	Follow instructions Pay attention to the operation instruction and fix them close to the battery.		**Chemical hazard** Risk of chemical burns by the electrolyte Sulphuric acid can cause blindness or severe burns. Flush eyes and affected body parts with water. Get medical help fast.
	Use protective clothes Use protective glasses and clothes when working on batteries. Pay attention to the accident prevention rules as well as EN 50272-3 and EN 50110-1.		**Ignition hazard** Risk of explosion or fire No smoking, open flames, sparks and electrostatic discharges near the battery. Do not use dry rags or feather dusters for cleaning.
	Specialty equipment Work on batteries to be carried out by skilled personnel only!		**Case crazing hazard** Risk of battery case damage by chemicals Do not use chemicals, sprays or similar to clean the battery. Use water damp cloth only.
	Electrical hazard Dangerous electrical voltage!		**Warning** Acid splashes in the eyes or on the skin must be washed with water. In case of accident consult a doctor immediately! Clothing contaminated by acid should be washed in water.
	Risk of fire, explosion, or burns Do not disassemble, heat above 60ºC, or incinerate. Avoid any short circuit. Metallic parts under voltage on the battery, do not place tools or items on top of the battery	Pb	**Environmental hazard** Risk of lead contamination. Dispose spent batteries properly with the help of your supplier. Do not throw them into garbage.
Ignoring the operation instructions, repair with non-original parts or using additives for the electrolyte will render the warranty void.			

Rating Date.

Nominal capacity	C_{10}
Nominal voltage	2.0V x no of cells/blocks
Nominal discharge current	C_{10}/10h
Nominal specific gravity (will be reached after 10 cycles)	1.24 kg/dm^3 ±0.01
Rated temperature	+20°C
Nominal electrolyte level	Up to mark "max"

1. Delivery and storage.

BATER supply battery filled and charged. Check that the electrolyte level in all cells is at the "MAX" line. Upon receiving a shipment of battery, it is advisable to open the shipping containers and carefully check the battery and hardware against the packing list. The contents of each consignment are carefully inspected by BATER before shipment. Any damage must be reported immediately to the carrier and the damaged items retained for inspection by the carrier's representative.
Store the battery in a dry, clean and preferably cool and frost-free location. Do not expose the cells to direct sunlight as damage to the container and cover may occur.
If the battery cannot be immediately installed, the cells should be stored in a clean, cool, dry room.
Cells supplied **filled and charged** should be placed on float charge until required. This charging should be carried out with the shipping cases open, or the cells unpacked, and with adequate ventilation to disperse the gases formed on charging.
If continuous charging is not possible, the battery should be given a refreshing or equalize at least every

- 3 months at 20°C
- 2 months at 30°C
- 1 month at 40°C

The refreshing charge shall be carried out according to clause 4.3. paragraph below.
Never store a battery discharged but ensure it is perfectly charged before storage.

2. Installation.

2.1. Battery room requirements

The battery room should be dry, well ventilated and have its temperature as moderate as the climate will allow, preferably between +15°C and +25°C.
The battery will give the best results and battery life when working in a room temperature of 20°C, but will function satisfactorily when operating in temperatures between about +5°C and +55°C. High temperatures increase the performance, but decrease the life of the cells; low temperatures reduce the performance.
Do not allow direct sunlight to fall on any part of the battery.
Adequate ventilation to change the air in the battery room **is essential** to prevent an accumulation of the gases given off during charge (**acc. to EN IEC 62485-2).**
DO NOT permit smoking or the use of open flames in the battery room.
If a rack is not supplied by BATER, suitable racks should be provided to support the cells. These should be arranged to provide easy access to each cell for inspection, topping up and general maintenance.
Suitable racks may be made of wood or metal with a coating of acid resistant paint. If metal racks are used, they must be fitted with rubber or plastic insulators to prevent the cells coming into contact with the metal.

2.2. Assembling.

Place the cells or blocs on the rack and arrange the positive and the negative terminals for connection according to the wiring diagram. Battery cells are installed in series forming a string. String may be connected in parallel to give higher current capability. In the case of parallel connected strings use batteries of the same capacity, design and age only with a maximum of 4 parallel strings. The resistance of the cables in each string must be the same, e.g. same

cross-section and same length. Connect the battery strings in parallel at the end terminals.
Check that all contact surfaces are clean. If required, clean with a brass brush. Tighten the terminal screws, taking care to use torque loadings:
OGi Optima:..... **24 Nm**
OPGi Block and Perfect: .....**20 Nm**.
To avoid damage to the plastic materials, do not use grease. Fit the covers supplied for protection against inadvertent contact. Make sure that all caps are closed.
Carefully follow the polarity sequence to avoid short circuiting cell groups.
Finally, with the charger switched off, the battery fuses removed and the load disconnected, connect the battery to the D.C. power supply.
Connect the positive terminal of the battery to the positive terminal of the charger and the battery negative to the charger negative. Switch on the charger and charge according to the commissioning charge paragraph below.
The first charge must be monitored to ensure that the limits are not exceeded and that no unacceptable temperatures occur.
The electrolyte level on delivery can vary.
The final electrolyte level will be achieved after the commissioning charge. Small quantities can be topped up with demineralized water.

3. Commissioning.

When commissioning a new battery supplied filled and charged (first charge) follow procedure initial boost charging in according to:

3.1. IU method.

Charging parameters

- charging voltage: 2.33 ÷ 2.40V/cell,
- charging time: 12 ÷ 36 hours depending on the initial charge,
- current must be limited to 4 x I_{10}.

3.2. I method.

Charging parameters

- constant current: 2.5 ÷ 5 A/100 Ah
- final charging voltage: 2.50 ÷ 2.75 V/cell,

Temperature	25°C	35°C	45°C
Charging current	End of charge voltages [V/cell]		
0.50 x I_{10}	2.65	2.60	2.55
0.25 x I_{10}	2.60	2.55	2.50

- charging time: 6 ÷ 24 hours

The charging must be monitored.
If the maximum temperature of +45°C is exceeded, charging must be terminated, continued at a reduced current.
Boost charging must be immediately switched off or switched to float charging when the fully charged state is reached.

4. Operation

EN IEC 62485-2 is the standard which applies to the operation OGi batteries.

4.1. Discharging.

The battery must not be discharged more than the capacity specified in the performance data tables. Deeper discharges may damage the battery and shorten its operational life. As a general rule the end of discharge voltage shall be limited to the values listed below:

Discharge time	Final voltage [V/cell]
5 min < t < 59 min	1.60
1h < t ≤ 5h	1.70
5h < t ≤ 8h	1.75
8h < t ≤ 24h	1.80
24h < t ≤ 100h	1.85

Individual cell voltages may fall below the end of discharge voltage by not more than 0.2 V/cell.
OPzS batteries must not be left in a discharged condition. Charging immediately after discharge including partial discharge. Failure to observe these conditions may result in greatly reduced service life and unreliability.
Following accidental deep discharge, the battery must be recharged by an equalizing charge. As the internal resistance is high at first, the initial charge current is low.
Important notice:
Each deep discharge could affect the life expectancy of the battery.

4.2. Charging during operation.

Only procedures in accordance with

- DIN 41773 (IU characteristic) – **only one permissible in case of use recombination plug**
- DIN 41774 (W characteristic)
- DIN 41776 (I characteristic)

are permitted.

Charging depending on the operating modes:

a) Stand-by parallel operation

Load, rectifier and battery are continuously connected in parallel. Charging voltage is the operating voltage of the battery and load. The battery only supplies current when main source fail.

Rectifiers current = maximum load current + battery charging current.

Recommended charging IU -characteristic:

Float charge

The recommended float charge voltage is

$U_{flo/cell}$ = *2.23 V/cell at 20°C*
$U_{flo} = U_{flo/cell}$ *x no. of cells (tolerance ± 1 %).*

If the average battery temperature exceeds the recommended operating temperature range of +10°C to +30°C, the float charge voltage shall be reduced by:

t≥+30°C
$(t_{cell} - 30) \times 0.003$ *V/cell*
but not less than 2.18 V/cell

t≤+10°C
$(10 - t_{cell}) \times 0.003$ *V/cell*
Deviations of individual cell voltages of
–0.05 ÷ +0.10 V/cell
may be observed. However the total voltage of the battery shall be within the limits stated above.

Boost Charge

To reduce the recharge time the battery may be recharged at

2.33 ÷ 2.40 V/cell current limited to 4 x I_{10}

Boost charging must be switched to float charging when the fully charged state is reached.

b) Floating operation

Rectifiers is not able to supply the maximum load current at all times. The load current sometimes exceeds rectifiers nominal current. During this period the battery supply load. Battery is not fully charged at all times. Therefore depending on the load, charge voltage is:

$U_{flo/cell}$ = *2.25 ÷ 2.30 V/cell at 20°C*
$U_{flo} = U_{flo/cell}$ *x no. of cells (tolerance ± 1%).*

c) Switch mode operation

During charging the battery is separated from the load.

End of charge voltage of the battery is
2.60 ÷ 2.70 V/cell

Charging process must be monitored. Charging must be immediately switched off or switched to float charging when the fully charged state is reached.

d) Battery (charge/discharge) operation

The load is supplied only by the battery.

End of charge voltage of the battery is
2.60 ÷ 2.70 V/cell

Charging process must be monitored. Charging must be immediately switched off or switched to float charging when the fully charged state is reached. The battery may be connected to the load if required.

4.3. Equalizing charging.

After a deep discharge or after inadequate recharging, an equalizing charge is necessary. This can be carried out as follows:

a) IU method boost

- *2.33 – 2.40 V/cell*
- *maximum charging time 72 hours.*

b) I or W method

Charge method according to the paragraph 3.2.
If the maximum temperature of 45°C is exceeded, charging must be terminated or continued at a reduced current or temporarily switched to float charging.
The end of equalizing charge is reached when the specific gravity of the electrolyte and the cell voltages have not risen for a period of 2 hours.

Because the permissible system voltage level may be exceeded when charging at increased voltages, suitable measures should be taken to protect the load circuits, e.g. charging «off line».

4.4. Charging current

Limitation of the charging current is not required under float charge condition.

At higher charge voltages up to 2.40 V/cell the charge current shall be limited to 4 x I_{10}.

After reaching the gassing voltage of 2.40 V/cell a current limit of 2.5 ÷ 5 A/100Ah is recommended.

Limits of charging current

Method	I_{Max}/100Ah	Cell Voltage	Temp. limits
	[A]	V/cell	[°C]
IU	5 ÷ 40	2.33 ÷ 2.40	0 ÷ 45
I (above 2.40 V/cell	2.5 ÷ 5.0	2.50 ÷ 2.70	
W	7.0	up to 2.40	
	3.5	up to 2.65	

4.5. Ripple current

In the standby operation mode the effective value of the A.C. ripple current must not exceed 5 A per 100 Ah C10, otherwise reduced operational life must be expected.
Up to 2.4 V/cell 10A per 100Ah nominal capacity may not be exceed

4.6. Recharge

After a discharge the battery can be recharged at the operating voltage (float charge voltage).
To reduce the charging time the recharging can be carried out with the boost charge voltage of 2.33 to 2.40 V/call. The recharging times depend on the charging procedure and on the charging current available.Generally 10 to 20 hours duration can be expected at charging currents between 5A ÷ 40A per 100 Ah nominal capacity.

4.7. Temperature

Operating temperature

- recomended:
  +15°C ÷ +25°C,
- maximum long term operating temperature:
  +30°C (with ventilation assured - reduced service life),
- maximum short term operating temperature (for hours):
  +50°C (with ventilation assured - reduced service life),,
- minimum long term operating temperature:
  +5°C (operating in lower temperature is not preferred according to possibility battery freezing in discharge case)

All technical data relates to the rated temperature of +20°C.
Higher temperatures reduce the operational life.
Lower temperatures reduce the available capacity.
Do not expose cells to direct sunlight.

Effect of temperature on capacity

If the battery operating temperature is different from 20°C, a correcting factor is to be applied to capacity value taking into account discharge time.

Temperature correcting factors

Disch. time	Temperature [°C]								
	0	5	10	15	20	25	30	35	40
5 ÷ 59 min.	0.60	0.71	0.81	0.91	1	1.05	1.08	1.10	1.12
1 ÷ 24 hour	0.80	0.86	0.91	0.96	1	1.03	1.05	1.07	1.08

4.7. Electrolyte

The electrolyte is diluted sulphuric acid. The nominal specific gravity of the electrolyte at 20°C is:

- maximum level 1.24 kg/dm^3
- medium level 1.25 kg/dm^3
- minimum level 1.26 kg/dm^3

Correction of specific gravity according to temperature

Electrolyte specific gravity varies with temperature. If temperature is above or below +20°C, specific gravity readings must be corrected.
The temperature correction factor for specific gravity is *–0.0007* kg/dm^3 *per °C*

5. Testing

Capacity tests are to be carried out in accordance with EN 60896-11. Check that the battery is fully charged. Before testing new batteries it must be ensured that a sufficient commissioning charge has been applied, the specific gravity is relating to the nominal value (±0.01kg/dm^3) and the battery is fully charged. Lower specific gravity results in lower capacity.

6. Maintenance

a) Water topping

Top up the electrolyte level to the nominal level, but without exceeding the « Max » mark. Only demineralized or distilled water (purity grade: max. conductivity 10µS/cm) shall be used.
After topping-up an equalizing charge can be applied to reduce the time for homogenisation of the electrolyte density.

b) Cleaning

Keep containers and lids dry and free from dust. Cleaning must be undertaken with a damp cotton cloth without man-made fibres.
WARNING - Do NOT use any type of oil, solvent, detergent, petroleum-based solvent or ammonia solution to clean the battery containers or lids. These materials will cause permanent damage to the battery container and lid and will invalidate the warranty.
If the battery, cell, lid or container is damp with or shows signs of spilled electrolyte, wipe with a cloth dampened with a solution of sodium bicarbonate and cold water, mixed in the proportions of 0.1 kg/1dm^3 of water.
Follow this by wiping with a cloth dampened in clear water. Avoid static discharges generated during cleaning.

c) Plugs

- Leak-resistant with flame arrestor plugs with a ceramic funnel must not be cleaned with water or positioned upside down Should the ceramic funnel be moistened with electrolyte, the plug must be replaced during regular maintenance.
- Standard plugs can be cleaned with purified water if necessary. Dry them thoroughly before fitting them back onto the battery.
- Recombination plugs does not required clean but can be cleaned with purified water if necessary.

WARNING!
Unscrewing and removing plugs during charging and less than 12h after charging are forbidden.

d) Inspection

The following must be measured and recorded:

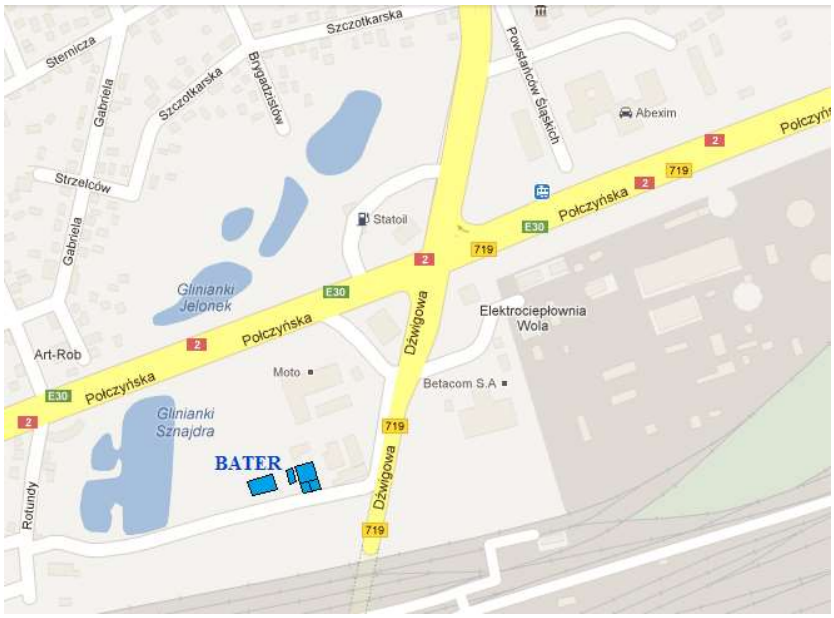
At least every 6 months:

- battery voltage,
- voltage of few reference cells,
- electrolyte density of few reference cells,
- electrolyte temperature of few reference cells.

At least every 1 year:

- voltage of all cells,
- electrolyte density of all cells,
- electrolyte temperature of all cells,
- visual check that unsecured bolt connectors are firmly seated
- check ventilation of the battery room
- if the battery has not been discharged within 12 months from the last test it is recommended to perform discharge tests.

Keep a logbook in which the measured values can be noted as well as power cuts, discharge tests, equalizing charges, topping up dates, storage times and conditions, etc.



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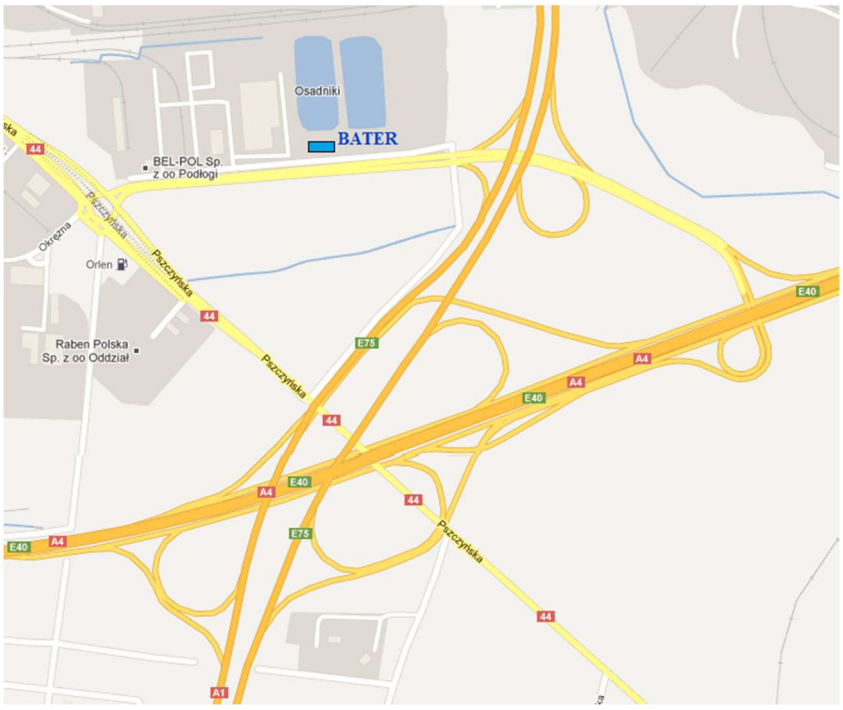

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