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MOG
Vented Lead-Acid STANDBY POWER BATTERIES

OPERATING, INSTALLATION AND MAINTENANCE INSTRUCTIONS

MOG CELLS
MOG BLOCKS

MOG

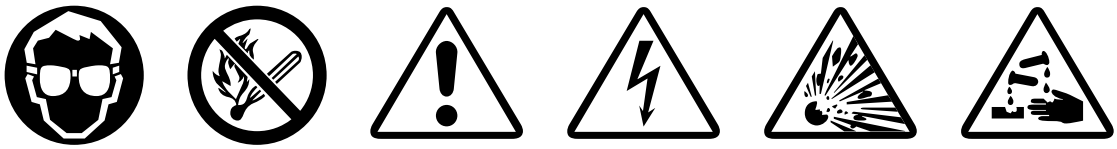
1. INTRODUCTION

Standby batteries are generally used as back-up power, to support all those users who need a reliable service continuity in case of black-out of the distribution network of electricity, hybrid and off-grid installations.
Lead-acid standby batteries are components of a system and they require the observance of suitable precautions and behavioral norms to guarantee safe working conditions and to ensure the best performance of the battery during its entire life. Scope of this document is to supply the necessary instructions for the correct cure, handling, installation, use and maintenance of MIDAC MOG low maintenance standby power batteries.

2. RECOMMENDATIONS

Carefully read this manual in all its parts upon receipt of MIDAC MOG low maintenance standby batteries.
The non-compliance with the instructions given herein may cause injury to people and damages to the equipment, as well as the bad operation of the battery.
Keep this manual in the battery room in a place easily accessible to the staff.

3. SAFETY RULES

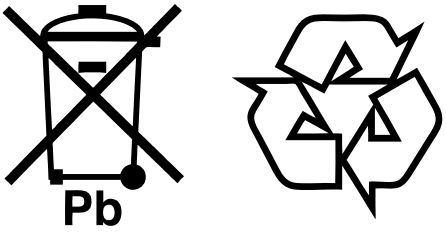


Observe the following precautions at all times. Batteries are no more dangerous than any other equipment when handled correctly.
Batteries may give off explosive gasses.

They are filled with diluted sulphuric acid (electrolyte), which is a corrosive substance. When handling and working with electrolyte always use protective equipment, such as protective clothing, rubber gloves and goggles. If acid is spilled on the skin, wash immediately with copious amounts of clean water, then cover with dry gauze. If acid comes into contact with the eyes, flush with clean water for at least 15 minutes. In all cases, obtain immediate medical attention.

Exposed metal parts of the battery always carry a voltage and are electrically live with the risk of short circuits.
Avoid any electrostatic charge; before starting your work on the battery, first discharge any possible electricity from yourself by touching an earth-connected part; repeat this action occasionally until the work is complete.

Always take the following precautions:
• Keep batteries upright.
• Use insulated tools.
• DO NOT place or drop metal objects on top of the battery.
• DO NOT wear rings or bracelets. Remove any articles of clothing with metal parts that might come in contact with the battery terminals.
• DO NOT smoke and DO NOT use open flames or create electric sparks.
• Take all precautions when using the main supply.
• Make sure that the first aid kits and fire extinguishers are easily accessible.
• Make sure that water and neutralizing products are easily accessible in case accidental contact with acid or spillage occurs.
Used batteries contain recyclable materials. They must not be disposed with the house waste but as a special waste. Methods of return and recycling must conform to the regulations in operation at the site where battery is located.



4. DELIVERY AND STORAGE

Unpack the batteries as soon as they are delivered.
Verify that the equipment has been delivered in good condition. Any damage must be reported immediately to the carrier and the damaged items retained for inspection by the carrier's representative.
For cells supplied in filled and charged conditions, check that the acid level in all the cells is at the "MAX" level. If necessary, fill them in with diluted sulphuric acid with the correct specific gravity (see characteristics described under section 5).
If the battery cannot be immediately installed, store it in a dry, cool and clean place.
Do not expose the battery to direct sunlight, to avoid any damage to containers and lids.

Important Note! Storage time for filled and charged cells is limited. It is essential that they are placed on charge at the latest within 90 days from the date of shipment. Failure to observe this condition may result in a greatly reduced capacity and service life or in permanent damage to the cells.

The charge shall be carried out according to the instructions given under section 8.
Charge should be carried out with the shipping cases open, or the cells completely unpacked, and with adequate ventilation to disperse the gases formed on charging.

If continuous charging is not possible, the battery should be given a freshening or equalize charge at least every 60 days and whenever distilled water is added.

If the battery is supplied in dry charged conditions, it can be stored for periods up to 3 years, provided that it is adequately protected against condensation and the effects of high humidity. For filling and commissioning of dry charged batteries, see instructions given under sections 8.1 and 8.2.

5. ELECTROLYTE

The following table gives specific gravity data at 25°C (77°F) for fully charged MOG low maintenance standby power batteries with the electrolyte at the maximum level:

Nominal Specific Gravity (kg/l)	Specific Gravity Range (kg/l)	Specific Gravity for Filling Dry Charged Cells (kg/l)
1,240	1,230 - 1,250	1,230

High quality electrolyte for standby lead-acid batteries (which is a solution of pure sulphuric acid diluted with distilled water to the correct specific gravity) is required for the first filling dry charged cells. If the electrolyte has been supplied by MIDAC, store it in a safe place until required.

If electrolyte is purchased locally, make sure that its characteristics are in accordance with the following table:

Impurity	Electrolyte for first filling (mg/l)	Electrolyte for refilling (mg/l)
Copper	0,5	0,5
Heavy metals (As, Bi, Sn, Sb)	2	6
Iron	30	100
Chlorine	5	200
Total azote	60	60
Organic substances	50	50
Other impurities	250	800

When electrolyte is sourced locally, we recommend an additional 10% spare is purchased to cover any loss or spillage during handling and filling.
For quantity of electrolyte needed, please refer to cell technical data given under section 13. Always check the specific gravity of the electrolyte before filling the cells. Minor adjustments may be made by adding water to lower the specific gravity or by adding acid to raise the specific gravity.

6. BATTERY ROOM

The battery room must be dry, clean and not subject to vibrations.
It must be properly sized to enable installation, inspection, topping up and maintenance. Also it must be duly ventilated, especially during charge, and provided with explosion proof electrical equipment. Its temperature should be as moderate as climate allows, preferably between 10°C (50°F) and 30°C (86°F). The battery will give its best performance when working in a temperature of 20°C (68°F) - 25°C (77°F), but will be functioning even operating in temperatures between -10°C (14°F) and 60°C (140°F). **High temperatures increase the performance but reduce battery life, while low temperatures reduce the performance.**
The entry doors of battery room must be provided with warning signs banning smoking, sparks and naked flames.
The batteries should be installed on suitable racks or shelves properly sized in loading capacity and dimensions. The layout must enable easy access to all cells.
Racks or shelves can be made of wood or metal with acid-proof coating. If metal racks are used, they must be equipped with rubber or plastic insulators to avoid any contact between the battery and the metal.
The rack location and ventilation system should be such that the maximum temperature differential between cells does not exceed 3°C (5°F).

PAY SPECIAL ATTENTION TO BATTERY ROOM STANDARDS, EFFECTIVE AT THE MOMENT OF THE INSTALLATION OF THE BATTERY.

7. INSTALLATION

Before installing the cells, clean and dry all parts. In particular: clean and dry lids and jars. Remove the protections from the terminal posts and clean them with a soft clean cloth. In presence of spilled acid, dip a rag into a non-caustic alkali solution (diluted ammonia or baking soda) and rub the posts body and the terminal inserts. If spilled acid is found into the post inserts, soak the part with this solution and then dry. Do not let the solution get into the cells.

If the terminal posts surface is slightly white, lightly abrade it with a fine grit abrasive paper and remove oxidation. Do not use a wire brush and be especially careful not to break through the lead plating. Wipe off any dust and protect the post body to the lid with a thin coating of no-oxide grease.

Place the cells on the rack and make sure that the spacing allows the accommodation of the supplied inter-cell connectors (around 10 mm). Most batteries have cells connected in a simple series arrangement, so the cells should be arranged to preserve the sequence: positive (+), negative (-), positive (+), negative (-) throughout the whole battery.
Cells supplied in dry charged conditions must be filled-in with electrolyte after installation on battery racks.

WARNING
NEVER LIFT CELLS BY THE TERMINAL POSTS. ALWAYS USE APPROPRIATED DEVICES (SUCH AS LIFTING STRAPS AND SUITABLE MECHANICAL LIFTING DEVICES) TO PREVENT INJURY TO PERSONNEL OR DAMAGE TO THE CELLS.

For batteries to be installed on multiple tiers, start by placing the cells on the lower tier on either side of the frame where the stand sections meet. Any unused stand space should be on the upper tier.

For batteries on stepped racks, leave any unused space on the back (top) step.

Where multiple racks are arranged end-to-end, adjust the position of the adjacent end cells to accommodate the flexible inter-rack connectors supplied. Take particular care to preserve the positive to negative sequence when using flexible inter-tier, inter-step or inter-rack connectors between rows of cells. Leave the main positive and negative terminals of the battery free for connection to the charging source.

Check cell alignment.

Check cell alignment. Prepare the inter-cell connectors by lightly abrading the contact surfaces with a fine grit abrasive paper. Do not use a wire brush and be especially careful not to break through the lead plating.

Apply a light coating of no-oxide grease to the contact-making areas of each connector. This is best done by carefully melting the grease and dipping connector ends (it is unnecessary to coat the central part of the connector).

Fit the inter-cell and inter-tier connectors using the bolts, nuts and washers supplied. Before assembly, lightly smear no-oxide grease on the surfaces of all hardware.
Use the insulated wrenches supplied to tighten the parts firmly together (see the table below for torque settings).

MOG block batteries 6V - 12V	10 to 12 Nm (90 to 106 in lbf)
MOG cells 2V	15 to 18 Nm (133 to 160 in lbf)

Pay special attention to avoid short-circuiting the cells with any of the battery hardware.
MOG block batteries:
AVOID OVER-TORQUE. WHEN CONNECTING A CABLE, HOLD IT IN POSITION WHILE TIGHTENING

Check tightness and cleanliness.

Make sure that all vent caps are closed.

Connect the positive terminal of the battery to the positive terminal of the charger and the battery negative to the charger negative.

Number the cells by using the set of numbering stickers supplied with the battery. It is common practice to number the cells beginning with #1 at the positive end of the battery and following the sequence of electrical connection of the cells, through to the negative end of the battery.

8. CHARGING

8.1 Filling of dry charged cells

Always use glass or plastic jugs and funnels to fill the cells. Never use metallic materials; electrolyte may corrode them or react by contact. Fill the cells to reach the "MAX" line level and wait to allow the acid soak into separators and plates. This operation should take approx. 3 hours; then, due to absorption, the electrolyte level will drop allowing topping up to the "MAX" level line.

The quantity of electrolyte required to fill each cell is given in section 14.

Always fill the cells with electrolyte after installation on battery racks.

NOTE
CELLS FILLED ON SITE MUST BE GIVEN AN INITIAL CHARGE AS SOON AS POSSIBLE. DO NOT STORE FILLED CELLS FOR MORE THAN 18 HOURS WITHOUT CHARGING THEM.

8.2 First charge of dry charged cells

An initial or freshening charge must be given to all batteries before being put into service. This is most important for cells supplied in dry charged conditions and filled on site.

Before starting the charge, check that electrolyte temperature does not exceed 35°C (95°F). If necessary let the battery rest until this temperature is reached.
Take individual cell readings of voltage, specific gravity and temperature before starting initial charge.
It is advisable to use a constant voltage charger, with constant adjustable voltage from 2.22 to 2.60 Vpc and with an available adjustable current from 0 to 0.20 C10 Amps.
If the charger does not allow any current adjustment, the max. current should not exceed 0.10 C8 Amps.
Charge the battery with a current rate of 0.10 C8 Amps for approx. 20 hours.
During this operation take voltage and specific gravity readings every 3 hours. Voltage readings must be taken on every cell; specific gravity readings can be taken on designate pilot cells (for example one out of five).

Monitor also electrolyte temperature (select 2 or 3 pilot cells).

Should the temperature exceed 45°C (113°F) then:
- decrease the charging current to a lower rate (50%)
or
- discontinue the charge and let the battery stand on open circuit until the temperature falls down to 35°C (95°F); after that, the charging process can be resumed. In this case, please consider the charging time to be extended proportionally.

At the end of this process, the Ah delivered to the battery must be 1.5 ÷ 1.6 times the C8 rated capacity.

Charging is to be deemed as completed when:
- the specific gravity readings in the cells have reached the nominal specific gravity of 1,240 kg/l ± 0.01 corrected at 25°C (77°F);
- the cell voltage is equal or greater than 2.60 Vpc;
- both above values (voltage per cell and specific gravity) remain constant for at least two or more hours under charge.

If the charger characteristics do not allow to reach 2.60 Vpc, the charging time shall be extended in order to deliver to the battery at least 1.5 ÷ 1.6 times the nominal Ah capacity. In any case a minimum constant voltage of 2.40 Vpc should be available for first charge process.

8.3 Filled and charged cells (Freshening Charge)

For batteries which have been supplied in a filled and charged condition, it is normal to lose charge while in transit or during storage. For this reason, a freshening charge should be given before putting the battery into service. This is normally accomplished using the "equalize" voltage setting on the charger (see section 8.4.2).
A lower charging voltage (down to a minimum of 2.33 Vpc) may be used, but this will extend the duration of the initial charge to as much as 100 hours.

The initial charge may be terminated when the specific gravity readings of all cells have remained constant for at least 2 hours.
At the end of this initial charge, set the battery voltage to the MIDAC recommended float voltage (see section 8.4.1).

8.4 Charging in service

Temperature compensation must be as follows:
±3.5 mV each °C out of the range 20°C / 25°C

- from 20°C to 25°C: no need of temperature compensation
- below 20°C (68°F): voltage +0.0035 V/°C
- above 25°C (77°F): voltage -0.0035 V/°C

Once put into service, MIDAC MOG low maintenance Standby Power batteries should be charged as follows:

8.4.1 Float charge at constant voltage

To maintain the battery in fully charged condition during normal battery operation or, after a discharge, to recover 90% of nominal capacity within 20 hours, a recommended float charge has to be applied.
Recommended float voltage settings are as follows:

Constant voltage 2.22 ÷ 2.23 Vpc with electrolyte SG 1.240 ± 0.01 kg/l at 25°C (77°F)
(Current limitation 0.10 C10 Amps)

With the method described above, the effective charging current is limited to very low values; such current increases as a function of temperature and age of the battery. Gassing and water consumption are also minimized.
To verify the charge efficiency of the battery, the constant control of the electrolyte specific gravity and temperature is essential.
Decreasing of specific gravity is symptom of insufficient charge.
Increasing of specific gravity and decreasing of electrolyte level are indication of excessive charge.
For comparison of electrolyte specific gravity vs. temperature, please refer to section 10.

8.4.2 Equalizing charge

Chargers have usually two adjustable charging voltages: one for the "floating" charge and one for the "equalizing" charge (also known as "boost", "high rate" or "recharge").

The equalizing charge is generally required:
- when the total voltage spread between the cells is greater than 0.04 V under float charging conditions;
- for fast recharging after a discharge;
- after addition of distilled water to assist in mixing the acid and water;
- for float charge using voltages below 2.22 Vpc (see table below)

Float Vpc	Equalizing Required at these Intervals
2.22 - 2.23	Never
2.20	Every 6 Months
2.17	Every 3 Months
2.15	Every Months

Equalizing may be carried out at voltage settings above 2.30 Vpc.

Recommended equalize voltage settings are as follows:

Constant voltage 2.33 ÷ 2.35 Vpc with electrolyte SG 1.240 ± 0.01 kg/l at 25°C (77°F)
(Current limitation 0.15 C10 Amps)

The length of equalize charging required will depend on the depth of discharge, electrolyte temperature and normal float voltage level. The best guideline is to continue equalizing until the specific gravity of the acid in the designate pilot cells has been constant for at least 2 hours.

9. SPECIFIC GRAVITY READINGS

Before taking readings of specific gravity value, ensure that the electrolyte level inside the cells is at the "MAX" level line and that any recent topping-up of distilled water has properly mixed-in, by an equalizing charge (see section 8.4.2).

The specific gravity of the electrolyte varies with temperature; consequently, hydrometer readings should be corrected as follows:

For every 1.5°C (3°F) above 25°C (77°F), add 1 point (0.001 specific gravity) to the hydrometer reading.

For every 1.5°C (3°F) below 25°C (77°F), subtract 1 point (0.001 specific gravity) from the hydrometer reading.

The specific gravity of the electrolyte in new cells should be as per section 5.
During the course of years there may be a slight fall in the maximum specific gravity values obtainable at the end of charge.
The specific gravity may range ± 0.01 points within a cell at the nominal temperature of 25°C (77°F).

NEVER TRY TO INCREASE SPECIFIC GRAVITY READINGS BY ADDING ELECTROLYTE

10. BATTERY MAINTENANCE

Proper maintenance will prolong the life of the battery and will aid in ensuring that it is capable of satisfying its design requirements. A good battery maintenance program will serve as a valuable aid in maximizing battery life, preventing avoidable failures, and reducing premature replacement. Personnel knowledgeable of batteries and the safety precautions involved shall perform battery maintenance.

Every month

Inspection of the battery on a regularly scheduled basis (at least once per month) must include the following activities and have to be made under normal float condition:

1 Check the general appearance and cleanliness of the battery, the battery rack and the battery area
2 Check the evidence of cracks in cells or electrolyte leakage
3 Check any evidence of corrosion at terminals, connectors or racks
4 Check the total battery floating voltage
5 Check the voltages, temperature and specific gravity of the designate pilot cells
6 Check the electrolyte level of a significant number of cells
7 Clean and dry the cell lids and connectors
8 Inspect the charging system, ambient temperature and ventilation

Every year

Inspection of the battery on a regularly scheduled basis (at least once per year) must include the following activities and have to be made under normal float condition:

1 Check the voltages of all the cells
2 Check the electrolyte level of all the cells
3 Check the electrolyte temperature of the designate pilot cells
4 Check the electrolyte specific gravity of all the cells
5 Check the total battery floating voltage
6 Check the inter-cell and terminal connections resistance
7 Tighten all connectors (see section 7 for torque settings)
8 Check cells appearance
9 Check the charging current
10 Inspect the charging system
11 Check the structural integrity of the battery racks

IMPORTANT NOTE

CARRY OUT AN "EQUALIZING CHARGE", whenever the following deviations between cells are detected:
- 0.02 kg/l or more in electrolyte specific gravity.
- 0.04 V or more in cell voltage.

Topping-up

The water consumption of MIDAC MOG low maintenance Standby Power batteries in float charge at 25°C (77°F) is minimized.
The water consumption increases with higher temperature, overcharge or other stressing conditions.
Never allow the electrolyte level to fall below the "MIN" level line.
Whenever it's necessary, top up the cells with pure distilled or demineralised water.

NEVER ADD ELECTROLYTE

Pilot Cell
For regular monitoring of the battery condition, select one cell near the middle of the battery string as a "pilot" cell (for batteries consisting of more than 60 cells, it is advisable to select one pilot cell out of 60).
The electrolyte specific gravity of the pilot cells will be indicative of the state of charge of the whole battery.

11. MAINTENANCE REPORT

It is advisable to keep a record of the battery maintenance operations, which will be helpful to monitor long-term changes of the battery condition.

Keep a log book where the measured values as well as power cuts, discharge tests, equalizing charges, topping-up dates etc. can be noted.

It is also advisable to give the battery a full discharge test at 5-year intervals until signs of degradation are observed or until the battery has reached 85 per cent of its original capacity. Once this stage has been reached, yearly capacity tests should be performed until the battery has reached the end of its useful life.

12. ADDITIONAL INFORMATION

For any further information on MIDAC MOG Low Maintenance Standby Power batteries,
please contact:

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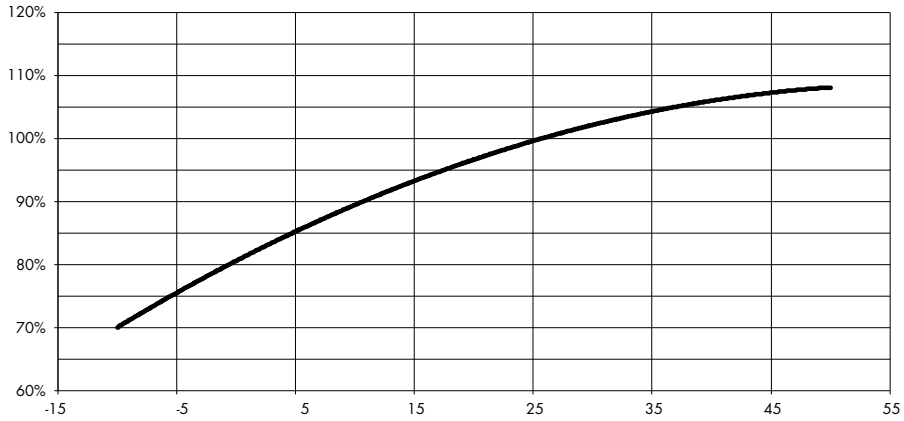
MOG

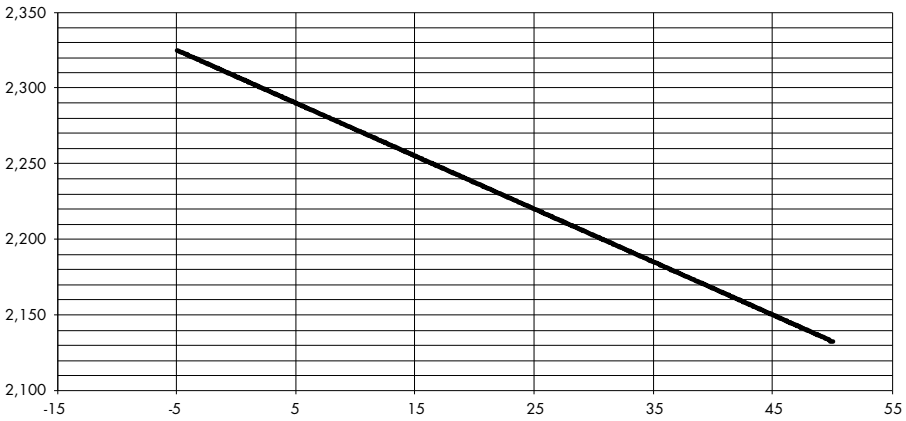
13. TECHNICAL DATA

Type	Nominal Voltage	Actual Capacity	Ri	Isc	Dimensions (mm)			Weight		Electrolyte		No. of Terminals
	V	Ah/8Hrs	mOhm	kA	Length	Width	Overall Height	Wet Kg	Dry Kg	Weight Kg	Volume Litres	
MOG Block 12V 1/50	12	**52**	14,75	0,83	**272**	**205**	**385**	**41,3**	**31,8**	9	7,6	**2**
MOG Block 12V 2/100	12	**103**	11,56	1,05	**380**	**205**	**385**	**61,6**	**45,7**	16	12,8	**2**
MOG Block 6V 3/150	6	**154**	3,16	1,92	**272**	**205**	**385**	**43,4**	**31,4**	12	9,7	**2**
MOG Block 6V 4/200	6	**206**	2,37	2,56	**380**	**205**	**385**	**58,0**	**40,5**	18	14,1	**2**
MOG Block 6V 5/250	6	**254**	1,90	3,20	**380**	**205**	**385**	**62,5**	**46,7**	16	12,8	**2**
MOG Block 6V 6/300	6	**285**	1,59	3,84	**380**	**205**	**385**	**68,5**	**53,5**	15	12,1	**2**
2 MOG 100	2	**115**	1,26	1,60	**103**	**206**	**410**	**14,6**	**9,7**	5	4,0	**2**
3 MOG 150	2	**154**	0,86	2,30	**103**	**206**	**410**	**16,6**	**11,9**	5	3,8	**2**
4 MOG 200	2	**206**	0,66	3,00	**124**	**206**	**410**	**20,4**	**14,5**	6	4,7	**2**
5 MOG 250	2	**254**	0,54	3,70	**124**	**206**	**410**	**22,1**	**16,7**	5	4,3	**2**
6 MOG 300	2	**305**	0,46	4,40	**145**	**206**	**410**	**26,0**	**19,4**	7	5,3	**2**
7 MOG 350	2	**359**	0,40	5,10	**187**	**206**	**410**	**31,8**	**22,3**	9	7,7	**2**
8 MOG 400	2	**410**	0,35	5,80	**187**	**206**	**410**	**33,2**	**24,5**	9	7,0	**2**
9 MOG 450	2	**448**	0,32	6,50	**187**	**206**	**410**	**35,0**	**26,8**	8	6,6	**2**
5 MOG 55	2	**297**	0,58	3,56	**100,5**	**197,5**	**405**	**19,2**	**14,9**	4,3	3,4	**2**
5 MOG 500	2	**515**	0,53	3,80	**145**	**206**	**726**	**45,5**	**32,0**	13	10,9	**2**
6 MOG 600	2	**602**	0,43	4,75	**145**	**206**	**726**	**49,4**	**36,3**	13	10,6	**2**
7 MOG 700	2	**702**	0,36	5,69	**191**	**210**	**726**	**62,3**	**45,7**	17	13,4	**4**
8 MOG 800	2	**800**	0,31	6,62	**191**	**210**	**726**	**66,1**	**50,0**	16	13,0	**4**
9 MOG 900	2	**896**	0,27	7,56	**233**	**210**	**726**	**76,7**	**55,9**	21	16,8	**4**
10 MOG 1000	2	**1000**	0,24	8,50	**233**	**210**	**726**	**80,8**	**60,2**	21	16,6	**4**
11 MOG 1100	2	**1096**	0,21	9,43	**275**	**210**	**726**	**91,5**	**66,1**	25	20,5	**4**
12 MOG 1200	2	**1200**	0,19	10,37	**275**	**210**	**726**	**95,4**	**70,4**	25	20,2	**4**
13 MOG 1300	2	**1272**	0,18	11,30	**275**	**210**	**726**	**99,2**	**74,7**	25	19,8	**4**
14 MOG 1400	2	**1376**	0,16	12,24	**275**	**210**	**726**	**103,2**	**79,0**	24	19,6	**4**
15 MOG 1500	2	**1504**	0,15	13,18	**368**	**218**	**702**	**120,0**	**88,0**	32	25,8	**6**
16 MOG 1600	2	**1600**	0,14	14,11	**368**	**218**	**702**	**123,9**	**92,3**	32	25,5	**6**
17 MOG 1700	2	**1664**	0,13	15,05	**368**	**218**	**702**	**127,8**	**96,6**	31	25,2	**6**
18 MOG 1800	2	**1800**	0,12	15,98	**449**	**218**	**702**	**144,9**	**103,9**	41	33,1	**6**
19 MOG 1900	2	**1904**	0,11	16,92	**449**	**218**	**702**	**148,6**	**108,2**	40	32,5	**6**
20 MOG 2000	2	**2000**	0,11	17,86	**449**	**218**	**702**	**152,5**	**112,5**	40	32,2	**6**

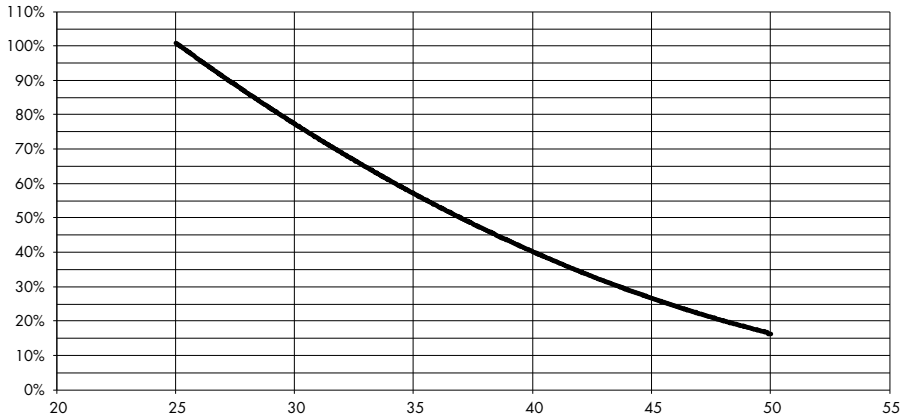
PERFORMANCE Capacity vs Temperature (°C)



TEMPERATURE COMPENSATION Float Voltage vs Temperature (°C)



THERMAL DEGRADATION Lifetime vs Temperature (°C)



LIFECYCLES No. of Cycles vs D.o.D. (% C8)