

Incident Summary #II-1568737-2023 (#36372) (FINAL)

SUPPORTING INFORMATION	Incident Date	June 22, 2023	
	Location	Richmond	
	Regulated industry sector	Electrical – Low voltage electrical system (30V to 750V)	
	Impact	Qty injuries	1
		Injury description	Electric shock to young worker. Individual was treated for shock at hospital.
		Injury rating	Moderate
	Damage	Damage description	None
		Damage rating	None
	Incident rating	Moderate	
Incident overview	Failure of a battery charger installation cord at an indoor electric go-kart facility resulted in an electric shock to a young worker at the facility.		
INVESTIGATION	Site, system and components	<p>The warehouse facility was upgraded to accommodate electric go-karts and an indoor track in 2016. To accommodate the electric charging of the go-karts, a 150KVA – 600-to-480-volt transformer and load centre was installed. The branch circuits from this new load centre feed multiple 480-volt 3phase twist lock receptacles in between the go-kart lanes. Battery chargers are plugged into these receptacles to facilitate the charging. The battery chargers and the associated charging cables are left in position in between the lanes (Image 1). The go-karts are parked single file in the lanes and connected to battery chargers through a charging cable and specific female end (Image 2). The worker is responsible for inserting the female cord end into the go-kart battery to facilitate a charge. The cables have a plastic handle used for handling the female cord end unit.</p> <p>Normal operation:</p> <p>The SPE model #CBHF-6 battery charger has a 480-volt – 10.7-amp input with a 48-volt DC – 100-amp output. The worker connects the female end of the 48-volt charging cable to the go-kart battery charger male end. The charging cable is void of any voltage until the cable is inserted into the go-kart's male battery charging end, completing the circuit. The cord ends are supplied with plastic handles that are for the worker to use when connecting or disconnecting the charging unit from the go-kart (Image 2). These cables require regular visual maintenance as per the BC Electrical Code 2-300, 1) <i>All operating electrical equipment shall be kept in a safe and proper working condition</i>", and the <i>specific manuals</i> (Image 5).</p>	

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<p>Failure scenario(s)</p>	<p>The battery chargers are turned off at the end of shift and subsequently turned on in the morning. The employees perform daily charging of the go-karts in their charging lanes. This is accomplished by physically grabbing the female plastic charging cable end and connecting to the male end which is located on the go-kart. The cable is held in position to the female end only by the two copper conductors. The employees have added tie wraps between the charging cable and the plastic handle for more stability (Image 3). Years of repetitive motion damaged the cables and exposed the copper conductors.</p> <p>The employees were unaware that the copper conductors were exposed (Image 4). On the date of the incident, the injured employee reached for the 48-volt female charging cable end with their right hand as the unit had fallen to the floor. The employee did not grab the unit by the plastic handle, but instead wrapped their right hand around the female charging end. The employee received a shock. The employee saw a flash of light at their right hand and heard a crackling noise. The employee immediately dropped the female charging cable end.</p>
<p>Facts and evidence</p>	<ul style="list-style-type: none"> • Statement from manager: Many years of handling the battery charging cables and the repetitive motion of connecting and disconnecting the battery charging cable caused damage to the conductors. No maintenance of any type to the charging cable. • Examination of all charging cables by the safety officer revealed frayed copper conductors at most charging cable female ends. • Tie wraps were installed by the workers at all charging stations. These tie wraps were installed around the plastic handle at the battery charging female end and the charging cable. • The workers stated that they were unaware that these charging cables are damaged or that exposed copper conductors pose a hazard. • The injured worker stated that they saw a flash of light and heard a crackling noise. • Statement from a work colleague that was close to the incident confirmed the crackling noise.
<p>Causes and contributing factors</p>	<p>Years of repetitive motion to the charging cable against the plastic female end has caused the insulation of the copper cable to split open and expose the copper conductor. While picking up the cable and cord end, the workers right-hand contacted both conductors thus closing the circuit.</p> <p>The likely cause of the electrical shock incident was damage to the charging cable at the female end with years of little or no maintenance.</p>



Image 1 - Go-karts ready to be charged. Battery chargers and battery charger cables are visible.

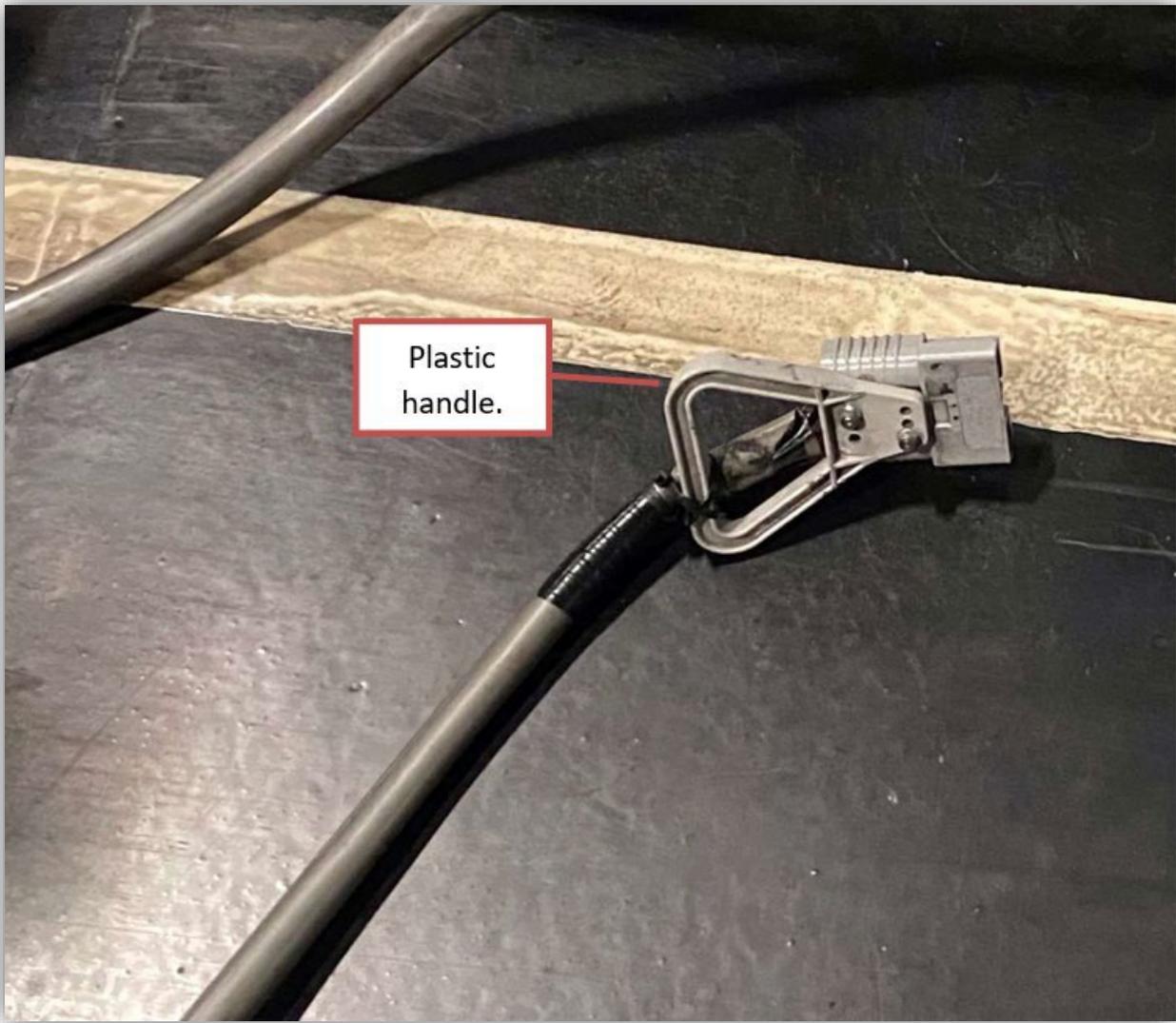


Image 2 - Battery charging cable. Visible female cord end with handle.



Image 3 - Visible female cord end with handle. Zap straps installed for stability. Exposed copper wire.



Image 4 - Close view of exposed copper wire.

9.5.5 Electrical cables

in rotation Check that all cables, both power and signal cables, are in good condition, do not present abrasions or cuts and are correctly positioned.

After the kart has been used, power cables - that is, cables with a large cross-section that are connected to the batteries, the control unit and the motor - must be checked for abnormal overheating or blackening of the cable terminations, which indicate the presence of high current levels resulting from increased resistance of the cable or, more probably, of terminations and clamps. If overheating is detected, it is necessary to check whether the cable is undamaged and the clamps are properly tightened. An abnormal increase in temperature indicates dispersion and therefore a power loss.

	Immediately replace cables that are overheated, cables with blackened terminations and clamps.
	The power cables (connecting batteries, control unit and motor) must be replaced every 2 - 3 years to ensure maximum kart efficiency.

Image 5 - Maintenance manual.