GomSpace A/S
Langagervej 6
9220 Aalborg E

# NANOPOWER BP8 100WH

Qualification Certificate

Reference: 1069135
Revision: 1.0
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| Prepared / Owned by: | Lars Vestergaard | PA Manager | LAV | 2025-12-15 |
| Verified / Reviewed by: | Tim Nielsen | Product Owner | TINI | 2025-12-18 |
| Approved by: | Poul Hove Kristensen | Commercial Product Manager | PHK | 2025-12-18 |

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**References**

| Reference | Document title | Document number | Revision, Date |
|---|---|---|---|
| [RD-1] | GomSpace Qualification Program | 1012670 | Rev. 2.3, 2023-03-24 |
| [RD-2] | gs-qtrp-NanoPower BP8 Structural and Mechanical Vibration Test Report | 1043385 | Rev. 1.0, 2022-11-03 |
| [RD-3] | gs-qtrp-nanopower-bp8 Mechanical Shock Test Report | 1047283 | Rev. 1.0, 2023-01-18 |
| [RD-4] | gs-qtrp-NanoPower BP8 Thermal Vacuum Test Reportv1-1 | 1043910 | Rev. 1.2, 2025-04-25 |
| [RD-5] | gs-qtrp-NanoPower BP8 Radiation Total Ionizing Dose Test Report 3rd | 1024842 | Rev. 1.6, 2025-04-25 |
| [RD-6] | gs-qtrp-nanopower-bp8 Thermal Stress Test Report | 1049161 | Rev. 1.1, 2025-04-25 |
| [RD-7] | gs-qtct-nanopower-bp8 Qualification Certificate | 1050634 | Rev. 1.2, 2025-05-01 |

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# 1. Qualification Tests

## 1.1 Purpose

This document describes the environmental qualification tests which is carried out on this specific product. In the following sections, the tests and the corresponding test results are described.

## 1.2 Product

Manufacturer Name: GomSpace
Product Name: NanoPower BP8 100Wh
Product Number: 112311

The NanoPower BP8 100Wh, with part number 112311, is introduced as a replacement for the NanoPower BP8, with part number 101651. The main difference between the two products are the battery cells, which are changed from 3000mAh to 3500mAh. The cells have the same physical dimensions and mass.
Because of the similarity of the two variants, the qualification tests from 101651 are inherited on 112311. See the qualification certificate for 101651 [RD-7].

In the following sections, the tests and the corresponding test results are described.

## 1.3 Vibration Tests

The product has been subjected to the following tests.

**Tests:** Random Vibration
Sinusoidal Vibration
Quasi-static / Sine burst

**Conditions:** Product is mounted in a 6U GomSpace structure which is mounted inside a GomSpace Qualification POD. It is tested under the following test conditions.

| Test Description | Test Conditions |
|---|---|
| Random Vibration | 20Hz, 0.026G2/Hz<br>20-50Hz, +6 dB/oct<br>50-800Hz, 0.16G2/Hz<br>800-2000Hz, -6 dB/oct<br>2000Hz, 0.026G2/Hz<br>Overall, 14.1Grms |
| Sinusoidal Vibration | 5-8Hz, 10mm pp<br>8-100Hz, 4.5G |
| Quasi-static / Sine burst | 30Hz, 15G,<br>19 cycles / 7 loaded cycles |

**Conclusion:** The NanoPower BP8 is tested according to the above-mentioned conditions.
The electrical / functional tests are passed.
This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

## 1.4 Shock Tests

The product has been subjected to the following tests.

**Tests:** Shock

**Conditions:** Product is mounted in the fixture for the GomSpace shock bench.
The device is exposed to three impacts at each axis, X, Y and Z.
It is tested under the following test conditions.

| Test Description | Test Conditions |
|---|---|
| Shock Response Spectrum (SRS): | 100Hz, 40G<br>1000Hz, 1000G<br>2000Hz, 1500G<br>10000Hz, 1500G<br>+/- 6db from the nominal shock<br>50% of the measured shock shall be above nominal shock |

**Conclusion:** The NanoPower BP8 is tested according to the above-mentioned conditions.
The visual mechanical inspection and electrical / functional tests are passed.
This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

## 1.5 Thermal Vacuum Tests

The product has been subjected to the following tests.

**Tests:** Thermal Vacuum (TVAC)

**Conditions:** Product is mounted in a 6U GomSpace structure, prepared with thermocouples and harness, installed in the TVAC chamber for test. The temperature range defined in the table below refers to the thermal interface of the product during test to ensure its operating temperatures are within specifications. It is tested under the following test conditions.

| Test Description | Test Conditions |
|---|---|
| Temperature | -15 to 38°C, Charging<br>-15 to 63°C, Discharging |
| Pressure | <1e-5 mbar |
| Cycles | 8 |
| Dwell time | 2 hours |

**Conclusion:** The NanoPower BP8 is tested according to the above-mentioned conditions. The electrical / functional tests performed the are passed.
This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

## 1.6 Radiation TID Tests

The product has been subjected to the following tests.

**Tests:** Radiation TID (Total Ionizing Dose)

**Conditions:** Product is mounted at plate for TID testing, prepared with harness and necessary logging equipment.
It is tested under the following test conditions.

| Test Description | Test Conditions |
|---|---|
| Method | Direct (Online) |
| Rate | Low dose – 36 to 360 rad(Si)/hour |
| Total dose | Target: 20 krad<br>Resilient up to 15 krad |
| Condition | Biased at room temperature |
| Annealing | >24 hours |
| Ageing | >168 hours |

**Remarks:** Test shows two components of product is TID resilient up to 16.6 krad.

**Conclusion:** The NanoPower BP8 is tested according to the above-mentioned conditions. The electrical / functional tests performed are partly passed for 20krad. Based on data logs and tests, the TID resilience therefore is specified up to 15 krad. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

## 1.7 Thermal Stress Test

The product has been subjected to the following tests.

**Tests:** Thermal Stress (Accelerated Lifetime)

**Conditions:** Product is prepared with thermocouples and installed at the shelf of the Thermal Stress chamber. It is tested under the following test conditions.

| Test Description | Test Conditions |
|---|---|
| Temperature – hot plateau | 100°C +15 /-0°C |
| Temperature – cold plateau | -55°C +0 /-10°C |
| Cycles | 150 |
| Dwell time | 15 minutes |

**Conclusion:** The NanoPower BP8 is tested according to the above-mentioned conditions. The visual mechanical inspection and electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

## 1.8 Flight Heritage

The new NanoPower BP8 100Wh (112311) is at TRL 8 and is expected to be launched in Q2 2026.
As described above the New NanoPower BP8 100Wh is upgraded with new battery cells only.

The existing NanoPower BP8 (101651) is at TRL 9 and have flight heritage since March 2024 on various customer missions.
Furthermore, the existing NanoPower BP8 has flight heritage on the Juventas satellite, part of the ESA HERA mission. The HERA satellite was launched in October 2024.

The new battery cell, LG Chem INR18650 MJ1, is tested by JPL in a comparison test of commercial 18650 cells, where the MJ1 cell outperformed the other cells in the test.
Published in “Performance of Commercial Li-Ion Cells for Future NASA Missions and Aerospace Applications” in Journal of The Electrochemical Society, 2021 168 040504