Thermal propagation Test

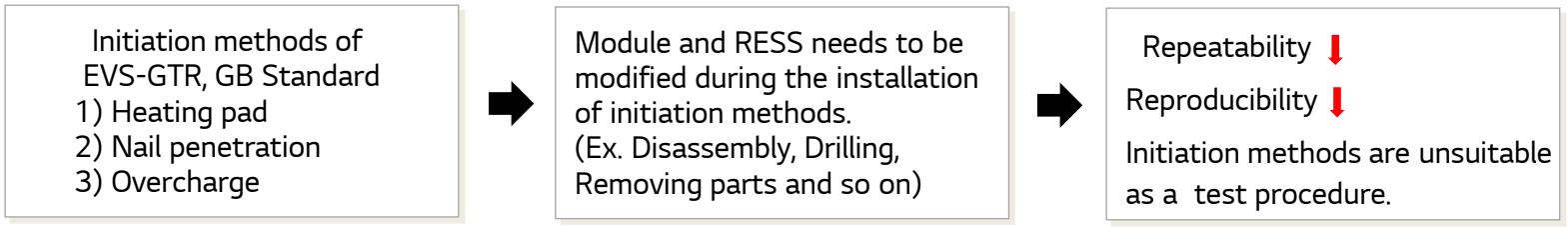
New initiation method

Thermal propagation: Test Outline

■ Background

Thermal propagation test procedure is currently not adopted as a madatory requirement in EVS-GTR, and development of a robust method for thermal propagation is expected in the 2018 or 2019 time frame.

Initiation methods of EVS-GTR, GB Standard are unsuitable as a test procedure considering 1) Repeatability and 2) Reproducibility because the design of Module and RESS needs to be modified due to the installation of initiation methods. (Unsealing the module, Drilling the hole, disassembling cell-arranged structures)

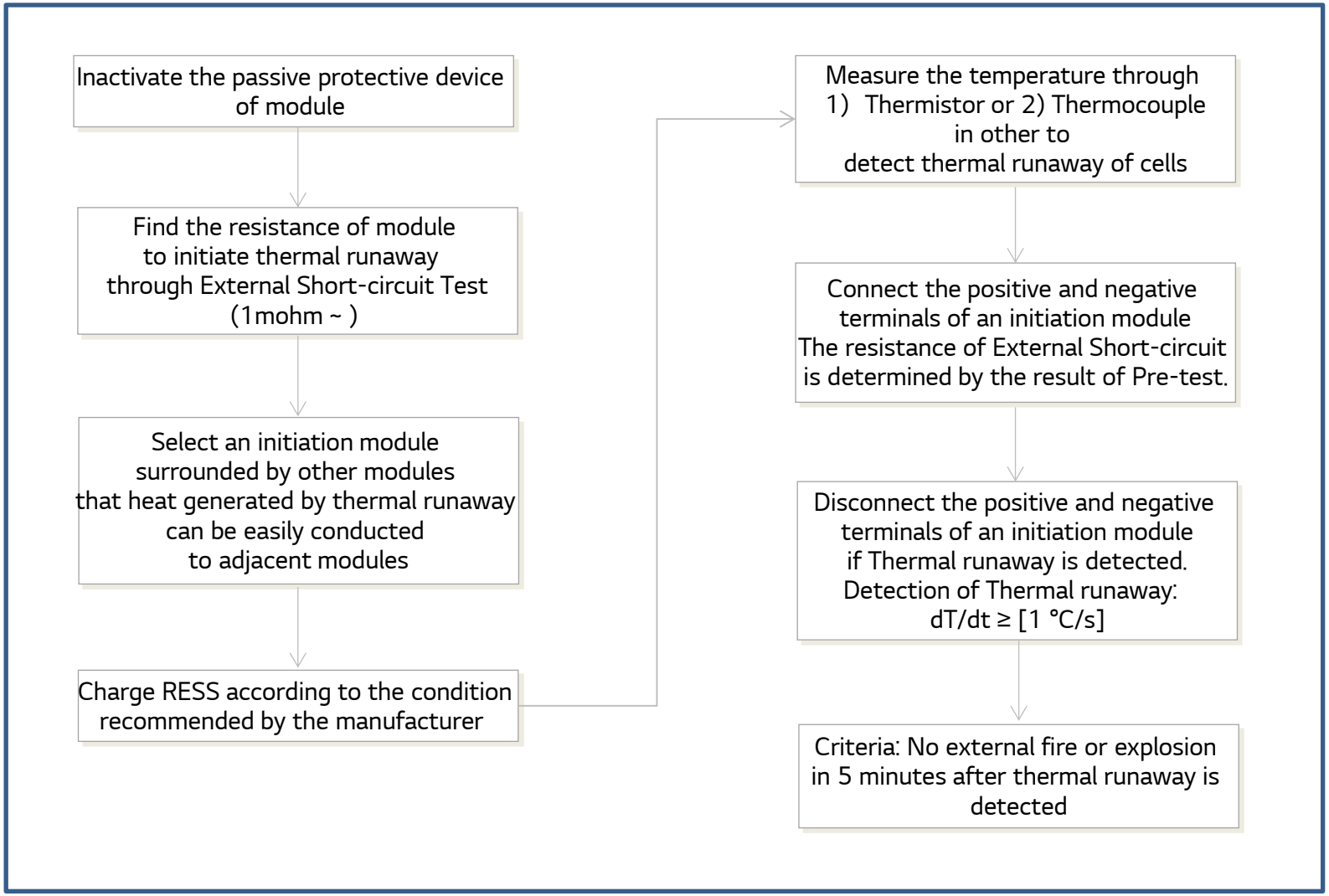


We are investigating new initiation method to be able to conduct Thermal Propagation test without the modification of module and RESS for 1) Repeatability and 2) Reproducibility.

New initiation method is supposed to be considered 1) to avoid the argument of related stakeholders and 2) to be easily tested by authorized laboratories without complex modification of RESS.

Thermal propagation: Test Procedure

An initiation module and RESS shall not be modified during the installation of initiation methods for 1) repeatability 2) reproducibility of Thermal propagation test.
The modification shall not affect the test result if necessary.



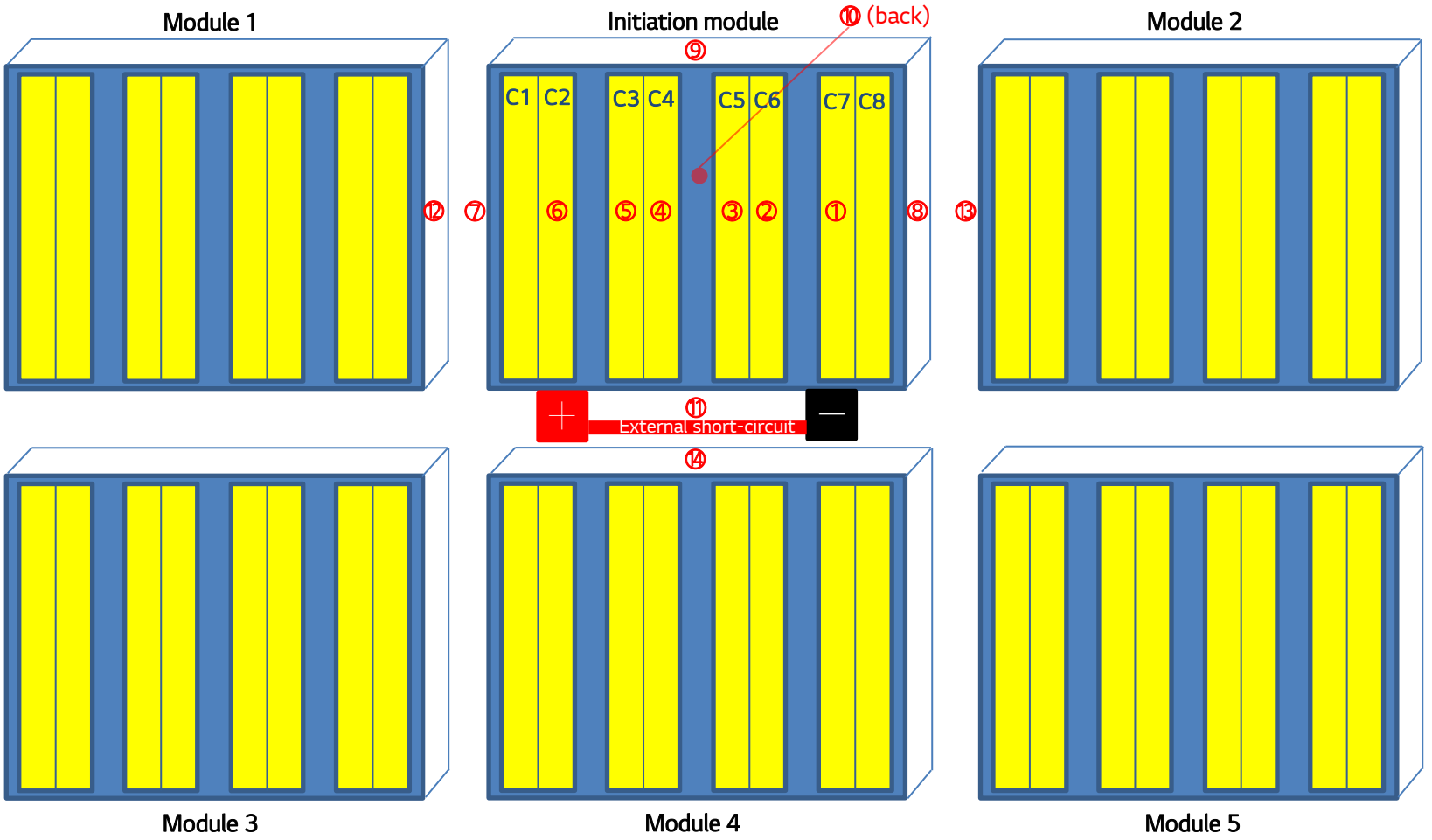
Thermal propagation: Test Condition

■ Test Condition

Sample Information	Use	EV (Lithium ion battery pack)
	Configuration	96S2P
	Rated capacity	Over 100Ah
	Rated voltage	350V
	Number of modules	24
	Weight	300kg
	Internal resistance (a module)	
Test condition	Initiation method	External short-circuit of a module
	Initiation module	One of center modules
	Initial SOC	100%
	External resistance	5mohm
	Observation time	24hrs

Thermal propagation: Initiation method diagram

■ Initiation method diagram

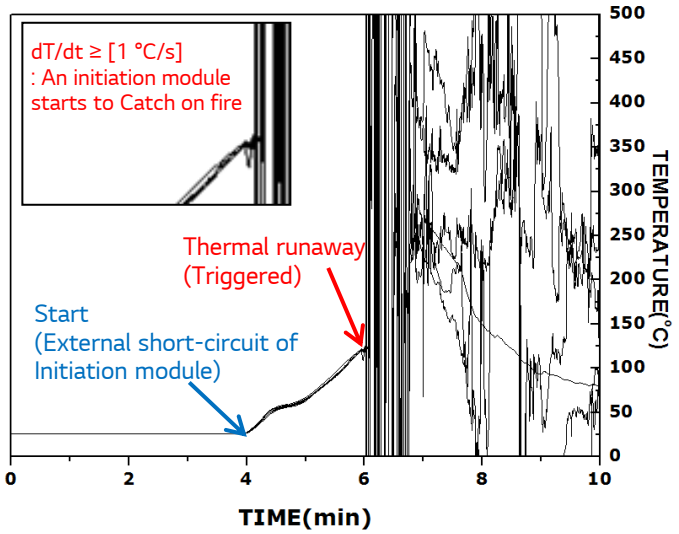


▲ ① ~ ⑭: Thermocouples to detect and measure temperatures inside and outside of an initiation module
C1 ~ C8: Cells of an initiation module

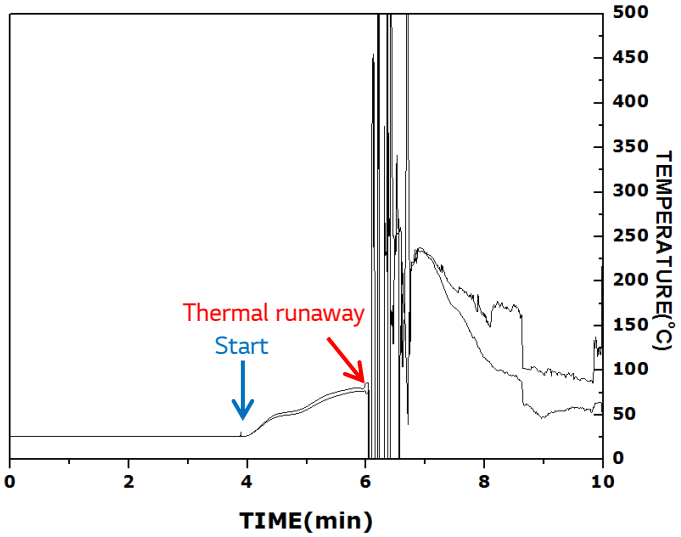
Thermal propagation: Test Result

■ Temperature graph

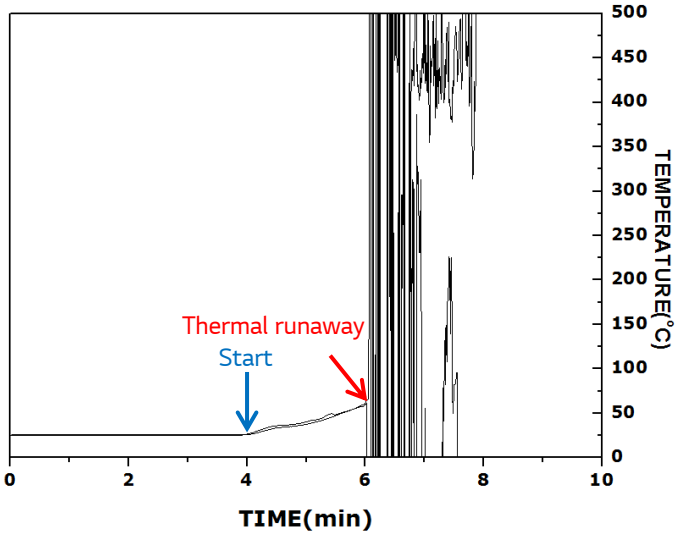
1) TC1~6 (Cells of Initiation module)



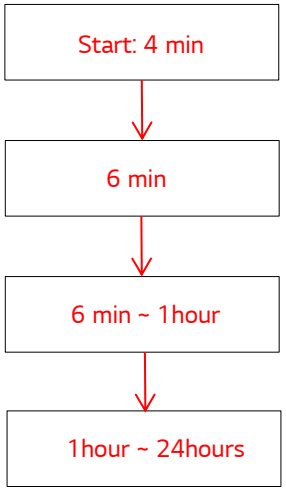
2) TC7, 8 (Both sides of Initiation module)



3) TC13, 14 (Adjacent modules)



4) Time record



External short-circuit of Initiation module (5mohm)

Thermal runaway Triggered
(Initiation module: Gas Vented or Fired)
Smoke (No external fire)

Smoke (No external fire)
Partially melted (Exterior)

No phenomenon

Result: No external fire or explosion in 5 minutes after thermal runaway is detected

Thermal propagation: Conclusion

We have to find new initiation method for repeatability and reproducibility to 1) avoid the argument of related stakeholders and 2) to be easily tested by authorized laboratories.

It means new initiation method should satisfy the below two conditions.

1) Minimalizing the modification of a target module
2) Simulating actual situations of Cell failure mode