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**1. SCOPE**

This specification governs the performance of the following HOWELL Nickel-Metal Hydride Cylindrical Cell and its stack-up batteries.

**Model: 4608.4P-250ET**

**Cell size : 9V**

The data involving nominal voltage and the approximate weight of stack-up batteries shall be equal to the value of the unit cell multiplied by the number of unit cells in the battery. For example, a stack-up battery consists of 7 unit cells:

Nominal Voltage of unit cell=1.2V

Thus, nominal voltage of stack-up battery=1.2V × 7=8.4V

**2. RATINGS**

Description	Unit	Specification	Conditions
Nominal Voltage	V	8.4	Unit cell
Nominal Capacity	mAh	250	Standard Charge/Discharge
Minimum Capacity	mAh	230	Standard Charge/Discharge
Standard Charge	mA	25(0.1C)	T <sub>a</sub> =0~45 <sup>0</sup> C (See Note 1)
	hour	16	
Fast Charge	mA	125(0.5C)	dT/dt=0.8-1 <sup>0</sup> C/minute -ΔV=5-10mV/cell Timer Cutoff=105% Input capacity (for ref only)
	hour	2.1approx (See Note 2)	
Trickle Charge	mA	6(0.03C)~10(0.05C)	T <sub>a</sub> =0~45 <sup>0</sup> C
Discharge Cut-off Voltage	V	7.0	Unit cell
Maximum Discharging Current	mA	750(3C)	T <sub>a</sub> =20~60 <sup>0</sup> C
Storage Temperature	<sup>0</sup> C	-20~35 <sup>0</sup> C	Discharged state
Typical Weight	gram	44.0	Unit cell

**3. PERFORMANCE**

Unless otherwise stated, tests should be done within one month of delivery under the following conditions:

Ambient Temperature, T<sub>a</sub>: 20±5<sup>0</sup>C

Relative Humidity : 65±20%

Notes: Standard Charge/Discharge Conditions:

Charge : 20mA(0.1C)×16hrs

Discharge : 40mA(0.2C) to 1.0V/cell

Test	Unit	Specification	Conditions	Remarks
Capacity	mAh	≥230	Standard Charge/Discharge	Up to 3 cycles are allowed
Open Circuit Voltage (OCV)	V	≥8.4	Within 1hr after standard Charge	Unit cell
Internal Impedance (Ri)	mΩ	≤650	Upon fully charge (1kHz)	Unit cell
High Rate Discharge (0.5C)	min	≥108	Standard Charge, 1hr rest before discharge	
High Rate Discharge (1C)	min	≥51	Standard Charge, 1hr rest before discharge	
Overcharge	N/A	No leakage nor explosion	20mA (0.1C) charge 28 days	
Charge Retention	mAh	≥130 (65%)	Standard Charge, Storage: 28 days, Standard Discharge	
IEC Cycles Test	Cycle	>300	IEC 61951-2(2503)	(see Note 3)
		Up to 500 cycles	Not less than 60% of nominal at 0.1C charge/ 0.2C discharge	
Accelerated Cycle Life	Cycle	≥200	Charge : 100mA (0.5C) Discharge: 100mA(0.5C) To 1.0V/cell End-of-life: 80% nominal Capacity.	Cycling Charging Cutoff condition: -ΔV=5-10mV/cell or Timer Cutoff=105% Of input capacity

Test	Unit	Specification	Conditions	Remarks
Leakage	N/A	No leakage nor deformation	Fully charged at 40mA (0.2C), stand for 14 days.	
Short Circuit	N/A	Leakage & deformation may occur, but no explosion is allowed	After standard charge, Short circuit for 1 hour (Leading wire =0.75mm <sup>2</sup> x20mm)	
Vibration Resistance	N/A	Charge of voltage Should be under 0.02V/cell Charge of impedance Should be under 5 milli-ohm/cell.	Charge the battery 0.1C 15hrs,then leave for 24hrs,check battery before/after vibration, Amplitude:1.5mm Vibration:3000CPM Any direction for 60mins.	Unit cell

Impact Resistance	N/A	Charge of voltage Should be under 0.02V/cell, Charge of impedance Should be under 5 milli-ohm/cell.	Charge the battery 0.1C 15hrs, then leave for 24hrs, check battery Before/after dropped, Height: 50cm Wooden board (Thickness 30mm) Direction not specified, 3 times.	Unit cell
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**1.CONFIGURATION, DIMENSIONS AND MARKINGS**

Please refer to the attached drawing.

**2.EXTERNAL APPEARANCE**

The cell/battery shall be free from cracks, scars, breakage, rust, discoloration, leakage nor deformation.

**3.WARRANTY**

One (1) year limited warranty against workmanship and material defects.

**4.CAUTION**

1. Reverse charging is not acceptable.
2. Charge before use. The cells/batteries are delivered in an uncharged state.
3. Do not charge /discharge with more than the specified current.
4. Do not short circuit the cell/battery. Permanent damage to the cell/battery may result.
5. Do not incinerate or mutilate the cell/battery.
6. Do not solder directly to the cell /battery.
7. The life expectancy may be reduced if the cell/battery is subjected to adverse conditions like: extreme temperature, deep cycling, and excessive overcharge/ over discharge.
8. Store the cell/batteries uncharged in a cool dry place. Always discharge batteries before bulk storage or shipment.
9. For storage of cells/batteries over one year, in order to prevent the degrading the function of cells, Cells/batteries should be at least charged and discharged once within one year.
- 10.Keep away from children. If swallowed, contact a physician at once.
- 11.Air ventilation should be provided in the plastic case of batteries, otherwise it may have a risk of generating gas inside them (oxygen gas, hydrogen gas) resulting explosion triggered by fire sources (motors or switches). Caution should be focused on the ventilation of battery compartments. Airtight battery compartments are strongly discouraged.

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Notes: 1. T<sub>a</sub>: Ambient Temperature  
 2. Approximate charge times from discharged state, for reference only.  
 3. IEC 61951-2 (2503) Cycle Life Test:

Cycle No.	Charge	Rest	Discharge
1	0.1C×16hrs	none	0.25C×2hs20mins
2-48	0.25C×3hrs10mins	none	0.25C×2hs20mins
49	0.25C×3hrs10mins	none	0.25C to 1.0V/cell
50	0.1C×16hrs	1-4hr(s)	0.2C to 1.0V/cell
Cycles 1 to 50 shall be repeated until the discharge duration on any 50th cycle becomes less than 3hrs			

**GENERAL CHARACTERISTICS**

