

Incident Summary #II-825724-2019 (#11410) (FINAL)

SUPPORTING INFORMATION	Incident Date	March 14, 2019	
	Location	Port Coquitlam	
	Regulated industry sector	Electrical - Low voltage electrical system (30V to 750V)	
	Impact	Qty injuries	1
		Injury description	Individual suffered a third degree burn to the top of one hand.
		Injury rating	Moderate
	Damage	Damage description	Damage occurred to the electrical connection lugs and the enclosure housing the lugs.
		Damage rating	Minor
	Incident rating	Moderate	
Incident overview	Arc flash occurred in the main electrical room when two individuals were attempting to install sub feed cables into the energized main service equipment. One individual sustained burns to the hand, the other individual did not sustain any injuries. There was damage due to heat and arcing to the existing electrical equipment as well as the newly installed cables.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>New sub service equipment was installed for one of the units at this building to provide more electrical capacity to the unit. The sub service equipment had fused disconnect switches installed to protect the conductors, and used parallel sub feeder aluminum armoured cables. Two multi-conductor aluminum armoured cables were installed to split the electrical load equally, instead of using one large cable. Multi-conductor cables provide electricity to each phase of the sub service.</p> <p>With this sub service there are three phases and a neutral point. Each multi-conductor cable has four aluminum conductors. One conductor dedicated for each phase and the neutral, for a total of eight conductors through two cables.</p> <p>When upgrades and sub service work is performed, it is standard practice to de-energize electrical equipment, make connections and re-energize equipment once the work is tested.</p> <p>Testing would involve visual inspection of terminations and cable connections, metering of cables for continuity and confirmation of phasing. Switched or crossed phasing may result in a short circuit scenario when energized. Testing to confirm continuity of cable sheathing and visual inspection of terminations would avoid a potential arc flash when energized. During the interview process it was indicated that the standard testing required and visual inspection was not done.</p>	
	Failure scenario(s)	Sub-distribution equipment was installed and the cables were terminated into this equipment in a de-energized state. The cables were then installed into the main service which was energized. There is potential for arc flash if the cables became crossed and the phasing wasn't consistent from the sub service to the main service. There is also potential for failure and arc flash if there was damage sustained to any the cables, their insulation and armoured sheathing during installation.	

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<p>Facts and evidence</p>	<p>The termination point of the cables at the main service had burning and signs of arcing at Line Two also called Phase B. This would indicate that there was a short circuit or a fault that occurred when it was attempted to be terminated. The above scenario would indicate that one of the lines was crossed, this would create an energized conductor being installed into an energized piece of equipment and would result in arcing. This appeared to be the scenario that was visible at the time of inspection when the main service was de-energized and site inspected. See Photos 3 and 5 below.</p> <p>An interview was conducted with the individual that was injured. This individual returned later that day to repair the damaged wiring and equipment in order to have the power turned back on to the building by the Utility. This individual disclosed during the interview, that he noticed damage to the insulation of the wire that was dedicated for Line Two. The damage to the insulation exposed the internal aluminum conductor and it was in contact with the exterior aluminum sheathing of the cable. This was not visible according to the individual at the time of installation because it was under the cable connector, and when the cable was attempted to be terminated there was an electrical fault between Line two and the exterior cable sheath. Which would also result in arcing and arc flash at the termination point. The damage to the cable and sheath was notice during disassembly, when the power to the building was being restored.</p> <p>During the interview process it was confirmed that both individuals doing the work were qualified journeymen electricians. A question was asked why de-energization and testing was not done. The reply was, that they were in a hurry to complete this for their customer and turning off the main service wasn't an option, because other tenants weren't notified that the power was going to be interrupted.</p>
<p>Causes and contributing factors</p>	<p>It is plausible that accidental contact between the Line 2 conductor and the armoured cable aluminum sheathing would cause an arc producing scenario at the energized termination point.</p> <p>This being a multi-unit facility with other tenants and added pressure from the owners of the equipment to have the work done quickly could also be likely reason that this work was done in an energized state.</p> <p>Section 2, rule 2-304 of the Canadian Electrical Code requires that no repairs or alterations shall be carried out on energized electrical equipment except where complete disconnection of equipment is not feasible, non-compliance to this rule is also a likely cause of the failure scenario.</p>



Unit 107. This is the unit that is having the service upgraded to it. In the photo is the existing 200 amp service

PHOTO 1: All of the fused disconnect switches above the meters were found in the on position.



PHOTO 2: Junction box with energized bussing at time of incident, de-energized by the utility at time of photo.

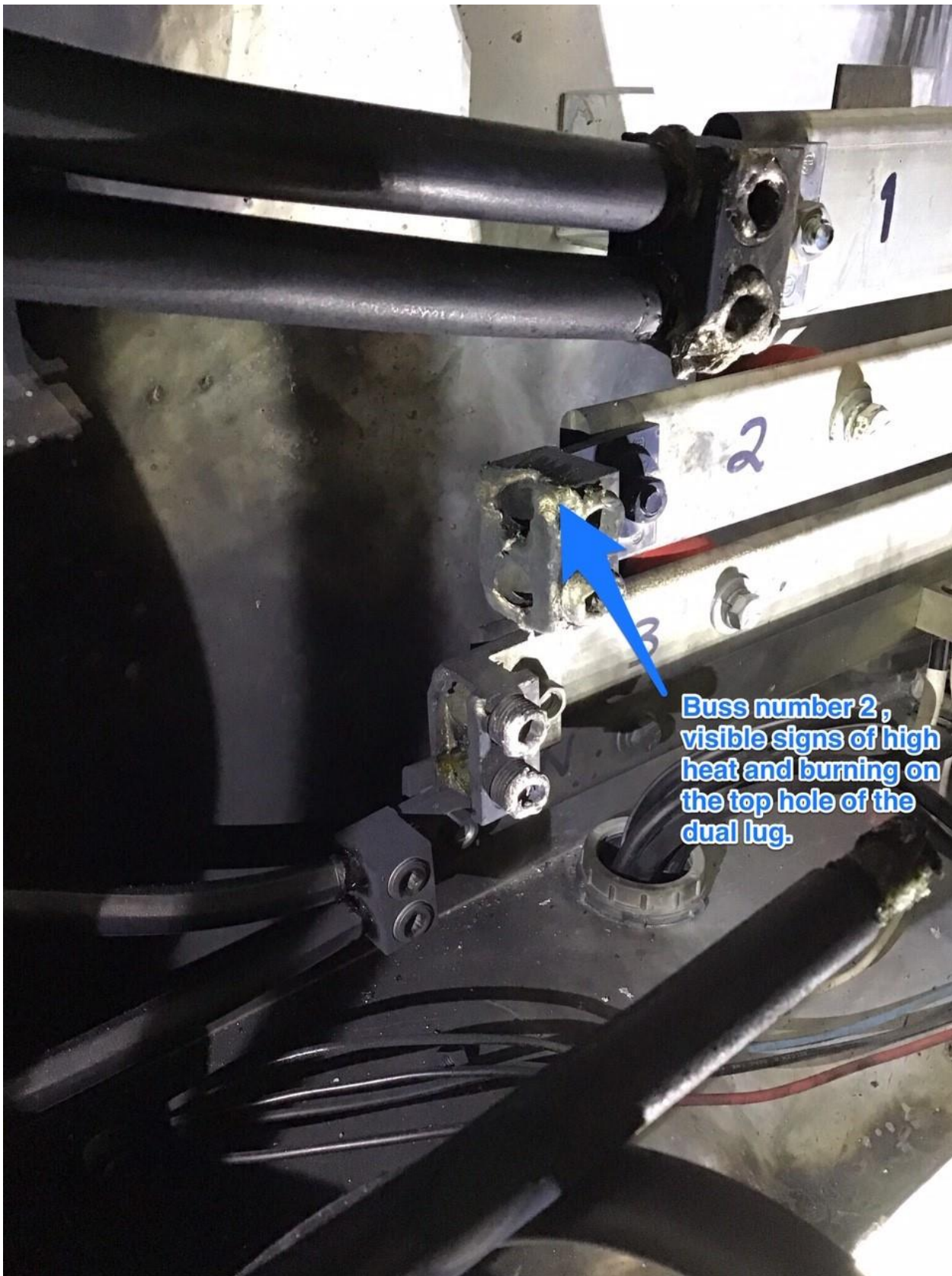


PHOTO 3: Top hole of lug 2 has had a large portion of the lug melt.



PHOTO 4: Line 2 Cables were cut, coiled and were attempted to be terminated into Lug #2.

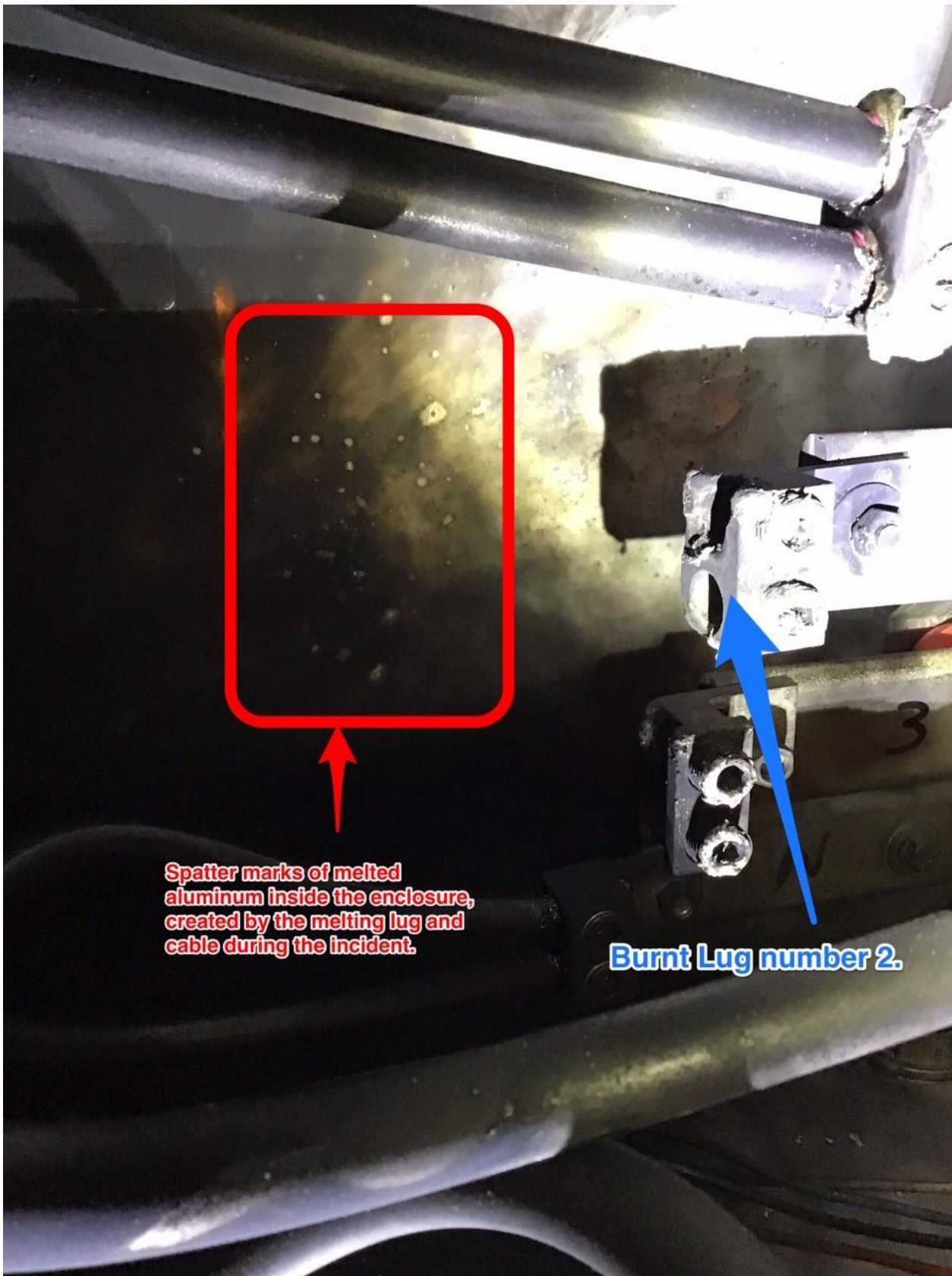


PHOTO 5: During incident high heat was created and began to melt Lug number 2