



EHIMA

Recommendations for Zinc-Air Hearing Aid Batteries

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1 Purpose

This recommendation for Zinc-Air hearing aid batteries documents the requirements of the hearing aid manufacturers as represented by the European Hearing Instrument Manufacturers Association (EHIMA).

Having a common recommendation for the Hearing Aid industry will benefit all, including the Hearing Aid users. EHIMA will work towards having the recommendations aligned with the IEC 60086 Standard.

2 References

- [1]: IEC 60086-1, edition 11 (2011). Primary batteries: General
- [2]: IEC 60086-2, edition 11 (2006). Primary batteries: Physical and electrical specification
- [3]: IEC 60086-3, edition 2 (2004). Primary batteries: Watch Batteries
- [4]: IEC 60410 (1973). Sampling plans and procedures for inspection by attributes.
- [5]: ISO 9227 (2006): Corrosion tests in artificial atmospheres -- Salt spray tests

3 Nominal operating conditions

All characteristics are specified for the following nominal conditions, unless stated differently:

- Temperature: $20 \pm 2^\circ \text{C}$
- Humidity: $55\% \pm 10\%$

4 Mechanical specification

4.1 Dimensional specification

The dimensions of the battery shall be according to Figure 1 and Table 1. Measures indicated with * are different from ref. [2].

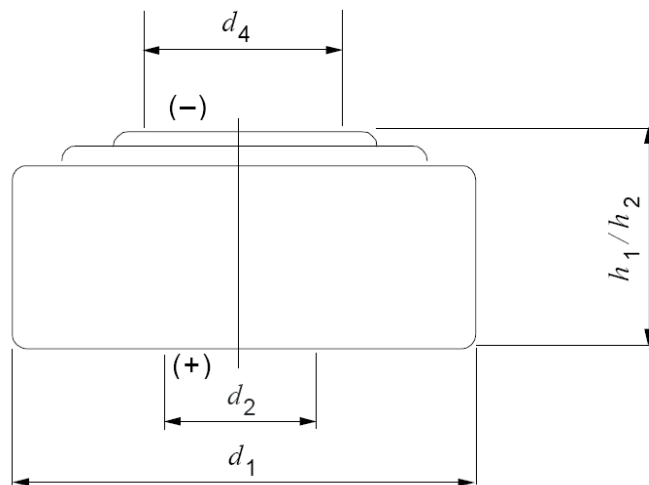


Figure 1: Battery dimensions

Type	Dimensions in mm			
	d1 _{min}	d1 _{max}	h1/h2 _{min}	h1/h2 _{max}
PR70 (size 10)	5,65*	5,80	3,3	3,60
PR41 (size 312)	7,70*	7,90	3,3	3,60
PR48 (size 13)	7,70*	7,90	5,05*	5,40
PR44 (size 675)	11,30*	11,60	5,05*	5,40

Table 1: Battery dimensions in mm; measures indicated with * are different from ref. [2]

4.2 Gauge dimensions

The dimensions of the gauge shall be according to Figure 2 and Table 2. The batteries have to fit freely into the gauge and shall not pass when turned upside down. Note that the gauge dimensions are defined slightly different from ref. [2].

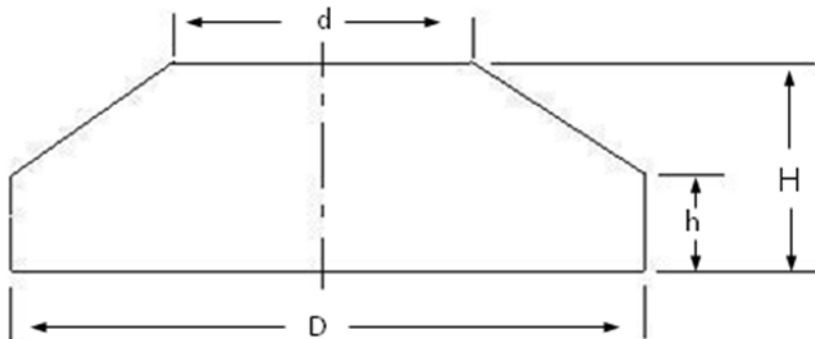


Figure 2: Gauge dimensions

Type	Gauge Dimensions in mm							
	D		d		H		h	
	Nom.	Tol.	Nom.	Tol.	Nom.	Tol.	Nom.	Tol.
PR70 (size 10)	5,810	±0,005	4,210	±0,005	3,610	±0,005	2,810	±0,005
PR41 (size 312)	7,910	±0,005	5,510	±0,005	3,610	±0,005	2,410	±0,005
PR48 (size 13)	7,910	±0,005	5,510	±0,005	5,410	±0,005	4,210	±0,005
PR44 (size 675)	11,610	±0,005	9,010	±0,005	5,410	±0,005	4,110	±0,005

Table 2: Gauge dimensions in mm

4.3 Position of air intake holes

The position of the air intake holes shall be according to Figure 3 and Table 3.

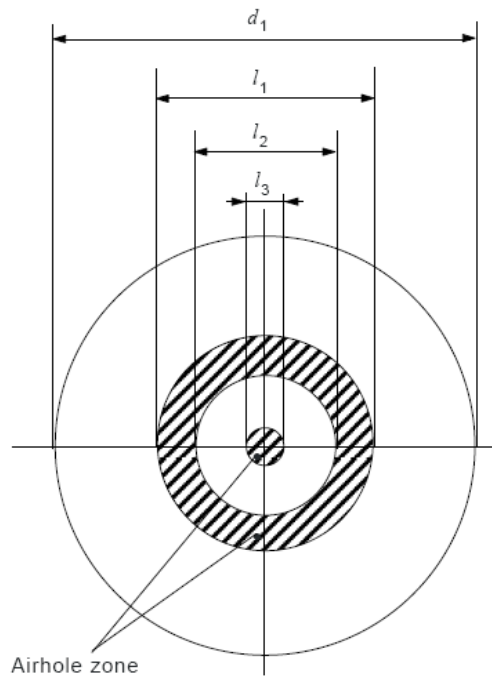


Figure 3: Position of air intake holes.

Type	Position of Air intake holes in mm				
	d1 _{min}	d1 _{max}	l1	l2	l3
PR70 (size 10)	5,65	5,80	-	-	2,0
PR41 (size 312)	7,7	7,9	3,7	2,3	1,0
PR48 (size 13)	7,7	7,9	3,7	2,3	1,0
PR44 (size 675)	11,3	11,6	5,8	3,8	1,0

Table 3: Position of air intake holes in mm

4.4 Post discharge height

The discharge profile is defined as follows:

- Phase 1: discharge down to 0,9 V as defined in chapter 5.1
- Phase 2: below 0,9 V observe height for 2 weeks.

For capacity calculation the end voltage of 1.1 V will be used as defined in chapter 5.2. During discharge down to the 0,9 V (Phase 1), the height $h_1/h_{2_{max}}$ shall not exceed dimensions of Table 1.

For post discharge conditions (Phase 2), the height $h_1/h_{2_{max}}$ of the battery shall not exceed the maximum height specified in Table 1 by more than 1%. This shall apply for the full humidity and temperature ranges as specified in section 6.1 and 6.2.

5 Electrical specification

5.1 Battery voltage

The nominal voltage and the maximum open circuit voltage will be 1,4 and 1,59 V respectively, according to the letter P system classification (ZnO₂) of 60086-1 (2011), section 4.1.4.

5.2 Discharge conditions

The discharge conditions are according Table 4. Measures indicated with * are different from ref. [2].

Type	Application	Discharge condition			
		Background current (mA)	Pulse current (mA)	EV (V)	Daily period
PR70 (size 10)	STD	0,7 mA	3 mA	1,10*	Six repeated cycles of the Pulse load for 100 ms followed by the Background load for 119 min, 59 s, 900 ms, then off for 12 hours.
	HP	1,5 mA*	5 mA		
PR41 (size 312)	STD	1,2 mA	5 mA		
	HP	2 mA	10 mA		
PR48 (size 13)	STD	2 mA	6 mA		
	HP	3 mA	12 mA		
PR44 (size 675)	STD	5 mA	15 mA		
	HP	8 mA	24 mA		

Table 4: Discharge conditions

Note 1: The End-point Voltage (EV) refers to the voltage reached in either the background load or the pulse load, which comes first.

Note 2: The first discharge cycle should start no earlier than one minute after the battery activation (the removing of the air hole tab). The pulse load is the first load of a cycle.

5.3 Battery capacity

Service Duration is defined as the total hours of operation until End-point Voltage (EV) is reached as measured under the discharge conditions of Table 4 and excluding the off hours.

The Rated Capacity in mAh is derived as the Service Duration multiplied by the background load current of Table 4.

The minimum Service Duration and minimum Rated Capacity are given in Table 5.

Type	Application	Minimum Service Duration (hrs)	Minimum Rated Capacity (mAh)
PR 70 (size 10A)	STD	125	90
	HP	55	85
PR 41 (size 312)	STD	125	150
	HP	70	140
PR 48 (size 13)	STD	125	250
	HP	80	240
PR 44 (size 675)	STD	100	500
	HP	60	480

Table 5: Minimum Service Duration and minimum Rated Capacity

6 Dependency from environmental conditions

6.1 Capacity versus Humidity

The minimum Rated Capacity of table 5 shall not drop below values as stated in Table 6 below:

Humidity	20 ± 10 % RH (dry)	55 ± 10 % RH (nominal)	80 ± 10 % RH (wet)
Temperature	20 ± 2 °C		
Δ Minimum Rated Capacity	-10 %	0	-20 %

Table 6: Minimum Rated Capacity versus humidity

6.2 Capacity versus Temperature

The minimum Rated Capacity of table 5 shall not drop below values as stated in Table 7 below:

Temperature	0 ± 2° C (low temperature)	20 ± 2° C (nominal)	50 ± 2° C (high temperature)
Humidity	55 ± 10 % RH		
Δ Minimum Rated Capacity	-10 %	none	none

Table 7: Minimum Rated Capacity versus temperature

7 Storage

7.1 Storage conditions

- a) Temperature range: 20 ± 10 °C
- b) Humidity range: 20 % to 80 % RH (Relative Humidity).

Relative Humidity: L Perry, R.H. and Green, D.W, Perry's Chemical Engineers' Handbook (7th Edition), McGraw-Hill, ISBN 0-07-049841-5, Eqn 12-7.

7.2 Delayed discharge capacity

Under storage conditions as outlined in 7.1, the minimum and/or stated minimum Rated Capacity shall not drop below values as stated in Table 8 below:

	Delayed discharge capacity		
	After 1 year	After 2 years	After 3 years
Δ Minimum Rated Capacity	- 5 %	- 10 %	- 15 %

Table 8: Capacity over time

8 Leakage

No leakage shall be observed for batteries:

- a) which are unused (batteries on stock up to 3 years)
- b) batteries during discharge until End-point Voltage has been reached
- c) 21 days after discharge.

Visual examination (see IEC 60086-3, paragraph 8):

- a) no visible leakage (crystals)
- b) using indicator strips to detect KOH leakage for pH values between 7,5 to 14.

9 Corrosion

Test conditions:

- a) Salt spray test according to ISO 9227:2006; Temperature 37 °C; Duration: 10 days.
- b) Alternatively an artificial sweat test according to DIN 53150-2 can be used; Batteries and sweat in closed container, batteries not touching sweat; 37°C, Duration: 10 days

Acceptance criteria:

- No rust residue.

10 Adherence and sealing of air tab

Minimum force

- a) Battery size 10: 0,5 N
- b) Battery size 312/13/675: 1 N.

No glue must be left on the battery or in the air holes after tab removal.

11 Labelling

11.1 Battery Capacity Labelling

If capacity is claimed on the battery package, this capacity should be stated as the Rated Capacity in mAh and should state STD or HP.

Batteries complying with this recommendation should have a minimum Rated Capacity according to the values given in Table 5.

Any battery with a Rated Capacity below 80 % of claimed Rated Capacity shall be rejected.

A shipment of batteries shall be rejected if the median capacity of a sample (according to IEC 60410) is below 90% of the claimed Rated Capacity.

11.2 Package Labelling

The following information is provided on the blister package:

1. Manufacturer
2. Use-up date (“best if used before....”)
3. Warning information for the user
4. Cell type (675, 13, 312, 10A)
5. Power rating (Std, HP)
6. Optional: rated battery capacity in mAh
7. Colour code for cell size and power rating according to Table 9.



Type	Colour code	Colour name
PR 44 (675)		Blue
PR 48 (13)		Orange
PR 41 (312)		Brown
PR 70 (10A)		Yellow

Table 9: Colour coding
