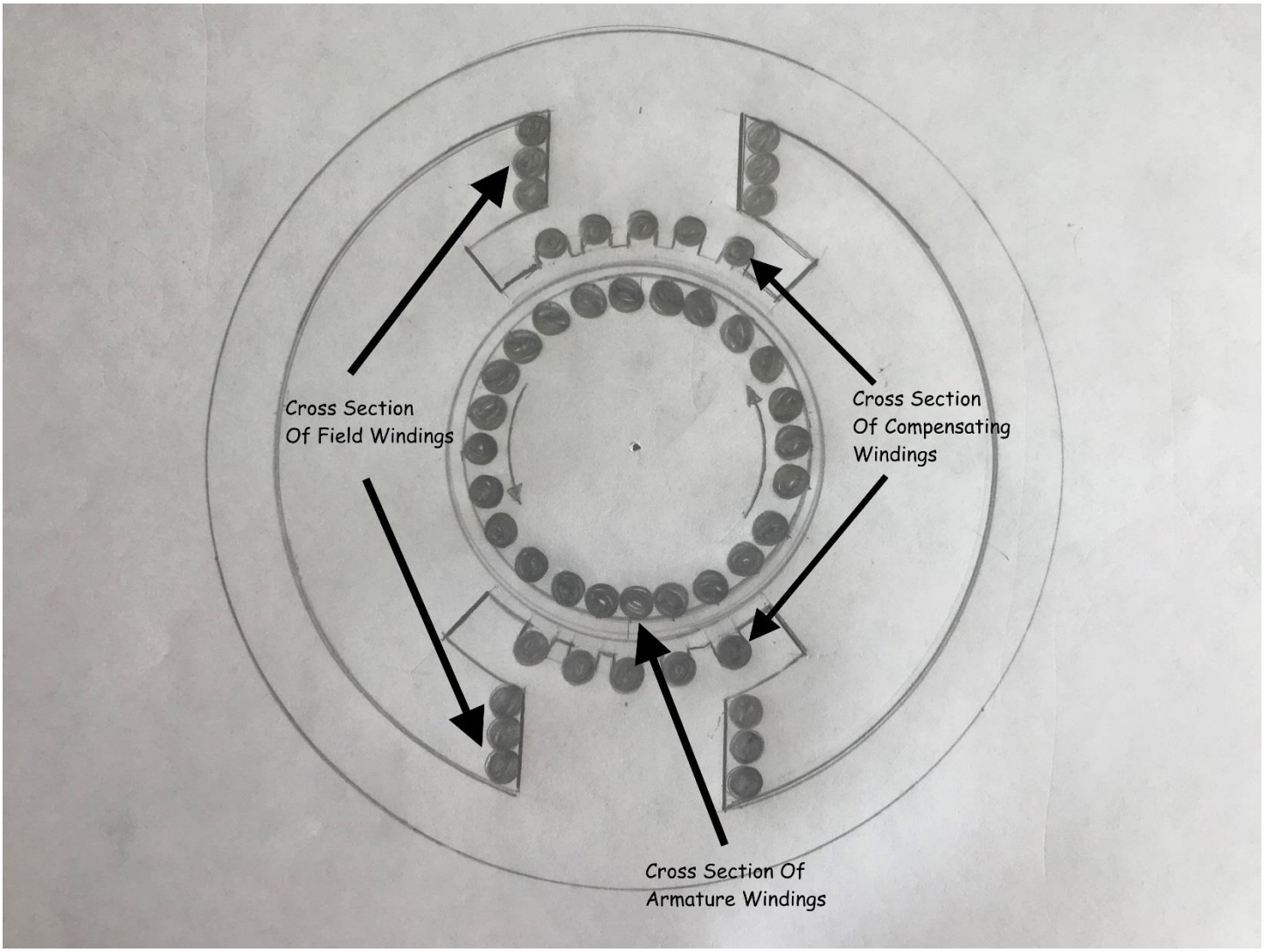
Incident Summary #II-809561-2019 (#10925) (FINAL)

SUPPORTING INFORMATION	Incident Date		February 10, 2019
	Location		Whistler
	Regulated industry sector		Passenger ropeways - Above surface ropeway
	Impact – Injury	Qty injuries	0
		Injury description	NA
		Injury rating	None
	Impact – Damage	Damage description	Occurring on February 9 the initial motor: Damage was reported as blown (arc damage) compensating windings, blown armature windings (reported as a “big blow hole) and blown field windings. Occurring on February 10 the replacement motor: Damage is reported as blown compensating windings (reported as “has a very large hole ”), and shorted field windings.
		Damage rating	Major
	Incident rating		Major
	Incident overview		The main drive DC motor had the windings fault (short) to ground. This occurred again to a similar replacement motor.
INVESTIGATION CONCLUSIONS	Site, system and components		A detachable grip chair lift with a DC motor as the normal prime mover (a device which converts energy from an energy source into mechanical energy). The DC motor utilizes (see **Drawing#1** of cross section of DC motor): • An internal set of carbon brushes that run and wear against a rotating commutator. This is the method in which voltage is supplied to the rotating armature winding. • An armature winding which produces electromagnetic flux and is attached to the rotating motor shaft. • A field winding which also produces electromagnetic flux and is fixed within the motor. • This motor also has compensating windings. *Compensating windings are situated in field pole plate. This is a type of winding that is utilized in reducing the ill effects of armature reaction (armature reaction will cause sparking at the brush surfaces).* Windings are isolated (or insulated) from the motor frame (i.e. energized windings are not to make electrical contact with non-current carrying metal components of the motor).

	Both motors have internal heaters (a feature which provides condensation control by providing heat to the internal components of the motor while the motor is not operating).
Failure scenario(s)	Motor windings failed to remain isolated from ground (both on the initial motor and the replacement motor).
Facts and evidence	Reports provided by operator indicate: • On 2 occasions over a 2 day period a drive fault occurred (fault in the DC drive system) to both the initially installed motor and then the next day to the replacement motor. Operation of the ropeway, on both days, were then continued by the use of an auxiliary diesel engine as the prime mover of the ropeway. • Findings on initial motor: The initially damaged motor had been megger tested (verifies integrity of insulation) May 3, 2018. Test results were deemed acceptable. Motor specialist assessing damage to motor determined that the compensating winding had failed (did not remain isolated from ground) to ground. Arc damage was found to be located at the six o'clock axis on the compensating winding, arcing damage also reported to the armature winding and the field winding. • Finding on the replacement motor: The replacement motor was stored in a heated shipping container. It is not known when the last megger test was conducted on this motor. Motor specialist assessing damage to motor determined that the compensating winding had been subjected to arc damage. Arc damage found to be at the six o'clock axis of the compensating winding. Arc damage, also reported, to the field windings. • Because the damage was located at the six o'clock axis, low point in motor, the motor specialist speculates that there is a likelihood this is an area in which excessive moisture and carbon dust could accumulate (carbon dust will act as an electrical conductor and is a result of the brushes wearing on the commutator). • Motor heater operation is verified by a monthly service inspection conducted by operator maintenance staff. • The area in which the arc damage occurred and the likely accumulation of carbon occurred, is not accessible for cleaning with the motor in place within the ropeway system.
Causes and contributing factors	An arcing condition may have occurred when a winding became electrically conductive to another set of windings or to non-current carrying metal components of the motor. Carbon dust collecting in the lower portion of the motor may have been the conductor through which a winding became conductive to the motor frame. Moisture may have also contributed to the conductivity of the winding to the motor frame. But because the motor heaters were confirmed functional, moisture is a less likely contributing factor.



Drawing #1

Example of the Cross Section of a DC Motor