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Silverwing Aeronautics

BTS (Battery Test-Setup) procedure

In case of emergency, push RED BUTTON to disarm circuit

Point of contact:

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This document specifies the procedure of testing battery packs using a programmable power supply and water cooled resistance circuit.

Tools:

Item	Purposes
Delta power supply	- Control discharge current - Charge batteries - Log voltage and current
Raspberry Pi	- Control power supply (ethernet) - Log data from power supply (ethernet) - Log data from temperature sensors (OneWire, ADC)
DS18B20 waterproof temperature sensor	- Measure ambient or water temperature
Thermistor	Measure individual cell temperature
Resistance circuit	Dissipate energy
Python	- Harmonize data - (Post) processing data
GitHub	- Update python - Retrieve test data

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General procedure

1. Check that all safety measures are in place and the perimeter is clear
    1. Fire blanket within reach
    2. Familiarize with the location of fire extinguishers, fire alarms, emergency exits and other people that may be at risk in case of emergency
    3. Remove conducting objects from the testing surface and perimeter
    4. Mark the testing area such that it is clear that a test is active
2. Check and enter the operating requirements of the battery from the data sheet into the testing script
    1. Minumum and maximum temperature
    2. Minimum and maximum voltage
    3. Maximum current draw
3. Connect the battery
    1. to the power supply using the clamps and make sure the cables are constrained
    2. to the temperature sensor using thermal paste as a heat conductor
4. Validate the temperature reading
5. Enter desired discharge cycle/profile and note the expected end time (loaded from test matrix)
6. When finished, upload the data from the Raspberry Pi and detach the battery
    1. If desired, bring battery to storage voltage using the script
    2. Store battery safely in the fire/battery cabinet

Control script

The Raspberry Pi establishes a connection with the Delta power supply on startup. Manual control on the Delta is automatically disabled, except for the on-screen on/off switch. The watchdog feature on the Delta power supply is enabled and will default the state of the supply to ‘off’ whenever communication is lost for more than 5 seconds.

When initializing the test sequence, the temperature and voltage of the connected battery will be measured. When within set bounds, the set sequence will start. The sequence can be defined as follows:

‘(c_rate, duration)’, in case duration is set to ‘0’ the battery will discharge to its minimum cutoff voltage.

Regardless of the set duration, the discharge will always be interrupted whenever the temperature or voltage exceeds any limits (default settings: $2.8 - I^2 * R_{sys} < \frac{V}{series} < 4.2$and 0°C < T < 60°C) with $R_{sys} = 0.02\Omega$. The temperature sensor updates at a 1Hz frequency and the voltage and current levels update at a 10Hz frequency.

Once a battery is discharged or a cycle is interrupted, the Raspberry Pi will wait until the battery is within its operating limits again and start a charge cycle according to a 1C, CC-CV process with a cutoff at 0.07C (~1.5 hours).

Uploading and accessing data

1. ’git add -A’
2. ‘git commit -m ‘Uploading test data’
3. ‘git push’
4. Access the GitHub repository ‘olivierwitteman/Silverwing/BTS’
    1. Request access from Olivier if not invited yet