

June 2019

Supersedes 16-24-FL

## Polarity identification for photovoltaic dc system conductors

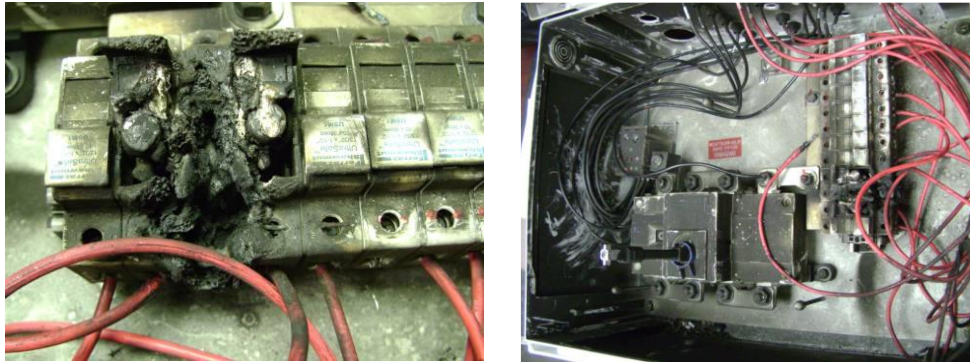
### Background

ESA has been involved in several fire investigations that resulted when polarity of PV (dc) source and/or output circuit wiring was accidentally reversed during installation. One of the main contributing factors was the lack of marking and/ or improper field marking of conductors which presents many opportunities for errors and consequently dangerous failures.

In Ontario we have experienced failure during installations that are suspected to have been caused by increased potential when a single array's wiring was reversed to a combiner box. Minor contaminants, such as moisture or dirt, have started self sustaining dc arcing faults, even with the fuses in the open position.

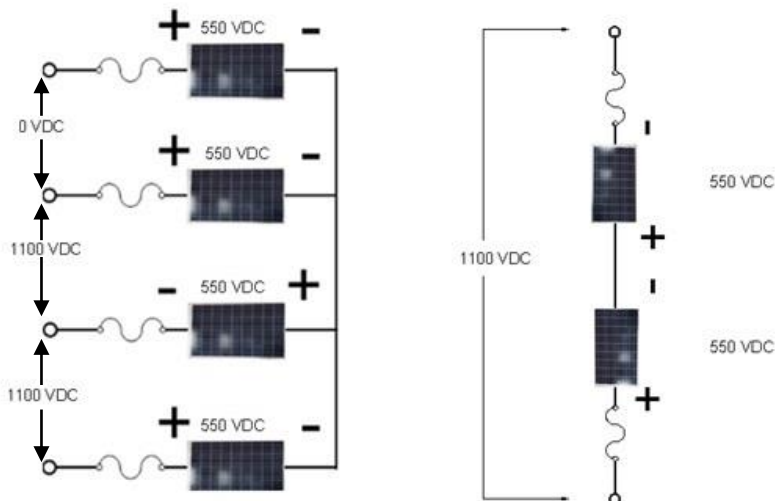
Photo F1 below shows an example of PV equipment (combiner box) failure as a result of reversed PV source circuit polarity.

**Photo F1 – Accident resulted when polarity of dc sources was reversed**



Unlike traditional ac systems where connection of incorrectly identified conductors will cause reversal of motors or an overcurrent device to operate, reversal of dc sources can create series circuits that will produce voltages well in excess of the rated system voltage. Diagram F1 below explains the circuit analogy of a reversed PV source circuit polarity.

**Diagram F1 – Reversed polarity of dc sources**



**Direction**

The Ontario Electrical Safety Code (OESC) Rule 64-212 requires dc Photovoltaic circuit conductors to be coloured or coded to identify polarity, see Photo F2.

**Photo F2 – Example of the required marking to identify polarity**



To file a notification of work, please contact ESA's customer service center at 1-877-ESA-Safe (1-877-372-7233). Failure to file a notification may result in charges under the Electricity Act for each offence identified.