Incident Summary #II-751517-2018 (#8849) (FINAL)

SUPPORTING INFORMATION	Incident Date		September 30, 2018
	Location		Saanich, BC
	Regulated industry sector		Electrical - High voltage electrical system (greater than 750V)
	Impact – Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	The main power transformer suffered some charring and burning where the fault occurred on one primary winding specifically the bottom connection on the B phase winding, as well some on the secondary windings. no other equipment was damaged.
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		During a site re-energization of an upstream circuit breaker, the main 25KV to 600V 3 phase 1000KVA transformer failed to ground.
INVESTIGATION CONCLUSIONS	Site, system and components		Utility supplied power enters the commercial building through a privately owned unit substation. Power is then transformed into usable levels to supply all electrical systems associated with the building.
	Failure scenario(s)		**Fault Sequence:** 1. Circuit breaker closed 2. ~.731 cycles after breaker closer trip issued from protection relay for a Primary Phase Instantaneous Overcurrent 3. ~1.461 cycles after breaker closer trip issued from protection relay for a Primary Ground Instantaneous Overcurrent 4. ~4.475 cycles after initial breaker closure, breaker opens 5. Event file indicates single phase to ground fault on B Phase which is consistent with the damage observed on the lower portion of the center core and coil assembly. With the delta configuration on the primary winding this would indicate that the transformer did not experience a thru fault (fault on the primary winding or low voltage distribution system or bus work) 50G11T: Primary Ground Instantaneous Overcurrent 50P11T: Primary Phase Instantaneous Overcurrent OUT101: Trip output from protection relay to circuit breaker TRIP1: Trip equation programmed in protection relay to assert trip output to circuit breaker IN101: Circuit breaker status “b” contact
	Facts and evidence		**Transformer Electrical Testing:** After performing physical inspections, various electrical testing was conducted 1. Multiple pictures were taken prior to disassembly of any components to document as found conditions.

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	2. 5000VDC Insulation resistance measurement was performed on the high voltage winding with the low voltage winding connected to ground. 3. 1000VDC Insulation resistance measurement was performed on the low voltage winding with the high voltage winding connected to ground. 4. Transformer turns ratio was performed on the in service tap (position 3-4). 5. 1ADC Winding resistance measurement performed on primary winding on the in service tap (position 3-4). 6. 10ADC Winding resistance measurement performed on secondary winding.
Causes and contributing factors	The transformer appeared to have sufficient insulating properties between the high voltage winding and grounded low voltage winding at 5000VDC. Further analysis such as power factor tip up testing to 10,000VAC could be performed to see if elevated test voltages result in greater insulation stress. Transformer turns ratio and winding resistance readings suggest that the transformer maintained electrical continuity and that no turn to turn shorts were discovered. Based on this information the effected equipment will be sent to manufacturer for further testing and possible repair. No on site defect observed at time of assessment.

Failed transformer core.