



RESERVE POWER · TUBULAR GEL VRLA

OPzV Battery Technical Guide

Tubular-plate gel cells for solar, telecom and unattended sites:
how they work, how to specify them, and how to keep them
alive.

MADE IN BENGALURU

Gel VRLA cells
built to order in
Bengaluru

EVIDENCE

CPRI type-tested
2 V 1200 Ah OPzV

DELIVERY

Built to order — 60
days

HERITAGE

Founded 1969,
exporting since
1977



2 V · tubular gel · VRLA

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India

Read this first

The three answers a specifier needs

1. What it is. An OPzV cell is a 2 V stationary lead-acid cell with tubular positive plates, its sulphuric acid held in a silica gel, and a pressure-relief valve in place of an open vent. It takes no water for its whole life. The plate inside is the same long-life tubular plate we build into our flooded OPzS; only the electrolyte system and the lid are different.

2. Where it fits. Sites nobody visits: solar and hybrid plants that cycle every day, telecom towers, oil-and-gas outstations, unmanned substations and signalling huts — anywhere a watering round cannot be guaranteed, acid handling is not allowed, or the cell must lie on its side. Where a trained maintainer will keep a flooded battery watered and equalised, OPzS remains the better buy; page 3 gives the honest comparison.

3. How fast. Cells and assembled banks are built to order in Bengaluru. Delivery is 60 days from order confirmation (as of October 2026). The datasheet, the drawing, the installation manual and the list of available test evidence travel with the quotation.

Specification snapshot

Item	Value
Nominal voltage	2 V per cell
Range (catalogue)	DIN-designation types 4 OPzV 200 to 24 OPzV 3000 — 14 types, C10 238 Ah to 3337 Ah — page 5; further types on request (data under revalidation)
Also built	T-Gel cells and assembled 48 V banks for solar and telecom duty — datasheets on request
Rating basis	25 °C, discharge to 1.80 V per cell
Design float life (catalogue)	15 years or more — a design value rated at 27 °C, not a warranty (page 9)
Operating temperature (catalogue)	-20 °C to +45 °C permissible; 10 °C to 35 °C recommended
Maintenance	No topping-up; voltage, ohmic and temperature trending (page 9)
Standards to specify	IEC 60896-21 and -22 (type tests), IEC 61427-1 (PV duty), IEC 62485-2 (installation safety), IEEE 485 (sizing), IEEE 1188 (maintenance) — page 7
Delivery	60 days from order confirmation
Warranty	12 months from the date of invoice as standard for supplies within India; export and project warranty terms are stated in the offer

Which cell for which duty

Duty	Our recommendation
Solar or hybrid plant, daily cycling, remote	OPzV cells, sized on autonomy and depth of discharge (page 7)
Telecom tower, visits quarterly or rarer	OPzV cells or assembled 48 V banks
Substation or plant with a battery maintainer	OPzS flooded tubular (microtex.com/opzs-battery/)
UPS room, short high-rate duty	2 V AGM range (microtex.com/2v-agm-vrla-battery/)
Hot room that cannot be shaded or ventilated	Talk to us before choosing gel — the room is the problem to solve first

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OPzV or OPzS: choosing honestly

THE NAME

The letters come from the German DIN designation system: O for stationary, Pz for the armoured tubular plate, V for a closed cell — in practice a valve-regulated one. A "4 OPzV 200" is a cell with four positive tubular plates and a nominal 200 Ah. The size series is standardised in DIN 40742 (current edition DIN 40742:2015-09, which replaced the 1999 edition), and its designations are the common language of tenders worldwide; our cells are built to those container families.

CHOOSE OPZV WHEN

- nobody will be on site to top up water or check specific gravity;
- the site is visited rarely — quarterly at best;
- acid handling or acid fumes are not acceptable in the room;
- cells must be shipped and installed as non-spillable units, or lie on their side (horizontal operation is possible — catalogue; the rack layout is agreed at quotation);
- the duty is daily cycling from solar or hybrid generation, or long autonomy for telecom and instrumentation;
- the room is unmanned but can be kept shaded and ventilated.

CHOOSE OPZS WHEN

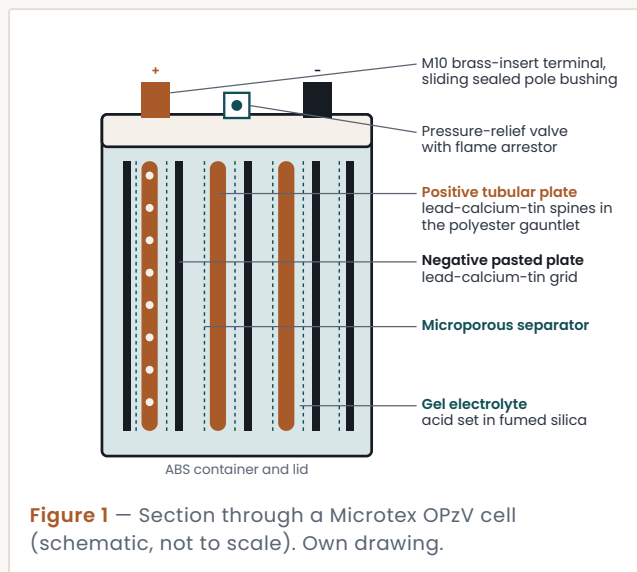
- a trained maintainer will water, equalise and read specific gravity on schedule;
- the longest verifiable life is the goal and the battery must be inspected, not inferred;
- the room runs hot and cannot be cooled — a flooded cell carries its own heat buffer and its water can be replaced;
- the duty demands heavy, short discharges, where flooded tubular and AGM designs deliver current faster.

THE HONEST LIMITS OF GEL — WHAT THE BOOKS SAY

- **Heat.** Every lead-acid cell ages faster when hot; Berndt's rule of thumb is that reaction rates roughly double for every 10 K rise in temperature. The gel cell is more exposed than the flooded one. Its overcharge current is converted into heat inside the cell by the oxygen cycle (Berndt), it has less water to absorb that heat (Berndt gives VRLA cells a lower specific heat than vented ones), and a warm cell draws more float current, which makes more heat — the loop Berndt, Pavlov and the US Bureau of Reclamation all call thermal runaway. Pavlov puts the ceiling for normal operation of any lead-acid battery at 60 °C. Shade, airflow and temperature-compensated charging are therefore conditions of use, not options.
- **Charging precision.** Linden's handbook lists thermal runaway with incorrect charging, and greater sensitivity to high temperature than conventional cells, among the VRLA's disadvantages. The Bureau of Reclamation's maintenance standard requires a VRLA charger to filter ripple and compensate for temperature, and warns against using a flooded-battery charger.
- **What you cannot see.** Dell and Rand list the trade-offs plainly: no water to add, no spillage, any orientation, negligible stratification in the gel type — against careful charging, more critical thermal management, no specific-gravity reading, deep-cycle life often below the flooded equivalent, and a limited shelf life. Health is judged from voltage, ohmic trend and periodic capacity tests (page 9).
- **Life in heat compared with OPzS.** Searles and Schiemann reproduce accelerated-life results (one manufacturer's cells on float at 62.8 °C, converted by the Arrhenius method) that credit the flooded OPzS design with longer equivalent life than the gel OPzV at every reference temperature from 20 °C to 35 °C. Our view: where a maintainer exists, OPzS gives the longer provable life, especially in a hot room; where the maintainer does not exist, OPzV is the battery that survives neglect.

The duty-by-duty recommendation table is on page 2.

Construction and the oxygen cycle



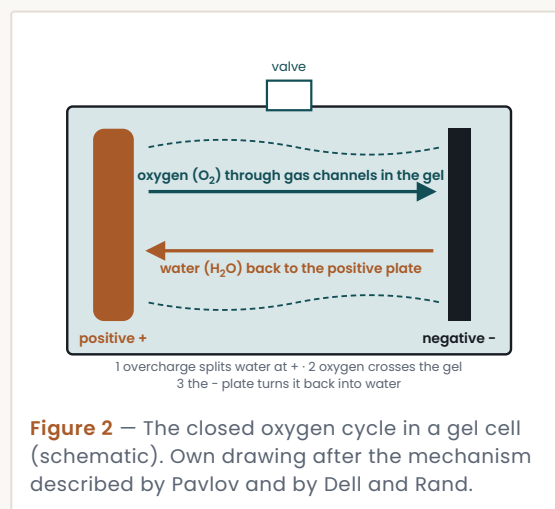
INSIDE A MICROTEX OPZV CELL

- **Positive plate — tubular.** Die-cast spines in a corrosion-resistant lead-calcium-tin alloy (catalogue) sit inside a woven polyester multi-tubular gauntlet that Microtex makes in-house (catalogue). The tubes are filled with lead oxide and formed to lead dioxide; the gauntlet holds the active material against the spine for the whole life of the cell.
- **Negative plate — pasted.** A lead-calcium-tin grid (catalogue) pasted with sponge-lead active material and a long-life expander. Calcium alloys are chosen for both plates because they keep hydrogen evolution and self-discharge low (Linden).
- **Separator.** A microporous separator between the plates; a gel cell keeps a conventional separator as well as the gel (Pavlov).
- **Electrolyte.** Sulphuric acid at 1.26 kg/l (catalogue) set into a thixotropic gel with fumed silica. The acid cannot move, so it cannot stratify.
- **Container and lid.** ABS (catalogue), moulded within the Microtex group by Kruger Industries.
- **Valve.** A pressure-relief valve with a flame arrestor; opening pressure about 100 mbar, closing about 50 mbar (catalogue).
- **Terminals.** M10 brass inserts in a plastic-coated sliding pole bushing that is gas- and electrolyte-tight (catalogue); because the bushing slides, the pole can move relative to the lid without breaking the seal.

HOW THE CELL KEEPS ITS WATER

1. As a lead-acid cell nears full charge, the current that is no longer needed for charging splits water: oxygen is released at the positive plate.
2. In a flooded cell that oxygen bubbles away and the water is lost. In the gel cell it travels through fine gas channels in the gel to the negative plate.
3. At the negative plate the oxygen is reduced and reacts back to water, which diffuses to the positive plate. The loop is Pavlov's "closed oxygen cycle"; Dell and Rand call it the internal oxygen cycle.

The channels are not there on day one. Pavlov and Dell and Rand both describe the early months: the new gel loses a little water, shrinks and fissures, and those fissures become the permanent oxygen paths. From then on water loss effectively stops. The valve keeps a slight positive pressure so that gases stay inside long enough to recombine (Linden), and opens only when its setting is exceeded.



Why a sealed cell still needs a ventilated room: page 8.

Cell range: 4 OPzV 200 to 24 OPzV 3000

Catalogue values at 25 °C. In a type name the first number is the number of positive tubular plates and the second the nominal capacity; the table gives the capacity at five discharge rates, each to the end voltage in its column head. Dimensions are length × width × height as the catalogue prints them (the datum for height is given on the cell drawing issued with your quotation); the mass is the catalogue's maximum mass. Internal resistance (R_i) and short-circuit current (I_k) are catalogue values for fuse and protection sizing; the datasheet issued with the quotation states how they were determined.

Type	C10 Ah to 1.80 V	C8 Ah to 1.77 V	C5 Ah to 1.77 V	C3 Ah to 1.75 V	C1 Ah to 1.67 V	R_i mΩ	I_k kA	L mm	W mm	H mm	kg max
4 OPzV 200	238	232	211	188	140	1.20	1.70	105	208	420	19.5
5 OPzV 250	298	291	263	235	174	0.96	2.15	126	208	420	23.5
6 OPzV 300	356	349	319	281	209	0.80	2.57	147	208	420	28
5 OPzV 350	427	416	371	324	234	0.71	2.88	126	208	535	31
6 OPzV 420	512	499	448	389	281	0.60	3.46	147	208	535	36.5
7 OPzV 490	597	583	520	454	329	0.51	4.04	168	208	535	42
6 OPzV 600	729	710	633	562	402	0.45	4.58	147	208	710	50
8 OPzV 800	972	948	845	751	537	0.34	6.10	215	193	710	68
10 OPzV 1000	1215	1187	1056	936	670	0.27	7.63	215	235	710	82
12 OPzV 1200	1463	1417	1267	1125	804	0.23	9.15	215	277	710	97
12 OPzV 1500	1669	1648	1437	1239	893	0.24	8.58	215	277	855	120
16 OPzV 2000	2225	2200	1916	1650	1191	0.18	11.4	215	400	815	160
20 OPzV 2500	2781	2752	2395	2064	1488	0.14	14.3	215	490	815	200
24 OPzV 3000	3337	3304	2874	2475	1786	0.12	17.1	215	580	815	240

Notes (catalogue): electrical values are nominal and may vary within $\pm 5\%$; dimensions within ± 2 mm; mass within $\pm 5\%$. Data are subject to change without notice — the datasheet and the cell drawing issued with your quotation govern. Long-duration ratings for solar sizing (C24 to C120) are stated on the datasheet.

The catalogue's outline drawings group the fourteen types in four — 4 OPzV 200 to 6 OPzV 600 · 8 OPzV 800 to 12 OPzV 1500 · 16 OPzV 2000 · 20 OPzV 2500 to 24 OPzV 3000 (catalogue); the terminal layout of each group is on the cell drawing issued with the quotation.

READING THE TABLE

C_n is the capacity the cell delivers over n hours at 25 °C when discharged at a constant current to the end voltage shown. The shorter the discharge, the fewer ampere-hours: across these fourteen types the one-hour rate gives about 53–59 % of C10, the three-hour rate 74–79 % and the five-hour rate 86–90 % (computed from the table). IEEE 485 sizing uses these rates through the K factors (page 7).

FURTHER TYPES AND BANKS

Cells outside this table, T-Gel cells (for example the 2 V 1000 Ah 2VT 1000PP type-tested at CPRI) and assembled 48 V banks for solar and telecom duty are built to order; their data are under revalidation and are issued with the quotation. Send the specification you must meet and we quote the right family.

Electrical characteristics and temperature-compensated charging

Typical values — confirm with the datasheet issued with your quotation.

Characteristic	Typical value (source)
Nominal voltage	2 V per cell
Rating basis	C10 at 25 °C to 1.80 V per cell; C8 and C5 to 1.77 V, C3 to 1.75 V, C1 to 1.67 V (catalogue)
Capacity and discharge time	The faster the discharge, the fewer ampere-hours the cell gives. Across the fourteen catalogue types the one-hour rate delivers about 53–59 % of C10, the three-hour rate 74–79 % and the five-hour rate 86–90 % (computed from the page 5 table). Long-duration ratings for solar sizing (C24 to C120) are stated on the datasheet
Operating temperature	–20 °C to +45 °C permissible; 10 °C to 35 °C recommended; 45 °C to 55 °C for short periods only (catalogue)
Self-discharge	About 2 % per month at 25 °C (catalogue)
Design float life	15 years or more, rated at 27 °C (catalogue design value, see page 9)
Design cycle life	20 % depth of discharge 5200 cycles · 50 % 3000 · 80 % 1800 (catalogue design values, rated at 27 °C)
Depth of discharge	Normally up to 80 %; deeper discharges, and discharge below the final voltage for the rate, must be avoided (catalogue)
Charging regime	IU characteristic — constant current, then constant voltage. Float voltage, boost voltage and the temperature-compensation coefficient are stated on the datasheet for the cell type; boost charging is time-limited
Valve	Opens at about 100 mbar, closes at about 50 mbar (catalogue)
Internal resistance, short-circuit current	Per type, page 5 — for fuse and protection sizing

Why temperature-compensated float charging is a requirement, not a preference

A cell on float sits at a fixed voltage and draws whatever current that voltage produces. That current rises with temperature — Berndt's rule of thumb is a doubling for every 10 K. In a flooded cell the extra current mostly makes gas, which leaves. In a gel cell nearly all of it feeds the oxygen cycle, and Berndt shows that the oxygen cycle turns the whole of that electrical energy into heat inside the cell. More heat means a warmer cell, a warmer cell draws more current, and more current makes more heat. If the room cannot carry the heat away faster than it is made, the loop does not settle — Berndt's definition of thermal runaway, and the mechanism Pavlov traces step by step in a polarised VRLA cell.

Temperature compensation breaks the loop at its first link. Lowering the float voltage as the cell warms keeps the float current close to what it would be at the reference temperature; raising it when the cell is cold ensures the cell still reaches full charge (Linden). The Sandia survey of over 740,000 VRLA cells found some 234,000 of them exposed to peak ambient temperatures above 40 °C, apparently with no temperature compensation of the float voltage — the condition that invites overcharge, dry-out and early replacement. The coefficient and the reference voltage depend on the cell type and are printed on our datasheet; we do not print a single universal number here because there is none.

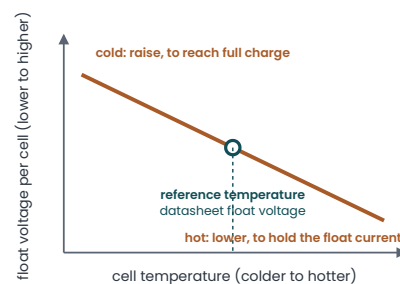


Figure 3 — Temperature-compensated float voltage, in principle. The slope and the reference value are per cell type (datasheet); no universal number exists. Own drawing.

Sizing and specifying for tender

-sizing a standby battery — IEEE 485 in words

IEEE 485-2020, the IEEE recommended practice for sizing lead-acid batteries in stationary float service, works like this:

1. **Define the duty cycle.** List every load the battery must carry during an outage, its current and its start and end time — including momentary loads such as breaker trips and motor starts.
2. **Fix the voltage window.** The lowest voltage the equipment accepts, divided by the number of cells, gives the end-of-discharge voltage per cell. Fewer cells mean a higher end-of-discharge voltage per cell, less usable capacity from each cell, and therefore a larger cell.
3. **Convert each period to cell size.** For each section of the duty cycle, the current is multiplied by the cell's capacity factor for that duration and end voltage (the "K" factor from the manufacturer's data) and the sections are summed; the worst-case section governs.
4. **Correct for temperature.** Capacity falls as the electrolyte cools, so the size is increased for the lowest expected cell temperature.
5. **Add an ageing margin.** A battery is treated as at end of life when it can no longer deliver 80 % of its rated capacity, so the size is increased — by 25 % in common practice (Searles and Schiemann) — so that the duty is still met at end of life.
6. **Add a design margin** for load growth and measurement uncertainty, then select the next larger cell.
7. **Check the charger** separately: recharge time, maximum current and the temperature-compensated voltages for the chosen cell. IEEE 485 itself excludes charger sizing and installation.

Microtex runs this calculation for every quotation; send the duty cycle and we return the sizing with the K factors used.

WHAT THE IEC 60896-21 / -22 TYPE-TEST PROGRAMME CHECKS (IN OUR WORDS)

IEC 60896-21:2004 gives the test methods for valve-regulated stationary cells and IEC 60896-22:2004 the requirements a purchaser may set against them. Together they cover three groups:

Safe operation — for example gas emission, short-circuit current and internal resistance for fuse sizing, valve operation and flammability of materials.

Performance — capacity at several rates, charge retention in storage and float service with daily discharges.

Durability — service life at elevated temperature, abusive over-discharge and thermal-runaway sensitivity.

The complete list of test methods is clause 6 of IEC 60896-21; a tender that cites both parts and lists the test numbers it wants evidence for gets a precise answer.

-sizing a solar battery — the PV duty

Standby sizing does not fit a solar battery, which is cycled every day and may sit partly discharged for weeks in poor weather. For PV duty the inputs are the daily load in watt-hours, the days of autonomy required, the maximum depth of discharge you will allow (normally 80 % for this range), the lowest site temperature and the array's ability to recharge the bank after a bad spell. IEC 61427-1:2013 is the international standard for batteries in off-grid photovoltaic systems: it sets the general requirements and the tests, including an endurance test that imitates the low-state-of-charge and high-state-of-charge seasons of PV service. Specify it for solar tenders.

writing the OPZV clause of a tender

Cell type and designation · C10 at 25 °C to 1.80 V per cell (and the long-duration rate, C100 or C120, for solar) · IEC 60896-21 / -22 test evidence requested, by test number, for standby float duty · IEC 61427-1 for PV duty (IEC 60896-21 itself excludes solar systems) · container material and flame rating · terminal type and connector material · rack type, seismic requirement if any · charger: temperature-compensated, ripple-limited, set to the cell datasheet · ventilation to IEC 62485-2 · commissioning records to be supplied · maintenance to IEEE 1188 · warranty terms · delivery (Microtex: 60 days from order confirmation).

Installation

BEFORE THE CELLS ARRIVE

- **Room.** Dry, shaded, ventilated, with the ambient as even as possible across the battery. Sunlight on cells and warm equipment beside the rack are the usual causes of one cell running hotter than its neighbours; keep the hottest-to-coldest cell spread small (Bureau of Reclamation FIST 3-6).
- **Racks.** The rack type — vertical or horizontal arrangement, tier count and any seismic requirement — is agreed with Microtex at quotation and shown on the installation drawing.
- **Charger.** Must be set to the datasheet float and boost voltages with temperature compensation driven by a sensor at the battery, and must limit ripple. A charger set up for flooded cells is not acceptable (FIST 3-6).

VENTILATION — IEC 62485-2 IN OUR WORDS

Why a sealed cell still needs ventilation. Recombination is high but never total: lead-calcium alloys keep hydrogen small, but some leaves through the valve, and more if the cell is overcharged or hot (Linden; Bureau of Reclamation FIST 3-6). Rooms and enclosures are therefore ventilated whether the cells are flooded or sealed.

IEC 62485-2:2010 is the international safety standard for stationary battery installations up to 1500 V d.c. It requires battery rooms and enclosures to be ventilated so that the hydrogen released during charging stays well below the concentration at which it can ignite. The air flow needed is calculated from the number of cells, the charging current the charger can push into them and a gas-evolution factor; the factor for valve-regulated cells is lower than for vented cells but it is never zero, because valves do open. The standard also covers safe distances around vents, the exclusion of ignition sources, signage, protection against electric shock and short circuit, and electrolyte hazards. Microtex supplies a ventilation calculation for your room on request; have your consultant verify it against the edition in force where you build.

INSTALLING

- **Orientation.** Upright as standard; horizontal operation is possible (catalogue) — say so at enquiry, so that the rack and the connectors are designed for it.
- **Handling.** Cells are heavy (page 5); use lifting gear, insulated tools and eye protection, and never place metal objects on the cells.
- **Connections.** Solid flat copper intercell connectors are supplied (catalogue); the M10 steel connector screws, with spring and flat washers, are torqued to the installation-manual value and the plastic shrouds fitted afterwards (catalogue). Inter-tier connections follow the drawing issued with the quotation. Check polarity before closing the circuit.
- **Protection.** Size fuses and breakers from the short-circuit current and internal resistance on page 5.

COMMISSIONING — CREATE THE BASELINE

1. Set the charger to the datasheet values, including temperature compensation, before connecting the battery.
2. Give the commissioning charge the installation manual specifics.
3. Record every cell's voltage, internal resistance and temperature, plus the ambient. This set of readings is the baseline every future reading is compared with (page 9).

TRANSPORT AND STORAGE

OPzV cells are shipped charged. The transport classification and the markings for your consignment are stated on the shipping documents — ask for them with the quotation. Store the cells cool, dry and upright and give a refresh charge at least every six months — the storage limit without recharge that our catalogue prints, and our warehouse rule; the instruction manual issued with the cells governs. Self-discharge continues during storage.

THE THREE THINGS THAT SHORTEN A GEL CELL'S LIFE, IN ORDER

1. **The charger** — wrong voltage, no temperature compensation, excessive ripple, or chronic undercharge from an undersized solar array.
2. **Heat** — every degree above the recommended band costs life; shade and airflow repay themselves.
3. **Deep and repeated over-discharge** — below the final voltage for the rate, or deeper than the cell was sized for.

Maintenance, design life and warranty

THE NEVER-DO LIST

- **Never open a valve.** The seal is the battery.
- **Never add water.** There is nothing to top up.
- **Never guess charger settings.** Use the datasheet values.

THE ALWAYS-DO LIST

- **Temperature-compensated charging — compulsory.** The charger must adjust as the room warms.
- **Baseline every cell on commissioning day.** Voltage and internal resistance are the reference for ever.
- **Trend quarterly:** voltage, internal resistance, temperature. Trends show degradation before failure.
- **Let programmed equalisation do its quiet work.** Automatic and scheduled — do not improvise extra charging.
- **Torque-check and clean connections yearly.** Loose joints heat; heat feeds corrosion.
- **In storage, refresh-charge at least every six months.**

THE TREND LOG

Reading	How often	Investigate when
Cell and bank voltage	Quarterly	The spread between cells keeps widening
Internal resistance	Quarterly	A cell drifts well above its commissioning baseline
Cell temperature	Quarterly	One cell runs hotter than its neighbours

WHAT AN OHMIC READING CAN AND CANNOT TELL YOU

Internal ohmic measurement — resistance, impedance or conductance, depending on the instrument — is the sealed cell's substitute for the hydrometer. EPRI's study of ohmic monitoring found that a rise in internal resistance (or a fall in conductance) does correlate with a loss of capacity, but a single reading cannot say *why* a cell is changing: dry-out and a discharged negative plate look alike on the meter yet fail differently. Readings identify good and bad cells; only a capacity test proves the battery's capacity. IEEE 1188 (current edition; 2025 revision) — the IEEE recommended practice covering how stationary VRLA batteries are maintained, tested and replaced — follows the same logic in its own terms: establish baselines, take readings on a schedule, compare against the baseline, run capacity tests at intervals and whenever readings move, and plan replacement from the results. The Sandia survey put the human side in one sentence:

"A monitoring regime alone without a proactive maintenance program cannot keep VRLA batteries free of early failures." — DeAnda, Miller, Moseley and Butler, Sandia report SAND2004-0914

Instruments watch; people act.

DESIGN LIFE, SERVICE LIFE AND WARRANTY ARE THREE DIFFERENT THINGS

Searles and Schiemann draw the lines clearly. **Design life** is the manufacturer's estimate under laboratory conditions at a reference temperature on the recommended float voltage — our catalogue prints a design float life of 15 years or more, rated at 27 °C. **Service life** is what a site actually gets, and the factors that decide it are the site's: temperature first, then the frequency and depth of discharge, charger accuracy and ripple, the quality of installation and the discipline of maintenance. **Warranty** is a promise against manufacturing defect for a stated period under stated conditions — not a prediction of life.

Microtex warranty: 12 months from the date of invoice as standard for supplies within India; export and project warranty terms are stated in the offer. Project-specific terms are quoted against the duty, the site conditions and the maintenance regime agreed.

How to request a quotation

Three routes. Every enquiry is acknowledged by our enquiry desk and answered by the engineer responsible for OPzV.

CALL OR WHATSAPP

+91 9686 4488 99

A WhatsApp Business account — send photographs of the existing battery and nameplate if you are replacing one

EMAIL

info@microtex.com

Attach the tender clause or the duty cycle

WEB FORM

microtex.com/contact/

Acknowledged the same working day; the OPzV engineer then replies

WHAT TO SEND

- The duty: loads and times for standby duty, or daily watt-hours and days of autonomy for solar.
- Bus voltage and the lowest voltage the equipment accepts (or the number of cells).
- Site temperature range and whether the room is shaded, ventilated or cooled.
- The charging source — rectifier rating, or solar array size and controller.
- How often the site is visited.
- Standards and approvals the tender requires, rack type and seismic needs.
- Delivery destination and date needed.

WHAT COMES BACK

A sized proposal with the K factors used, the cell datasheet and drawing, the installation and maintenance manual, the list of test evidence available for the cell type, warranty terms, and the delivery schedule — **60 days from order confirmation** for cells and assembled banks.

APPROVALS AND EVIDENCE

- **CPRI type-tested:** 2 V 1200 Ah OPzV (12 OPzV 1200) — marking, rated capacity and Ah/Wh efficiency, type-tested against customer specification, CPRI Bengaluru, January 2025; 2 V 1000 Ah T-Gel (2VT 1000PP) — type-tested against customer specification, CPRI Bengaluru, January 2025. Report numbers and ULR references travel with our tender documentation.
- **Management systems:** ISO 14001:2015 environmental management, Microtex Energy Pvt Ltd (the current certificate is supplied with the offer); registered with the Central Pollution Control Board as a producer under the Battery Waste Management Rules 2022.
- **Gel manufacture in Bengaluru,** sold as the Eternia gel range; tubular plates, gauntlets, containers and lids made within the Microtex group.

REFERENCE INSTALLATION — NAMED WITH THE CUSTOMER'S PERMISSION

TEC International, Paris: sixteen 48 V 3000 Ah tubular gel battery sets, including standby banks, for a 288 kWh installation — Djibouti, 2024

Microtex Energy supplied, installed and commissioned sixteen sets of 48 V 3000 Ah tubular gel (OPzV) batteries, including standby banks, for a 288 kWh installation in Djibouti in 2024 for TEC International S.A.S. of Paris. TEC International's letter reports satisfactory performance — reliable operation under site conditions, with the project's requirements met — and records its appreciation of the product quality, the timely execution and the technical support given during supply and commissioning.

Letter on file; shown with the quotation on request. Further reference installations and performance letters for Microtex VRLA and tubular flooded banks are available on request.

Sources and legal

SOURCES CONSULTED FOR THIS GUIDE (THE TEXT ABOVE IS IN OUR OWN WORDS)

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- Mindi Farber DeAnda, Jennifer Miller, Patrick Moseley and Paul Butler, *Reliability of Valve-Regulated Lead-Acid Batteries for Stationary Applications*, Sandia National Laboratories report SAND2004-0914, March 2004.
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STANDARDS REFERRED TO (DESCRIBED IN OUR OWN WORDS; EACH VERIFIED AT ITS ISSUING BODY ON 13 OCTOBER 2026)

- IEC 60896-21:2004 (IEC, Geneva), titled "Stationary lead-acid batteries – Part 21: Valve regulated types – Methods of test".
- IEC 60896-22:2004 (IEC, Geneva), titled "Stationary lead-acid batteries – Part 22: Valve regulated types – Requirements".
- IEC 61427-1:2013 (IEC, Geneva), titled "Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid application".
- IEC 62485-2:2010 (IEC, Geneva), titled "Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries".
- IEEE Std 485-2020 (IEEE, New York), titled "IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications".
- IEEE Std 1188 (IEEE, New York) — the IEEE recommended practice on maintaining, testing and replacing stationary VRLA batteries; the 2025 revision was board-approved on 10 December 2025 and is listed Active by IEEE, superseding IEEE Std 1188-2005.
- DIN 40742:2015-09 (DIN, Berlin), titled "Lead acid batteries – Stationary valve regulated cells with positive tubular plates and immobilized electrolyte (gel)"; replaces DIN 40742:1999-07.

Sources quoted: one sentence from DeAnda, Miller, Moseley and Butler, SAND2004-0914 (a US Government work), report p. 21 (§2.2) — quoted on page 9 of this guide.

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