

ASSOCIATED ENVIRONMENTAL SYSTEMS

BATTERY SAFETY



BATTERY SAFETY FEATURES



FEATURING: SD-508-SAFE

	Safety Feature	Description
1	Set Point Temperature Limit	Temperature control set points to prevent the user from accidentally setting the chamber's temperature outside of the determined limits.
2	High Low Temperature Limit	Designed to be independent of all chamber controls actions that are taking place. *ATP limit point is: -20°C and 80°C
3	Rapid Rise	Safety feature in place to monitor and detect a rapid temperature change.
4	Emergency Stop Button	Stop button to disable the chamber function rapidly.
5	Audible and Visual Alarm	Three color system that emits an audible alarm when the chamber is in an alarm condition. Green - Chamber is ready to use, and door is unlocked. Blue - Chamber is in use, and door is locked. Red - Chamber is in alarm condition, and door is locked.
6	Door Lock	Electronic rotary cam fail safe door lock with mechanical override. It is equipped with a cam position sensor indicating the lock state. AES XCHANGE logs door activity (open and close state) *Chamber will not run with an open door. *Door will not open in alarm condition *Lock rated to 1119 lbf or 4980 N
7	Reinforcement	Reinforced stainless steel interior.
8	Burst Disk/Low Flow Vent	Graphite burst disc with rupture sensor that triggers system alarm.
9	Gas Sensor/s	Sensors for monitoring chamber working volume for combustable gasses. *Optional single, dual or triple gas sensors
10	Temperature Limited Sheath Heaters	Stainless steel finned tubular heaters with a temperature sensor to limit the max operating temperature.

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	Safety Feature	Description
11	Product Sensors	8 Thermocouple connectors installed on the rear of the chamber for customer device under test monitoring. *Additional Thermocouples are optional
12	Safety Purge	Inert gas purge is triggered when the chamber is in an alarm state
13	Chamber Alarm Input	The external terminal block sends a voltage signal that, when interrupted, will trigger an alarm state and shut down the chamber. *This can be interfaced with other test equipment or DUT.
14	Chamber Alarm Output	When the chamber is powered and in a safe state the contact closes. Loss of power or alarm condition opens the contacts. *This Alarm output is designed to safely disable test equipment or DUT.

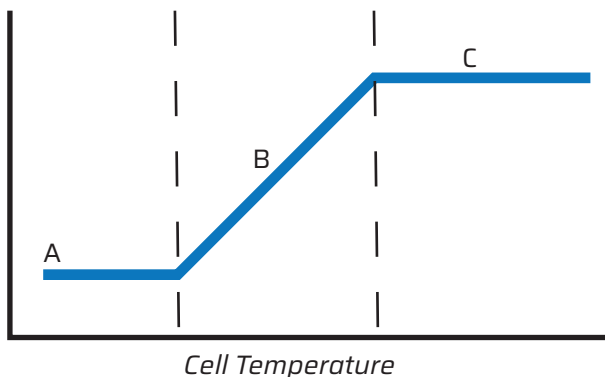
BATTERY SAFETY FEATURES

Battery safety features are important for operator safety during a battery thermal event (BTE). The AES SAFE chamber series is designed to first prevent and then mitigate a BTE.

Preventative Safety Features	Preventative Action
Set Point Temperature Limit	Prevents the chamber from being set to a temperature outside the desired range.
High Low Temperature Limit	High low limit control(FM approved) is independent from primary chamber controller. This is a back-up safety to the set point temperature limit safety feature.
Product Sensors	Measures the cell temp. If cell temperature gets too high, testing will be stopped.
Rapid Rise¹	Measures cell and air temperature. If the chamber is heating or cooling too fast, this feature shuts down testing prior to a BTE.
Temperature Limited Sheath Heaters	Keeps surface temperature of the heater far below the auto-ignition temperature of any gas present in the chamber, preventing ignition.
Alarm Input/Output	I/O designed to communicate alarm status between chamber and cycler, hardwired.
Gas Sensor/s <i>Optional</i>	Monitor gas levels inside the chamber for abnormal conditions. Puts chamber in alarm state with abnormal levels.

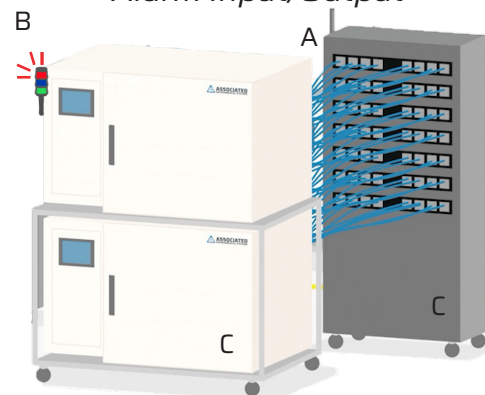
Mitigation Safety Features	Mitigation Action
Emergency Stop Button	Stops all temperature conditioning and put the chamber in an alarm state.
Reinforcement	Reinforced chamber inner structure and enhanced door structure hinging and latching. Designed to handle pressure increase during BTE.
Safety Purge	Removes oxygen from chamber and replaces with inert gas (fire suppression).
Audible and Visual Alarm	Alerts chamber user/s to alarm status and evacuate area.
Burst Disk/Low Flow Vent	Graphite burst disk and rupture sensor relieve pressure in case of BTE.
Door Lock	Prevents access to the chamber when running or in alarm condition. Intergrated door position sensor (open/close).
Alarm Input/Output²	Communicates alarm status between chamber and cycler and triggers audible and visual alarms. Halts temperature conditioning and charging/discharging.

¹ Rapid Rise: Safety Algorithm



- A. Cell is at room temperature cell is being loaded into the chamber and in nominal state.
- B. Cell heat is rising during charge/dishcharge testing.
- C. Cell has hit max heat rise during charge/dishcharge testing.

² Alarm Input/Output



- A. Communicates chamber alarm status
- B. Triggers Audible and Visual alarm on chamber
- C. All temperature conditioning inside the chamber stops
- D. Cycler charge/dishcharge testing halts

BATTERY TEST CHAMBERS

All AES SAFE series battery test chambers are safe up to EUCAR Hazard Level 7. See EUCAR hazard level chart on page 7.

FD-548-7.5-SAFE



SPECIFICATIONS

Volume	48 cubic ft (1359.2liters)
Temperature	-20°C to 80°C (-4°F to 176°F)
Electrical Supply	480 VAC, 3 PH, 60Hz
Full Load Amps	35 A
Electrical Connectivity	Hardwired
Refrigeration System	Single stage

FD-527-7.5-SAFE



SPECIFICATIONS

Volume	27 cubic ft (764.55 liters)
Temperature	-20°C to 80°C (-4°F to 176°F)
Electrical Supply	480VAC, 3 PH, 60Hz
Full Load Amps	28 A
Electrical Connectivity	Hardwired
Refrigeration System	Single stage

SC/SCH-512-4-SAFE



SPECIFICATIONS

Volume	12.95 cubic ft (366.7 liters)
Temperature	-20°C to 80°C (-4°F to 176°F)
Electrical Supply	208 VAC, 1 PH, 60Hz or 230 VAC, 1PH, 60 Hz
Full Load Amps	50 A
Electrical Connectivity	6' cord with 2-Pole 3-Wire Grounding, Non-NEMA, Twist lock plug. CATALOG# CS8265C
Refrigeration System	Single stage
Humidity Range (SCH only)	10-95% RH, limited by +4°C Td (for 98% add option)

BATTERY TEST CHAMBERS

SC/SCH-508-4-SAFE



SPECIFICATIONS

Volume	8.64 cubic ft (244.65 liters)
Temperature	-20°C to 80°C (-4°F to 176°F)
Electrical Supply	208 VAC, 1 PH, 60Hz or 230 VAC, 1PH, 60 Hz
Full Load Amps	50 A
Electrical Connectivity	6' cord with 2-Pole 3-Wire Grounding, Non-NEMA, Twist lock plug. CATALOG# CS8265C
Refrigeration System	Single stage
Humidity Range (SCH only)	10-95% RH, limited by +4°C Td (for 98% add option)

SD/BHD-508-SAFE



SPECIFICATIONS

Volume	8 cubic ft/226.53 liters
Temperature	-20°C to 80°C (-4°F to 176°F)
Electrical Supply	208 VAC, 1 PH, 60Hz or 230 VAC, 1PH, 60 Hz
Full Load Amps (SD)	22 A
Full Load Amps (BHD)	25 A
Electrical Connectivity	Attach power cable with NEMA L6-30
Refrigeration System	Single stage
Humidity Range (BHD only)	10-95% RH, limited by +4°C Td (for 98% add option)

SD-501-SAFE



SPECIFICATIONS

Volume	1.01 cubic ft (28.59 liters)
Temperature	-20°C to 80°C (-4°F to 176°F)
Electrical Supply	208 VAC, 1 PH, 60Hz or 230 VAC, 1PH, 60 Hz
Full Load Amps	13A
Electrical Connectivity	Attach power cable with NEMA 5-15p
Refrigeration System	Single stage

AES SAFETY LEVELS

Standard AES Chambers
 AES SAFE Required

Severity Level	Description	Severity Classification & Effects Criteria
0	No Effect	No effect. No loss of functionality.
1	Reversible Loss of Function	No defect; no leakage; no venting, fire, or flame; no rupture; no explosion; no exothermic reaction or thermal runaway. Cell reversibly damaged. Repair of protection device needed.
2	Irreversible Defect/Damage	No leakage; no venting, fire, or flame; no rupture; no explosion; no exothermic reaction or thermal runaway. Cell irreversibly damaged. Repair needed.
3	Leakage Δ mass <50%	No venting, fire, or flame*; no rupture; no explosion. Weight loss <50% of electrolyte weight (electrolyte = solvent + salt).
4	Venting Δ mass $\geq$ 50%	No fire or flame*; no rupture; no explosion. Weight loss $\geq$ 50% of electrolyte weight (electrolyte = solvent + salt).
5	Fire or Flame	No rupture; no explosion (i.e., no flying parts).
6	Rupture	No explosion, but flying parts of the active mass.
7	Explosion	Explosion (i.e., disintegration of the cell)

***Gas Sensors and Additional Safety Features Available**



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AES SAFE