1. Scope

This document provides technical information, package information, price information, and safety information of Universal Power alkaline battery.

Item : Mercury free Alkaline Manganese battery LR20, LR14, LR6, LR03, LR1, 6LF22

Related documents : IEC 60086-1/ JIS C 8500, IEC 60086-2/ JIS C 8515

2. General

IEC designation Common	LR20 D	LR14 C	LR6 AA	LR03 AAA	LR1 N	6LF22
Nominal voltage	1.5 V	1.5 V	1.5 V	1.5 V	1.5 V	9.0 V
Shape and dimension	Refer to below (*2)					
Typical weight	128 g	62 g	22 g	11 g	9 g	46 g
Nominal capacity (*1)	15,000 mAh	7,500 mAh	2,700 mAh	1,260 mAh	900 mAh	500 mAh
Operating temp range	-10～50℃（In the state of over 40℃, within 30 days）					

*1) LR20,LR14: 20 ohm cont discharge/ LR6: 75 ohm cont discharge/ LR03,LR1: 300 ohm discharge
6LF22: 620 ohm discharge

*2) Shape and Dimension

IEC designation	LR20	LR14	LR6	LR03	LR1	6LF22
Height (mm)	60.9	49.6	50.1	44.3	29.4	47.5
Outer diameter (mm)	33.0	25.6	14.0	10.3	11.6	—
Long side length	—	—	—	—	—	25.5
Short side length	—	—	—	—	—	16.5

3. Electrical characteristics

IEC designation		LR20	LR14	LR6	LR03	LR1	6LF22
Off-load Voltage (V)	Initial	1.60	1.60	1.60	1.60	1.60	9.3
	After 12 months	1.58	1.58	1.58	1.58	1.58	9.2
On-load Voltage (V)	Initial	1.56	1.53	1.54	1.52	1.38	7.6
	After 12 months	1.51	1.51	1.51	1.45	1.30	7.4

1) Test temperature : 20±2℃, Storage temperature : 20±2℃.

2) Load resistance : LR20,14,6,03,1) 5Ω (Measure time：0.3 seconds)
6LF22) 47Ω (Measure time : 0.3 seconds)

4. Discharge and reliability test

4-1. LR20

(1) Discharge test

Discharge condition		Initial	After 1 year
600mA 2hr/D (hr) EPV=0.9V	Normal	16	15
	JIS/IEC(MAD)	11	9.5
10Ω 4hr/D (hr) EPV=0.9V	Normal	113	111
	JIS/IEC(MAD)	85	76
2.2Ω 1hr/D (hr) EPV=0.8V	Normal	23	22
	JIS/IEC(MAD)	16	14
1.5Ω 4m/15m × 8hr/D (m) EPV=0.9V	Normal	819	803
	JIS/IEC(MAD)	520	465

1) EPV : End point voltage

2) Test temperature : 20±2℃, Storage temperature : 20±2℃.

3) MAD=Minimum average duration

(2) Anti-leakage before use (60℃90%RH)

Period	n	10days	20days	30days	40days
Universal Power	40	none	none	none	none

(3) Safety test

	Test mode	Requirements	Result
Intended use	1. Partial use	No leakage, No fire, No explosion	Passed
	2. Transportation shock	No leakage, No fire, No explosion	Passed
	3. Transportation vibration	No leakage, No fire, No explosion	Passed
	4. Climatic	No fire, No explosion	Passed
Reasonably foreseeable misuse	5. Incorrect insertion	No explosion	Passed
	6. External short circuit	No fire, No explosion	Passed
	7. Over discharge	No fire, No explosion	Passed
	8. Free drop	No fire, No explosion	Passed

4-2. LR14

(1) Discharge test

Discharge condition		Initial	After 1 year
400mA 2hr/D (hr) EPV=0.9V	Nominal	11	11
	JIS/IEC(MAD)	8.0	7.2
20Ω 4hr/D (hr) EPV=0.9V	Nominal	105	103
	JIS/IEC(MAD)	80	72
3.9Ω 1hr/D (hr) EPV=0.8V	Nominal	19	19
	JIS/IEC(MAD)	14	12
3.9Ω 4m/56m × 8hr/D (m) EPV=0.9V	Nominal	1096	1074
	JIS/IEC(MAD)	800	720

1) EPV：End point voltage

2) Test temperature：20±2℃, Storage temperature：20±2℃.

3) MAD=Minimum average duration

(2) Anti-leakage before use (60℃90%RH)

Period	n	10days	20days	30days	40days
Universal Power	40	none	none	none	none

(3) Safety test

	Test mode	Requirements	Result
Intended use	1. Partial use	No leakage, No fire, No explosion	Passed
	2. Transportation shock	No leakage, No fire, No explosion	Passed
	3. Transportation vibration	No leakage, No fire, No explosion	Passed
	4. Climatic	No fire, No explosion	Passed
Reasonably foreseeable misuse	5. Incorrect insertion	No explosion	Passed
	6. External short circuit	No fire, No explosion	Passed
	7. Over discharge	No fire, No explosion	Passed
	8. Free drop	No fire, No explosion	Passed

4-3. LR6

(1) Discharge test

Discharge condition		Initial	After 1 year
43Ω 4hr/D (hr) EPV=0.9V	Normal	86	84
	JIS/IEC(MAD)	60	54
3.9Ω 1hr/D (hr) EPV=0.9V	Normal	7.4	7.2
	JIS/IEC(MAD)	5.0	4.5
100mA 1hr/D (hr) EPV=0.9V	Normal	21.0	20.8
	JIS/IEC(MAD)	15	13.5
250mA 1hr/D (hr) EPV=0.9V	Normal	7.8	7.6
	JIS/IEC(MAD)	5.0	4.5
1000mA 10s/50s × 1hr/D (pulse) EPV=0.9V	Normal	415	406
	JIS/IEC(MAD)	220	195
(1500mW-2S/650mW-28S)x10/h (pulse) EPV=1.05V	Normal	78	72
	JIS/IEC(MAD)	40	36
24Ω 15s/45s × 8hr/D (hr)EPV=0.9V	Normal	40	39
	JIS/IEC(MAD)	33	29
3.3Ω 4m/56m × 8hr/D (m) EPV=0.9V	Normal	322	316
	JIS/IEC(MAD)	190	170

1) EPV : End point voltage

2) Test temperature : 20±2℃, Storage temperature : 20±2℃.

3) MAD=Minimum average duration

(2) Anti-leakage before use (60℃90%RH)

Period	n	10days	20days	30days	40days
Universal Power	40	none	none	none	none

(3) Safety test

	Test mode	Requirements	Result
Intended use	1. Partial use	No leakage, No fire, No explosion	Passed
	2. Transportation shock	No leakage, No fire, No explosion	Passed
	3. Transportation vibration	No leakage, No fire, No explosion	Passed
	4. Climatic	No fire, No explosion	Passed
Reasonably foreseeable misuse	5. Incorrect insertion	No explosion	Passed
	6. External short circuit	No fire, No explosion	Passed
	7. Over discharge	No fire, No explosion	Passed
	8. Free drop	No fire, No explosion	Passed

4-4. LR03

(1) Discharge test

Discharge condition		Initial	After 1 year
5.1Ω 4m/15m × 8hr/D (m) EPV=0.9V	Normal	232	225
	JIS/IEC(MAD)	130	115
24Ω 15s/45s × 8hr/D (hr) EPV=0.9V	Normal	20.4	19.8
	JIS/IEC(MAD)	14.5	13.0
5.1Ω 1hr/D (hr) EPV=0.8V	Normal	4.2	4.1
	JIS/IEC(MAD)	2.0	1.8
75Ω 4hr/D (hr) EPV=0.9V	Normal	74	71
	JIS/IEC(MAD)	44	39
600mA 10s on/50s off × 1hr/D (pulse) EPV=0.9V	Normal	370	358
	JIS/IEC(MAD)	170	150
100mA 1hr/D (hr) EPV=0.9V	Normal	9.9	9.7
	JIS/IEC(MAD)	7.0	6.3

1) EPV : End point voltage

2) Test temperature : 20±2℃, Storage temperature : 20±2℃.

3) MAD=Minimum average duration

(2) Anti-leakage before use (60℃90%RH)

Period	n	10days	20days	30days	40days
Universal Power	40	none	none	none	none

(3) Safety test

	Test mode	Requirements	Result
Intended use	1. Partial use	No leakage, No fire, No explosion	Passed
	2. Transportation shock	No leakage, No fire, No explosion	Passed
	3. Transportation vibration	No leakage, No fire, No explosion	Passed
	4. Climatic	No fire, No explosion	Passed
Reasonably foreseeable misuse	5. Incorrect insertion	No explosion	Passed
	6. External short circuit	No fire, No explosion	Passed
	7. Over discharge	No fire, No explosion	Passed
	8. Free drop	No fire, No explosion	Passed

4-5. LR1

(1) Discharge test

Discharge condition		Initial	After 1 year
5.1Ω 5min./day (min) EPV=0.9V	Normal	129	123
	JIS/IEC(MAD)	94	84
300Ω 12hr./day (hr) EPV=0.9V	Normal	197	192
	JIS/IEC(MAD)	130	115

1) EPV：End point voltage

2) Test temperature：20±2℃, Storage temperature：20±2℃.

3) MAD=Minimum average duration

(2) Anti-leakage before use (60℃90%RH)

Period	n	10days	20days	30days	40days
Universal Power	40	none	none	none	none

(3) Safety test

	Test mode	Requirements	Result
Intended use	1. Partial use	No leakage, No fire, No explosion	Passed
	2. Transportation shock	No leakage, No fire, No explosion	Passed
	3. Transportation vibration	No leakage, No fire, No explosion	Passed
	4. Climatic	No fire, No explosion	Passed
Reasonably foreseeable misuse	5. Incorrect insertion	No explosion	Passed
	6. External short circuit	No fire, No explosion	Passed
	7. Over discharge	No fire, No explosion	Passed
	8. Free drop	No fire, No explosion	Passed

4-6. 6LF22

(1) Discharge test

Discharge condition		Initial	After 1 year
270Ω 1hr./day (hr) EPV=5.4V	Normal	18	16
	JIS/IEC(MAD)	12	10
620Ω 2hr./day (hr) EPV=5.4V	Normal	50	45
	JIS/IEC(MAD)	33	29

1) EPV : End point voltage

2) Test temperature : 20±2℃, Storage temperature : 20±2℃.

3) MAD=Minimum average duration

(2) Anti-leakage before use (60℃90%RH)

Period	n	10days	20days	30days	40days
Universal Power	40	none	none	none	none

(3) Safety test

	Test mode	Requirements	Result
Intended use	1. Partial use	No leakage, No fire, No explosion	Passed
	2. Transportation shock	No leakage, No fire, No explosion	Passed
	3. Transportation vibration	No leakage, No fire, No explosion	Passed
	4. Climatic	No fire, No explosion	Passed
Reasonably foreseeable misuse	5. Incorrect insertion	No explosion	Passed
	6. External short circuit	No fire, No explosion	Passed
	7. Over discharge	No fire, No explosion	Passed
	8. Free drop	No fire, No explosion	Passed

Information for safety

In normal use, the alkaline manganese battery provides a safe and dependable source of power. If they are misused or abused, leakage, heating or explosion in extreme case may result. Taking care with following cautions are essential.

１． Hazard of Alkaline manganese battery

a) Take care not to touch the chemicals and electrolyte in batteries directly. Since alkaline solution is used in this battery system, there are risks of not only damage of cloth and sore due to adhesion of the solution, but of loss of eyesight if the solution gets into the eye.

★ In such an emergency case that the solution gets into the eye, wash it immediately with plenty of water and receive medical treatment of doctor.

★When the solution adheres to the skin and/or clothes, wash it with water and consult a doctor.

b) The battery equips the mechanism that release excessive internal pressure to preclude explosion. In case of charge, short-circuit and overdischarge of batteries, the internal pressure may rise abnormally and result in electrolyte leakage by venting. However, the vent mechanism may not normally work and result explosion depend on circumstances in extreme case.

c) The short-circuit makes battery heat and the surface temperature may rise above 100℃.

２． Precautions during handling of batteries

a) Always take care to insert batteries correctly according to designation of polarity (+ and -) on the battery and the equipment. Batteries which are incorrectly placed into equipment may be short-circuit, or charged. This can result in a rapid temperature rise and venting causing leakage and explosion.

b) Do not short-circuit batteries. When the positive (+) and negative (-) terminals of battery are directly contacted with each other, the battery becomes short-circuit. Such batteries that is mingled or mixed together can be short-circuited. If batteries are short-circuited, an excess current flows instantaneously, and excess current may cause risks of electrolyte leakage, explosion, etc. by damage of internal structure of battery due to heat generation.

c) Do not charge batteries. This battery is not available for charging, therefore, electrolyte leakage and/or damage may occur if charged. When gas is abnormally generated by charging inside of the cell, the internal pressure rises and the pressure may cause electrolyte leakage and/or damage of cell. If the charging current is excessively large, the cell could be at risk of explosion due to much gas generation. Especially, when unused cell is charged, the rate of occurrence of electrolyte leakage, damage, explosion, etc will increase.

ｄ）Do not overdischarge batteries. When battery is kept connecting with the electrical circuit (due to forgetting switch off or likely misuse) even after the equipment does not work normally, supplying of energy from battery is continued, the battery becomes excessive discharged condition, lot of gas is generated from inside and electrolyte leakage or explosion may be caused. When two or more batteries are connected in series and are overdischarged, the voltage may reach zero or minus volt (becoming polarity change) and such condition may promote the risk of electrolyte leakage and explosion.

ｅ） **Do not mix batteries.** When replacing of batteries, replace all of them at the same time with new batteries of the same brand and type. When batteries of different kinds are used together, or new and old batteries are used together, some batteries may be overdischarged due to a difference of voltage or capacity. This can result at risk of leakage and explosion.

ｆ） **Exhausted batteries should be immediately removed from the equipment and disposed of.** When discharged batteries are kept in the equipment for a long time, electrolyte leakage may occur causing damage to the appliance.

ｇ） **Do not heat batteries.** If batteries are heated, the resin part used in batteries melts and deforms due to the temperature rise, and electrolyte leakage and explosion may occur.

ｈ）**Do not directly solder batteries.** When a battery is directly soldered, it may be damaged by heat. This may result in leakage, explosion, etc.

ｉ） **Do not disassemble batteries.** Unreasonable disassembling of a battery may result in such risks as injury of the fingers, damage of eye and skin due to scattered chemicals inside the battery.

ｊ） **Do not deform batteries.** Batteries should not be dropped, crushed, punctured, or otherwise mutilated. Such abuse may result in leakage, heat generation or explosion.

ｋ）**Do not dispose of batteries in fire.** When batteries are disposed of in fire, the heat build-up may cause explosion.

l) Do not allow children to replace batteries without adult supervision.

ｍ） **Keep batteries out of the reach of children.** Keep batteries which are considered swallowable size out of the reach of children. In case of ingestion cell or battery, seek medical assistance promptly.

ｎ） **Do not modify batteries.** Modification of battery may cause blockage of the safety vent mechanism and may promote risk of explosion.

ｏ） **Store unused batteries in their original packaging and keep them away from metal substance which may short-circuit them**.

ｐ） **Remove discharged batteries from equipment.** Remove batteries which can not work enough from equipment, or when a long period of disuse is anticipated (e.g. video-cameras, photoflash, etc.). The battery partially or completely exhausted may be more risky of leakage than unused battery.

３． <u>Precautions during handling, transportation, display, storage, and disposal</u>

ａ） **Avoid rough handling of battery cartons.** Rough handling of battery cartons may result in battery damage and impaired electrical performance and may result in leakage, explosion or heat generation.

ｂ） **Battery cartons should not be piled up in several layers (or should not exceed a specified height).** If too many battery cartons are piled up, batteries of bottom cartons may be deformed and my allow leakage. As general guide, this height should not exceed 1.5 m for cardboard packs.

c）**Batteries shall be stored in well-ventilated, dry and cool conditions**. Storage at high temperature and high humidity allows deterioration of the battery performance and electrolyte leakage. For normal storage, the temperature should be between +10℃ and +25℃ and never exceed +30℃. Extremes of humidity (over 95% RH for example) for sustained periods should be avoid since they are detrimental to both batteries and packing. Batteries should not be stored at near radiators, boilers or in direct sunlight.

d）**When batteries are stored in warehouse or displayed in storefront, do not place batteries at a place exposed to direct sunshine for a long time or splashed by rain water.** Exposure to high temperature may increases deterioration of performances and risk of electrolyte leakage. If batteries get wet, their insulation resistance decreases, allowing risk of self-discharge and generating of rust.

e）**Do not mix unpacked batteries so as to avoid mechanical damage and/or short-circuit among each other**. When batteries are mixed together, physical damage or heat generation may be caused by external short circuit. And then, leakage and/or explosion may occur. To avoid these possible hazards, batteries should be kept in their packaging until use of batteries.

f）**In distribution process such as transportation, display and storage, carry out the first in and first out and take care to avoid storage for a long period.**

g）**Batteries shall be disposed of in accordance with local government rules.** For disposal of batteries, insulate terminals of battery by winding with tape for prevent from external short circuit due to the shape of terminals like 9V square type batteries.

４. Battery compartment guidelines

4.1 Technical Liaison

It is recommended that companies producing battery-powered equipment should maintain close liaison with the battery industry. The capabilities of existing batteries should be taken into account at design inception. Whenever possible, the battery type selected should be one included in **IEC 60086-2**. The equipment should be permanently marked with the IEC designation, grade and size of battery which will give optimum performance.

4.2 Battery Compartment

a) Battery compartments should be easily accessible. Design compartments so that batteries are easily inserted and do not fall out. The dimensions and design of compartments and contacts should be such that batteries complying with this standard will be accepted. In particular, the equipment designer should not ignore the tolerances given in this standard, even if a national standard or a battery manufacturer calls for smaller battery tolerances.

b) The design of the negative contact should make allowance for any recess of the battery terminal.

c) Equipment intended for use by children should have battery compartments which are tamper-proof.

d) Clearly indicate the type of battery to use, the correct polarity alignment and directions for insertion.

e) Use the shape and/or the dimensions of the positive (+) and negative (–) battery terminals in compartment designs to prevent the reverse connection of batteries. Positive (+) and negative (–) battery contacts should be visibly different in form to avoid confusion when inserting batteries.

f) Battery compartments should be electrically insulated from the electric circuit and positioned so as to minimize possible damage and/or risk of injury. Only the battery terminals should physically contact the electric circuit. Care should be taken in the choice of materials and the design of contacts to ensure that effective electrical contact is made and maintained under conditions of use even with batteries at the extremes of dimensions permitted by this standard. Battery and equipment terminals should be of compatible material and low electrical resistance.

g) Battery compartments with parallel connections are not recommended since a wrongly placed battery will result in charging conditions.

h) Although batteries are very much improved regarding their resistance to leakage, it can still occur occasionally. When the battery compartment cannot be completely isolated from the equipment, it should be positioned so as to minimize possible damage.

i) The battery compartment shall be clearly and permanently marked to show the correct orientation of the batteries. One of the most common causes of dissatisfaction is the reversed placement of one battery in a set, which may result in battery leakage and/or explosion and/or fire. To minimize this hazard, battery compartments should be designed so that a reversed battery will result in no electrical circuit.

j) The associated circuitry should not make physical contact with any part of the battery except at the surfaces intended for this purpose.

k) Designers are strongly advised to refer to **IEC 60086-4** and **IEC 60086-5** for comprehensive safety considerations.

4.3 Voltage cut-off

In order to prevent leakage resulting from a battery being driven into reverse, the equipment voltage cut-off shall not be below the battery manufacturers' recommendation.