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# Safety Certification of NAS Battery





Japanese Fire and Disaster Management Agency (FDMA) defines fire safety requirements for Sodium Sulfur batteries (Shoboki-No. 53).

Safety Test of NAS Battery was implemented to confirm conformity with the requirements.

Japanese Hazardous Materials Safety Techniques Association (HMSTA) witnessed the test and validated the testing methods and results (Evaluation No. 78).

Unit	Test items	Test Condition	Remarks
Battery Cell	Overcharging	High Temperature	
	Short Circuit		
	Temperature Fluctuation		
	Drop Test		
	Static Load Test		
	Crush Test		
Battery Module	Outside Short Circuit	High Temperature	Test Result (1)
	Fire Resistant Test		
	Submerge Test		
	Drop Test		
	Fire Self-extinguishing Test		Test Result (2)
Battery Container	Fire Self-extinguishing Test		Test Result (3)
	Drop Test		Test Result (4)

# Safety Test Result (1)

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Item	Testing view	Result
(1)-1 Outside short circuit test (High Temperature)	After the Test	<ul> <li>0.8sec after short circuit, fuses inside the module were activated, and circuit was opened.</li> <li>No cell damage and active material leak.</li> </ul>
(1)-2 Fire Resistance Test (High Temperature Expose to fire for 30 min.)		<ul> <li>Max. temperature inside the module was under 360°C.</li> <li>No cell damage and active material leak.</li> </ul>
(1)-3 Submerge Test (High Temperature)		•No cell damage and active material leak.
(1)-4 Drop Test (High Temperature)	After the Test	•No active material leak.

## Safety Test Result (1)-1

### Battery Module - Outside short circuit test

0.8sec after the short circuit outside of battery module, fuses inside the battery module were activated, and circuit was opened.

■No Cell damage and active material leak.



Battery cells after the test



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# Safety Test Result (1)-2





Battery Module - Fire Resistance Test (Expose to fire for 30min.)

Max. temperature inside the module was under 360°C.
 No cell damage and active material leak.



(a) Battery module during the test

(b) Battery module after the test



(c) Battery cells after the test

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# Safety Test Result (1)-3

### Battery Module - Submerge Test

■No cell damage and active material leak.





Battery Module

(a) Battery Module during the test



(b) Battery Module after the test

(c) Battery cells after the test

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# Safety Test Result (1)-4

#### Battery Module - Drop Test

#### ■No active material leak.



(a) Battery Module before the test



(b) Battery Module after the test

Battery cell (1-14-1) located on the corner of battery module





(c) Battery cells after the test

### Safety Test Result (2) • Battery Module - Fire self-extinguishing test





One Battery Cell in a Battery Module was compulsory ignited.

Fire self-extinguishing property of the Battery Module was confirmed (No spread to adjacent cells).



(a) Battery Module during the test



One battery cell compulsory ignited





(b) Battery Cells inside Battery Module after the test



(c) Adjacent Battery Cells after the test

# •Battery Container - Fire self-extinguishing test





One Battery Cell in a Battery Module in a Battery Container was compulsory ignited.

■There was no damage for the Battery Container.

Fire self-extinguishing property of the Battery Module and the Battery Container was confirmed.

■SO2 gas at the container outside was below the detection limit (1ppm)

#### Tested module



Before test



Temperature measuring points (In Container around the tested Module)



During test

Maximum temperature in Battery Container

Base	130 degrees-C
Back Surface	210 degrees-C
Side Board	530 degrees-C

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## Safety Test Result (4) • Battery Container Drop Test

Confirm the safety even if the container dropped during installation. (Module temp.: room temp.)

■No active material leak, no fire.



# After Drop Test (Outlook) After Drop Test (Inside) Mining Ceed Point

