to remain connected for the breaker to perform as intended. The sub distribution switchboard is certified to a particular rating to contain arcing, short circuit and electrical faults. The fire and fault event was contained to the sub distribution enclosure due to appropriate conduit and cable entries and prevented further damage to the surrounding area and equipment.

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Failure scenario(s)	During a recent renovation to a tenant space at the building, additional electrical work had been done to add electrical loads to the sub distribution switchboard. The switchboard lacked room for expansion and one of the additions utilized a direct connection via field installed lugs directly to the switchboard bus bar. This connection fed directly to an externally mounted fused disconnect switch and then to a transformer system. The point of failure was at the direct connection to the bus bar system. Either the lug was not bolted securely to the bus bar, or the cable itself was not tightened appropriately in this lug. This caused arcing at the connection. The arching heated up overtime and resulted in an electrical fire. Once the protective insulation covering on the conductor was melted completely, there was a short circuit between other conductors and/or the grounded enclosure. The breaker upstream of this equipment is intended to trip and disconnect the electrical energy feeding the fault and limiting damage. In this instance, the main breaker protecting the switchboard did not trip during the arc fault and short circuit event as the external components and protections for the breaker had been disconnected. This allowed the electrical system to remain energized for an extended period of time and thereby provided energy to the fault until a high voltage fuse tripped to deenergize the system. The wiring methods and maintenance of the enclosure contained the fault events as intended.
Facts and evidence	**Site observations** • Electrical room sub distribution switchboard sections were full. • Upper/interior section of the switchboard was melted and charred. • A/B phase of switchboard external tap connection lugs were still intact, and the wire was melted. • C phase external tap connection lug and wire were completely disintegrated. • C phase upper bus bar was completely disintegrated. • Switchboard enclosure was warped and charred due to the fire and flash over event. • 1000-amp breaker was not in the tripped position. • Labelling on the breaker section that trip unit had been disconnected. • Fault events were contained to the rated enclosure of the switchboard. **Contractor statement** • High voltage fuse was blown and replaced. • High voltage utility supply was disconnected outside of the building. • Smoke and soot were found at the external components. • Cleaning was required at the external components. • Recertification and testing of the external busduct completed. • 1000-amp breaker trip components were inoperable at the time of the fault. • External components of the 1000-amp breaker were reconnected, certified and tested. • 1000-amp breaker was certified and tested for reconnection. • Temporary distribution to be installed. • New distribution switchboard to be installed.

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Causes and contributing factors	It is possible that a loose wire termination lug resulted in the connection heating up over time, eventually causing ignition and electrical fire. During the fire, the insulation may have burned from the conductors also creating a short circuit and arc flash event. A contributing factor to the incident was the disconnection of the 1000-amp main breaker upstream from the event which prevented it from tripping and shutting off the electrical energy to the fault. This allowed the fault and fire to continue until a main high voltage fuse tripped to deenergize the system causing a higher degree of damage.

Image 1 – Distribution board enclosure.

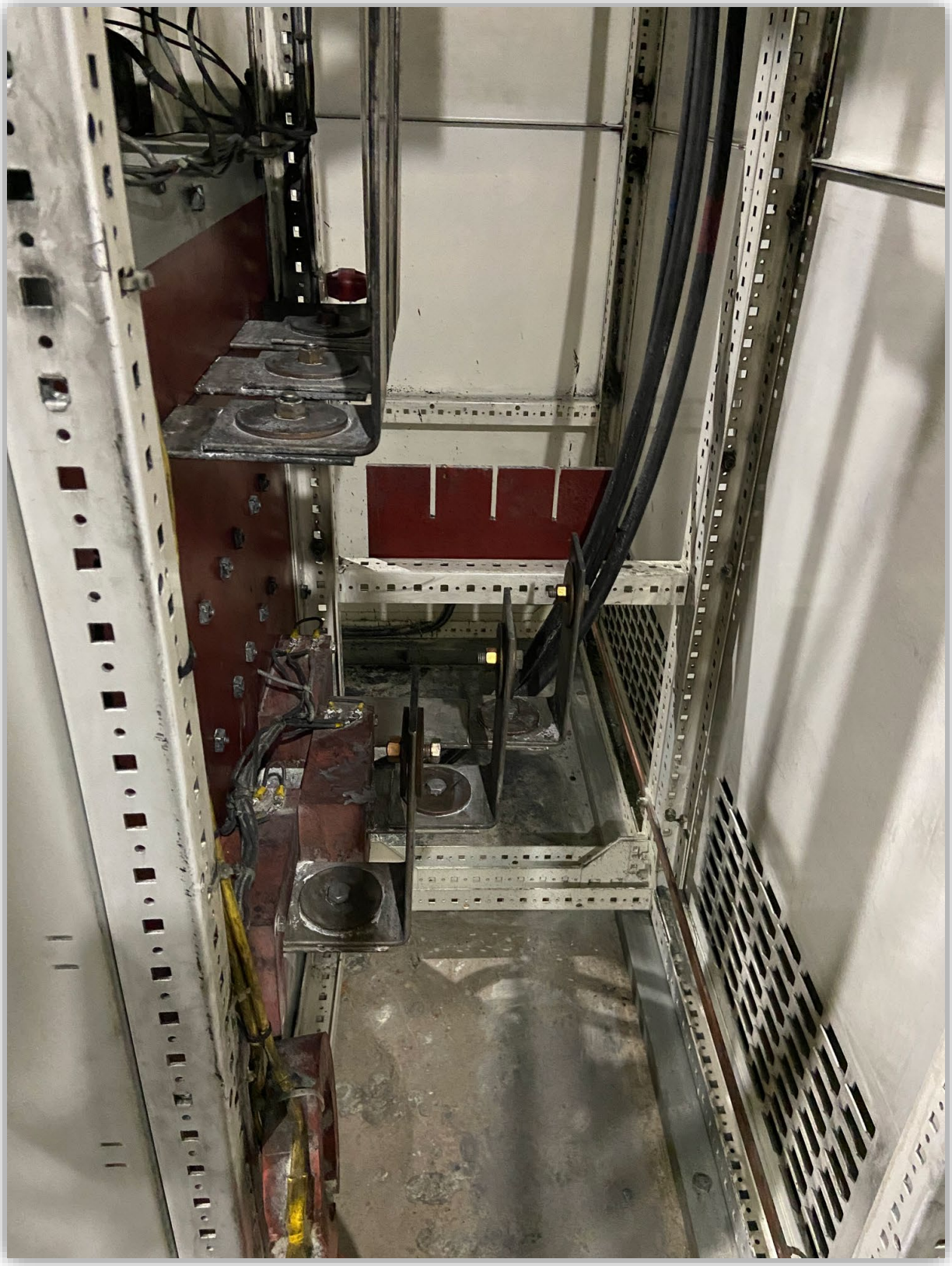

Image 2 – Side view of distribution board enclosure.

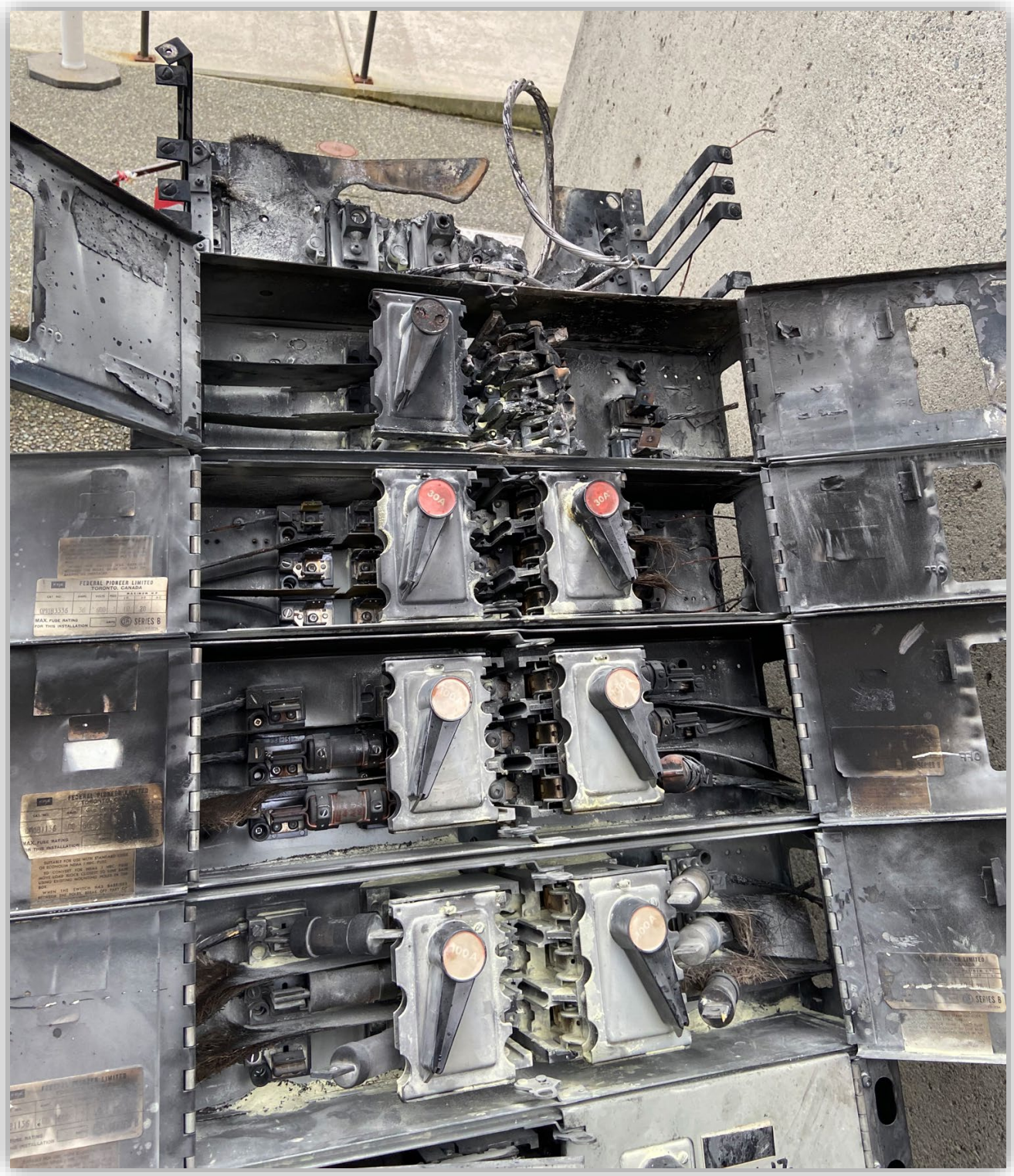

Image 3 – Fused switches and distribution board.

Image 4 – Close up of melted bus bar.

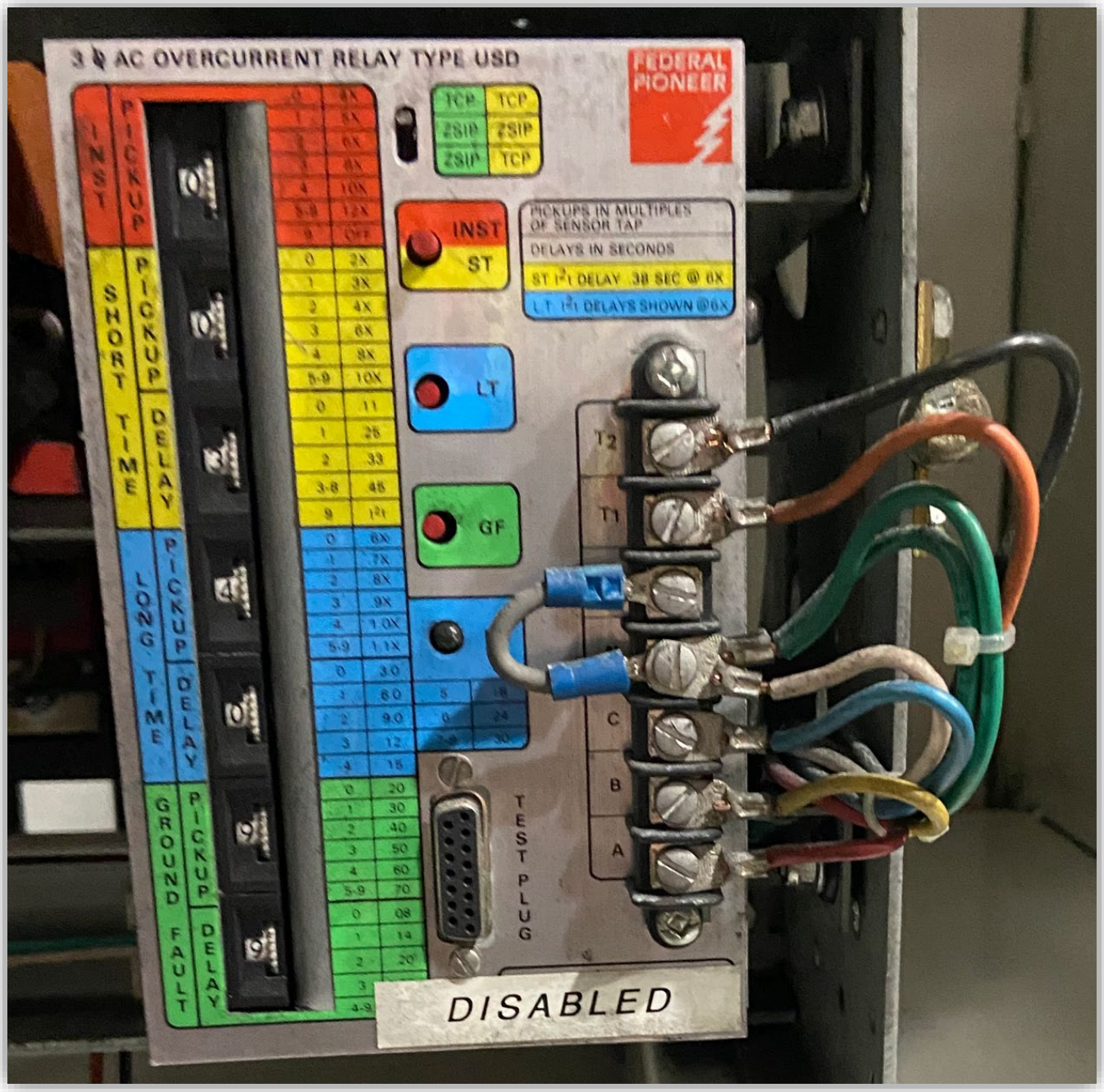

Image 5 – Trip unit labelled as disabled.