

Incident Summary #II-1327095-2022 (#26153) (FINAL)

SUPPORTING INFORMATION	Incident Date		February 9, 2022
	Location		Vancouver
	Regulated industry sector		Elevating devices - Elevator
	Impact Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Damage	Damage description	Damage to KEB F5 variable frequency drive (VFD) unit and braking resistor bank
		Damage rating	Moderate
	Incident rating		Moderate
Incident overview		A failure of the variable frequency drive (VFD) unit caused the regenerative power to feedback to the regenerative resistor bank, which caused the resistors to become red hot and resulted in a fire. No one was using the elevator at the time of fire.	
INVESTIGATION CONCLUSIONS	Site, system and components	A mid-rise apartment building houses passenger elevators of the electric traction type. The installation is of the machine-room-less type, where the elevator’s electric motors are installed in the hoistway, and the controllers are housed in a remote closet located on the premises. The controller cabinet houses the variable frequency drive (Image 1). The variable frequency drive is a device normally used in motor control applications. They are internally equipped with power electronics that are exclusively designed for smooth speed regulations of three phase motors. The controller comes equipped with a bank of resistors known as the braking resistors (Image 2). The braking resistors are used in conjunction with the drive’s internal brake transistor (Insulated-gate bipolar transistor – IGBT, Image 3). The IGBT in the drive acts like a switch, that turns on and off. When an electric current switches the brake transistor on, it allows excess energy to be routed across the braking resistors. Under normal operation, when the elevator is in the motoring state with no load up or full load down, the motor will act as a generator. Energy being generated by the motor, is fed back to the drive’s DC Bus Link. The drive’s DC Bus normally stores energy that is generated by the drive. The additional energy being fed from the motor during deceleration eventually reaches the bus voltage limit, at which point the braking transistor is switched on, and the excess energy being generated by the motor is shunted across the braking resistors. The braking resistors dissipate the excess energy by converting it to heat. If the braking transistor were to fail, there is a possibility that the failed transistor would allow an abnormally high amount of electrical current across the braking resistors. This high volume of current across the resistors could lead to drive overload failure or possibly a fire. The resistors are not rated for continuous duty cycle. For this reason, the drive manufacturer recommends that an external thermal switch be mounted in the brake resistor cabinet. It would turn off voltage to the resistor in the event of failure of the internal braking transistor	

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Failure scenario(s)	A failure of the IGBT in the variable frequency drive (VFD) caused all the power to be shunted continuously on to the braking resistors which resulted in a fire in the braking resistors.
Facts and evidence	A technical bulletin was issued by the manufacturer confirming that drives may have potential issues with the IGBT power module that could result in premature failure of the drive. After discussing the situation with the notifier/mechanic, it was concluded that the failure was part of the technical bulletin from MCE.
Causes and contributing factors	It is very likely that a premature failure in the drive's power components resulted in an abnormal and continuous current flow to the braking resistors. The continuous current flow would have likely exceeded the resistors' power rating, to the point where the resistors ignited inside its compartment. It is very probable that any combustible material above or in proximity to the resistor's cabinet would have been affected by its radiant heat.

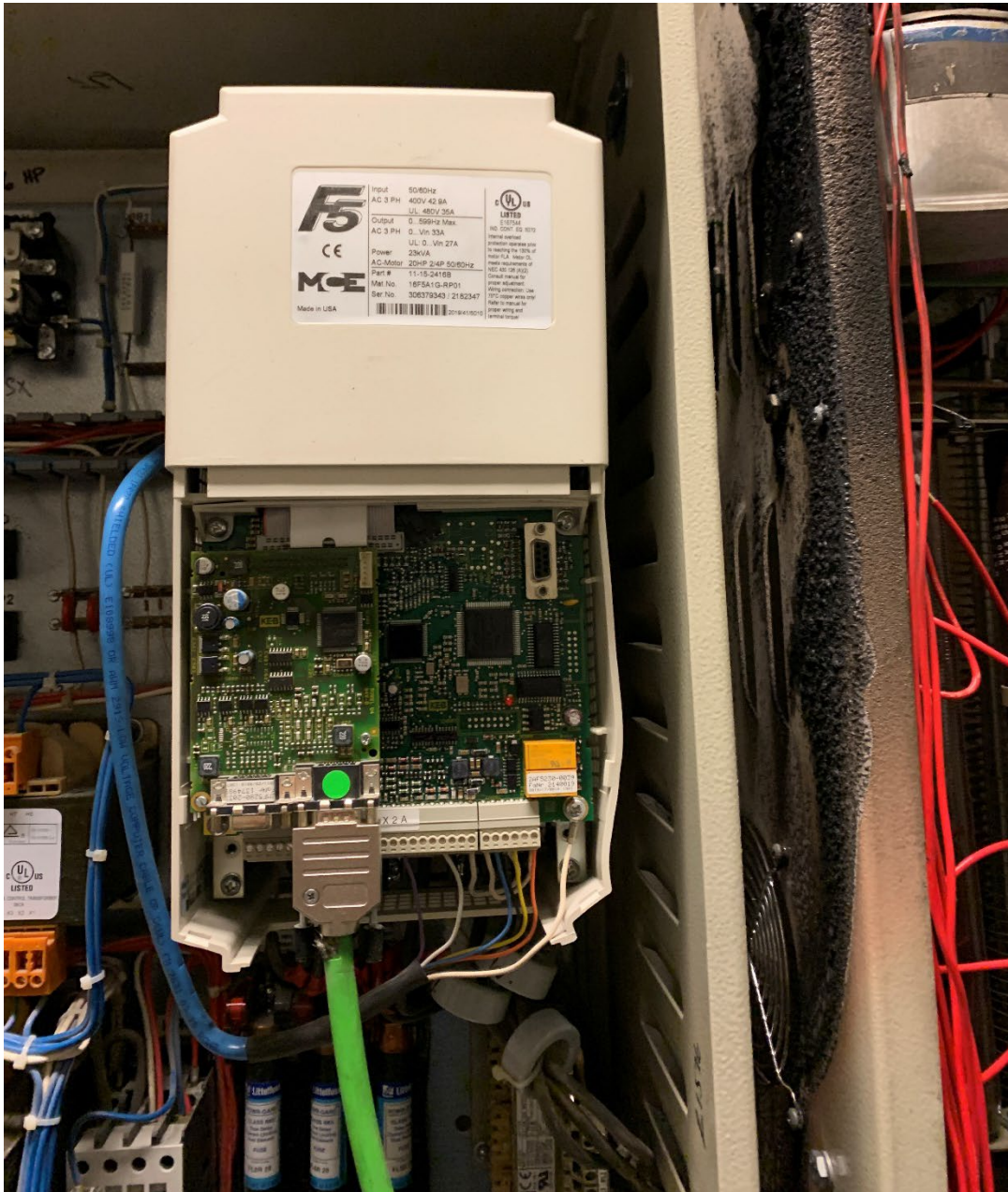


Image 1 - KEB F5 Drive

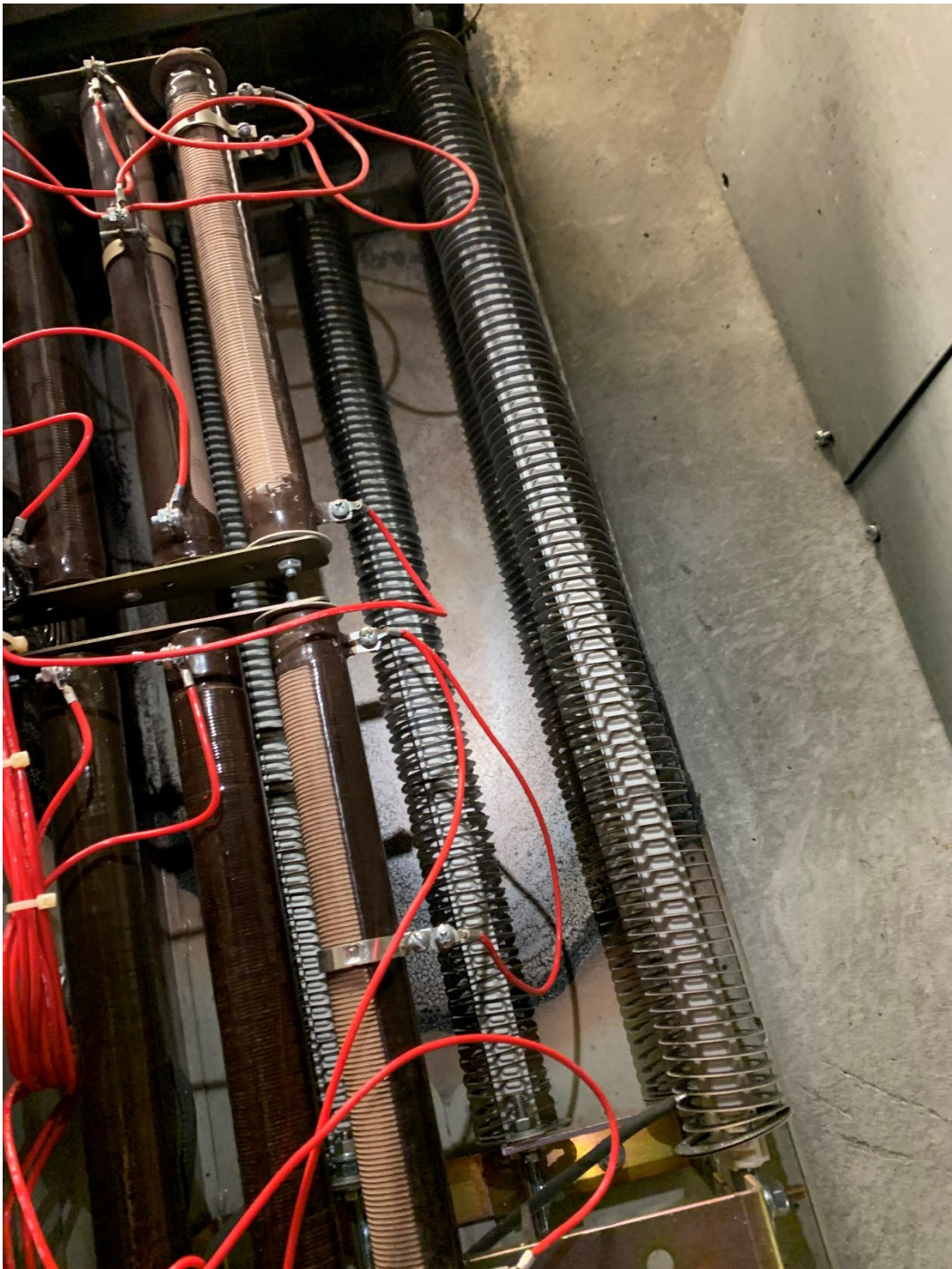


Image 2 - Braking Resistors

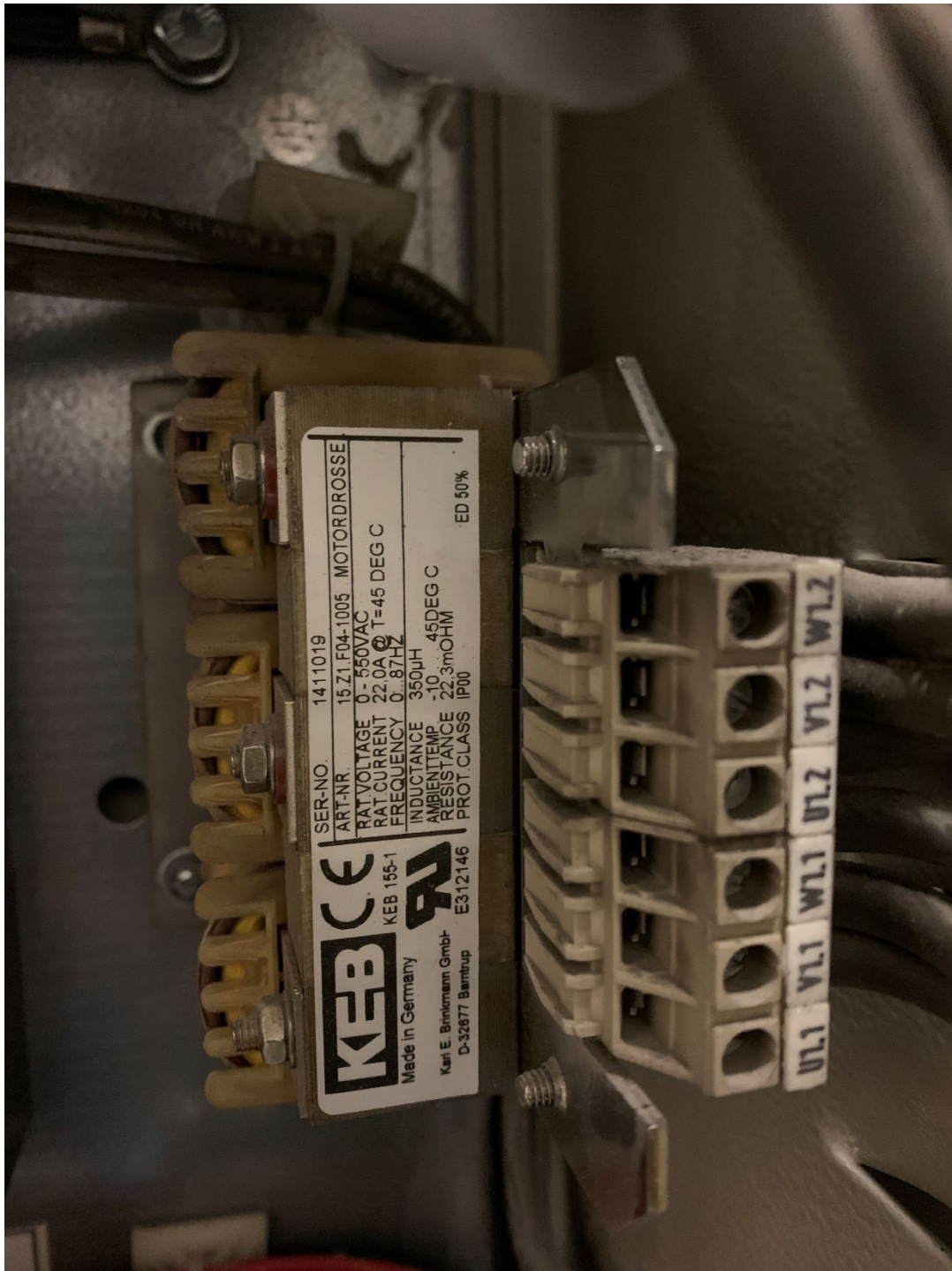


Image 3 - IGBT Power Module



TECHNICAL BULLETIN

➤ *Advisory* ◀

www.nidec-mceinc.com

Reference # 157

Route to: **Modernization Managers/Service Managers**
From: MCE Technical Support Department (916-463-9200 then press "2")
Date: June 4, 2020
Pages: 1

Subject: Premature IGBT Failure on KEB F5 480V size 16 & 17 G Housing Drives

Equipment: iControl and Motion 4000 (M4000) AC Controllers equipped with KEB F5 480V size 16 and 17 G-Housing Drives.

Description: KEB recently informed MCE that the KEB 480V F5 size 16 and 17 G Housing Drives (16F5A1G-RPxx and 17F5A1G-RPxx) produced between the years of 2016 through 2019 have a potential issue with the Power Modules. This could result in a premature failure of the drive with a shorted transistor or "Error Over Current" (E. OC) fault. KEB will provide a warranty exchange of these drives if they fail with either:

- G-Housing drive, 480V size 16 or 17 or,
- H-Housing drive, 480V size 16 or 17

Action: If a 480V F5 size 16 or 17 G-Housing Drive fails, please follow these steps:

1. Contact MCE and provide us with the job number and the failed drive serial number.
2. Decide whether to replace the failed drive with an identical one or upsize.
 - a. If identical replacement, we strongly recommend incorporating a Monitoring Circuit as an added protective measure to take the elevator out of service and disconnect power from the drive, in case of a fault. MCE will supply the Monitoring Circuit if requested by the contractor.
 - b. If upsizing to an H-Housing. It has the same height and depth as G-Housing, but it is 5" wider. Please note that some controller cabinet components may need to be relocated.

MCE Help: As always, should you require any additional technical assistance on this or if you wish to add your email for future technical bulletin advisories:

- Email: techsupport@nidec-mce.com
- Refer to the reference number above