Incident Summary #II-1102219-2020 (#19872) (FINAL)

SUPPORTING INFORMATION	Incident Date		October 6, 2020
	Location		Quesnel, BC
	Regulated industry sector		Electrical - Low voltage electrical system (30V to 750V)
	Impact – Injury	Qty injuries	1
		Injury description	An individual received an electrical shock from an improperly wired generator feeder.
		Injury rating	Insignificant
	Impact – Damage	Damage description	None
		Damage rating	None
	Incident rating		Insignificant
	Incident overview		A three-phase generator feeder cable was wired improperly causing an individual to receive a shock when they contacted the metal connector.
INVESTIGATION CONCLUSIONS	Site, system and components		A generator was rented for an industrial site to power electrical equipment during a power outage. This generator has a cable with a connector on the end used to plug into various electrical equipment inside the facility. The cable was installed directly to the circuit breaker terminals of the 600Volt disconnect (at the generator. Images 2 and 3) with a female Arktite connector on the other end (Image 4). The specific connector for this voltage and current combination only allows it to be connected to same voltage and current male plug end. A portable welding machine was onsite and fed from the generator. In a typical configuration of the Arktite connector, the three-phase conductors of the cable connect to the internal pins on the connector, and the ground conductor connects to the ground terminal of the connector (bonding the whole body of the connector). This ensures that if any phase contacts the metal body of the connector, a fault condition will occur and the overcurrent device will open, de-energizing the system.
	Failure scenario(s)		The cable fed from the generator was not wired correctly. With no connection to ground and all phases isolated from each other, the breaker did not trip, only the incorrect and exposed parts of the connector became energized. As voltage was applied to the green conductor through improper wiring of the cable, that energized the shell of the connector. When the individual handled the connector at the end of the cable, they became the path and received a shock as voltage went through them to the ground.
	Facts and evidence		A picture of the wiring of the breaker at the time of the incident, shows a green conductor (taped blue) connected to the ‘C’ phase. (Image 3) The proper installation of the green conductor should have been to the ground lug inside the 600Volt

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	disconnect panel. The white conductor (normally used for phase 'C') was installed on the neutral terminal, however the 600Volt equipment did not require the neutral so this connection was incorrect. The proper installation of the white conductor should have been to the phase 'C' terminal (which should have been taped blue). The connector end of the cable (Image 4) remained unchanged and wired as per normal with the 3 phase conductors being red, black, white (identified blue) and the ground (green). With the green conductor bonded to the metal parts of the connector, and incorrectly installed in the phase C terminal, 600Volts would have been present on the metal parts of the connector leading to a shock when the ground path was completed (i.e., the individual handling the connector). Through interviews the following events and information was confirmed: • The individual who wired the cable was not an electrician. • The welding machine at the site was reported as not working when plugged into the distribution panel, prompting an individual to unplug the welding machine. • The individual who unplugged the welding machine, unplugged the generator connector from the distribution panel and plugged the generator connector into the welding unit directly receiving a mild shock. • Following these events, a certified electrician was called to investigate.
Causes and contributing factors	Unqualified personnel working on electrical systems was very likely to be the cause of the incident. It is very likely that the complexity of three phase wiring and the ancillary 600 volt disconnect contributed to the likelihood of the incident occurring. Other contributing factors are: • The cable being handled (unplugged and plugged) while energized; and • The absence of a qualified individual checking on the safety of the installation prior to use.

Image 1 - Generator set showing 480/600-Volt transformer and disconnect.

Image 2 - 600Volt circuit breaker disconnect.

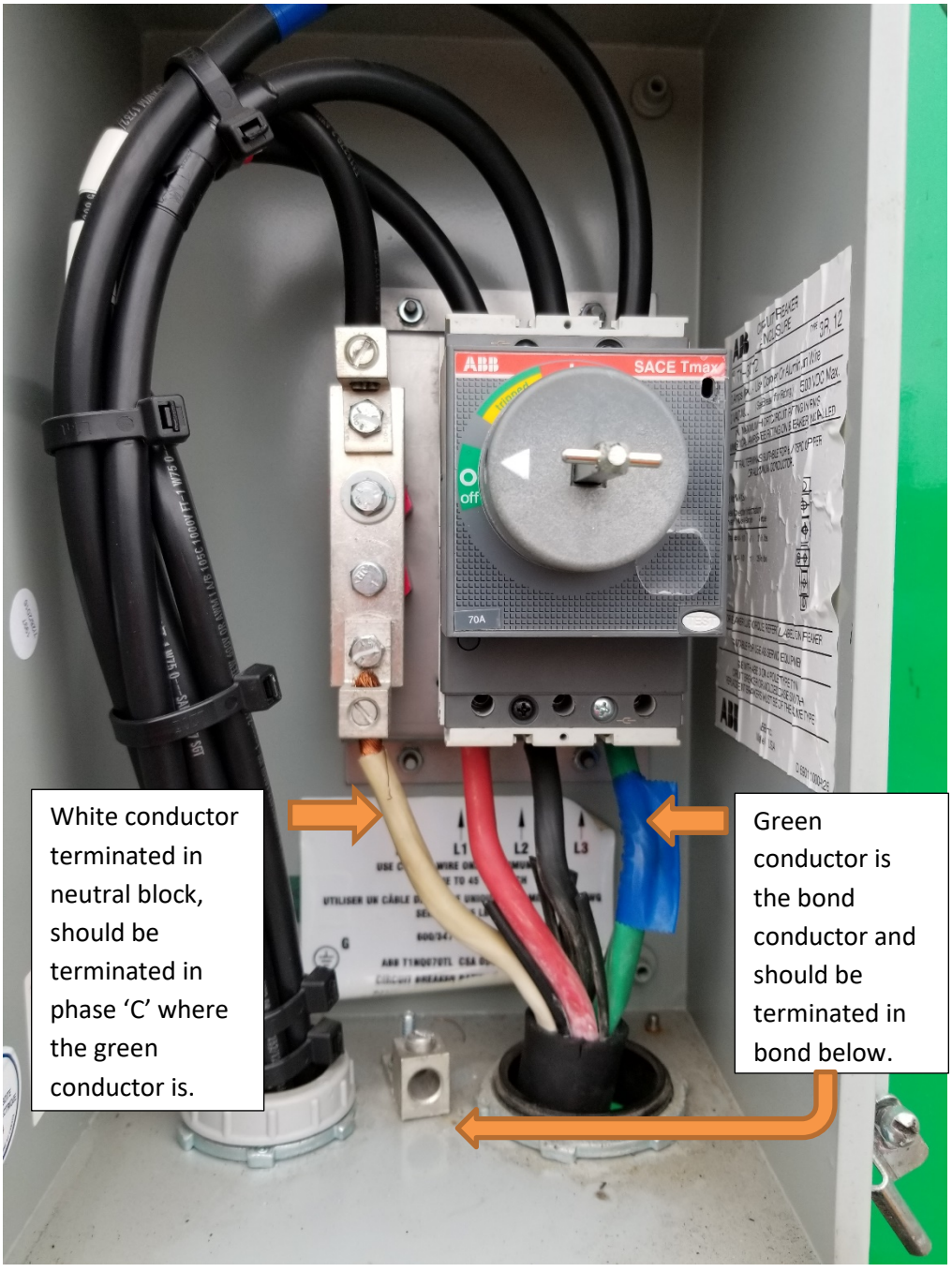

Image 3 - Incorrect wiring of cable in 600-Volt circuit breaker disconnect.

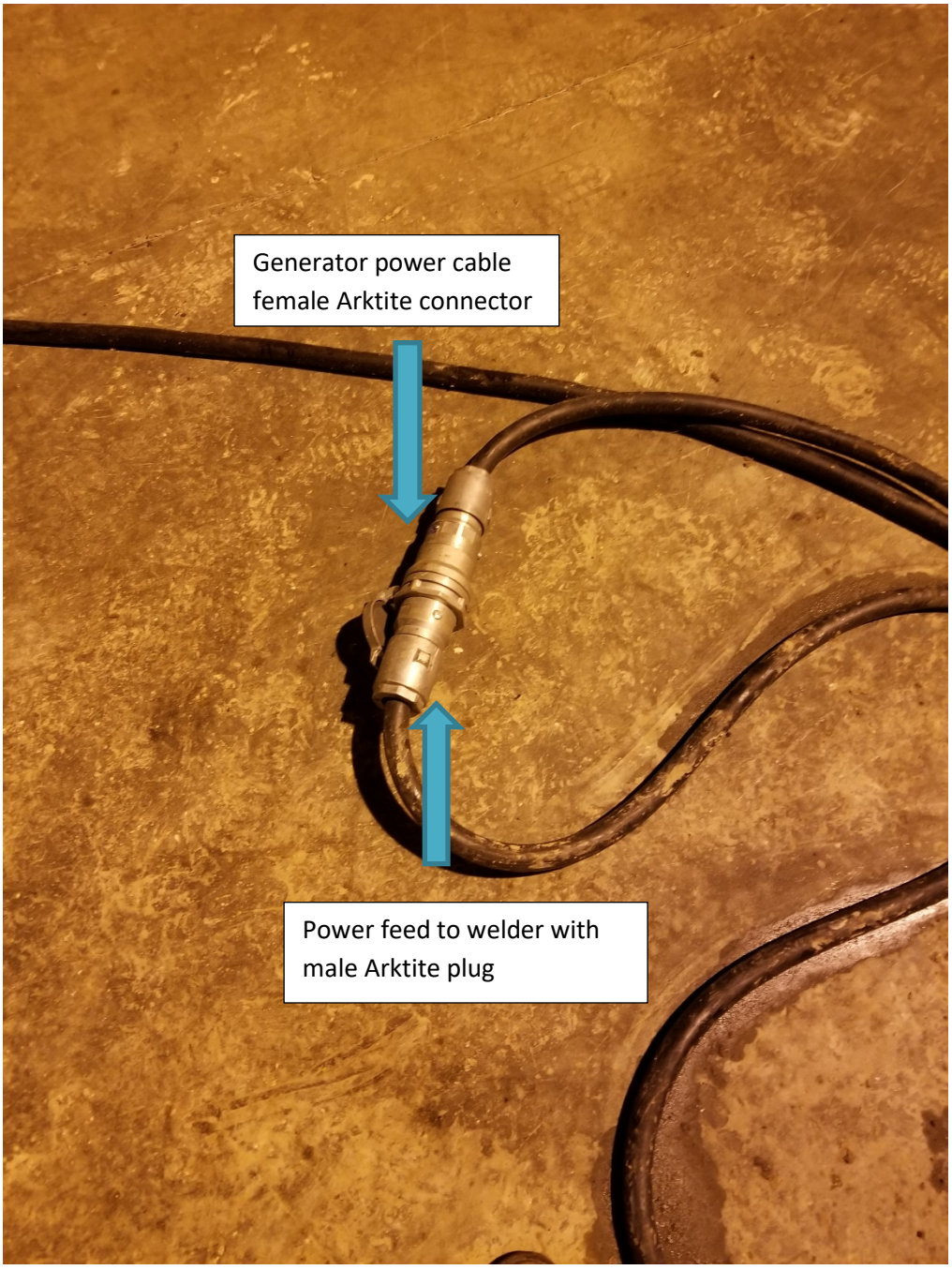

Image 4 - Cord end Arktite connector where individual received shock.