# SOL Single Cell
# Ni-Cd Battery Range

IN UNITY IS ENERGY®

# 140 YEARS OF EXCELLENCE

Throughout our rich history, Geräte- und Akkumulatorenwerk Zwickau has always been at the forefront of technological development. Today we rank among the leading suppliers of industrial Ni-Cd batteries and energy storage solutions based on Li-ion batteries.

We develop and manufacture Ni-Cd cells of highest quality, pushing the boundaries of this proven chemistry with innovative design features. Delivering customized battery solutions to customers around the world, our battery systems serve as backup power sources for critical equipment in industries ranging from oil and gas, energy and communications to transportation and other infrastructure.

# EUROPEAN QUALITY WITHOUT COMPROMISE

GAZ® SOL range are built with uncompromised quality and worksmanship in accordance to IEC 62259 and IEC 61427-1 standards. And not only to meet but exceed the requirements specified in these standards. All nickel coated steel components of electrodes ensure product longevity and reliability. In addition almost no iron (Fe) content in active masses guarantees lower rate of capacity degradation over the period of usage and extend the service life even in extreme operating conditions.

MADE IN GERMANY
GAZ
SINCE 1884

# TAILORMADE FOR RENEWABLES

GAZ® SOL Ni-Cd batteries are the ideal energy storage solution for integration into demanding renewable energy resources like photovoltaic (PV) and wind energy applications to optimize available energy utilization. Exceptionally efficient and reliable even in extreme temperatures, SOL batteries are designed to cope with unpredictable demands, frequent daily cycling, and variable depths of discharge and fluctuating charging conditions from MPPTs and solar charge controllers.

SOL Ni-Cd batteries provide a completely predictable 20-year service life, typically when operated at shallow depth-of-discharge with appropriate sizing with application conditions and factors. Combined with gas-recombination technology of SOL cells that ensure low maintenance requirements, making them the first choice for remote installations.

# TYPICAL APPLICATION

**Oil and gas infrastructure**
+ Off-Grid backup power for on-shore and off-shore drilling facilities and hydraulic equipments
+ Cathodic protection, monitoring and communication (RTU) of pipelines and for remote boosting stations

**Community Off-Grid**
+ Micro grids, Off-grid renewable energy resource integration for islands and remote villages and rural electrification, where utility grid reachability and reliability is uncertain

**Commercial Buildings**
+ Energy Storage from PV arrays on large buildings and in industrial facilities, Emergency lighting and communications
+ Safety and alarm systems

**Transportation infrastructure**
+ Including track-side applications such as crossing guards, lighting, portable information displays, signaling

**Telecommunications**
+ Backup systems, off-grid energy supply to remote base stations and SCADA systems

**Navigational aids**
+ GPS-based systems in off-shore facilities, lighthouses, buoys

# SINGLE CELL CONSTRUCTION

**Low pressure flame arresting vent**

**GAZ® safety terminal**
Redundant leak protection minimizes carbonate formation.

**GAZ® single cell design**
Weld above the electrolytelevel eleminates risk of faulty on the side and on the bottom of the cell.

**Electrode edge**
Connected to terminal by screwing or welding providing high mechanical stability.

**Electrode frame**
Consisting of electrode edge and side bars.
Seals the plates and acts as a current collector.

**Horizontal pockets**
Formed by perforated steel strips containing the active material.

**Fleece separator**
Special fleece separator insulates the plates and improves the internal recombination.

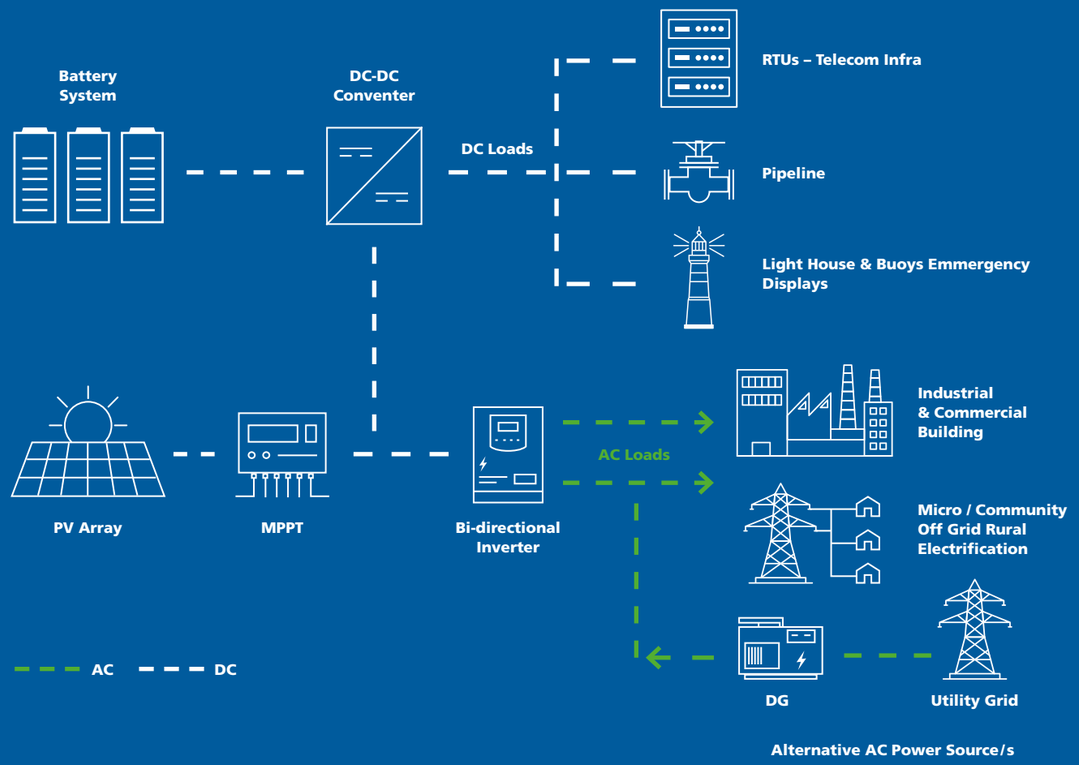
# ADVANTAGES OF GAZ® SOL RANGE

+ A wide range of capacities starting from 30 Ah up to 1950 Ah (C120) in 64 capacity steps to fit in every possible renewable energy application without much oversizing
+ Excellent cycling capability under typical conditions. Over 8000 cycles at 20% of daily DOD can provide over 20 years of service life. See Curve-2
+ Supporting daily and seasonal cycling at variable depth of discharge and state of charge
+ Up to 95% recharge efficiency in typical shallow cycling conditions for PV applications. See Curve-1
+ Performing well under fluctuating voltage and current a typical charging condition for renewable applications
+ Operating temperature ranges -20 °C to +50 °C but can tolerate occasional extreme desert temperatures of +70 °C
+ A special electrolyte can extend the operation of GAZ® SOL cells even at extremely low temperatures of up to -40 °C

# PERFECTLY SUITED FOR REMOTE PV APPLICATION

GAZ® SOL Range is ideally suited for remote, hard to access installation sites where routine maintenance is time consuming and expensive.

+ SOL batteries require only minimal maintenance thanks to their internal gas recombination that exceeds IEC 62259 requirements
+ Topping-up intervals are up to 6 years due to the improved recharge efficiency and internal gas recombination. See Curve-4
+ Installation is easy with limited handling equipment
+ Reliable operation over a predictable service life that eliminates interim maintenance
+ Rugged all steel cell stack construction facilitates lower risk of mishandling during transportation to remote sites
+ Single cell containers are designed with seamless, non-welded surfaces. This ensures that the electrolyte can never be stagnantly in contact with any plastic welded area, preventing leakage and thus minimizing handling and environmental hazards





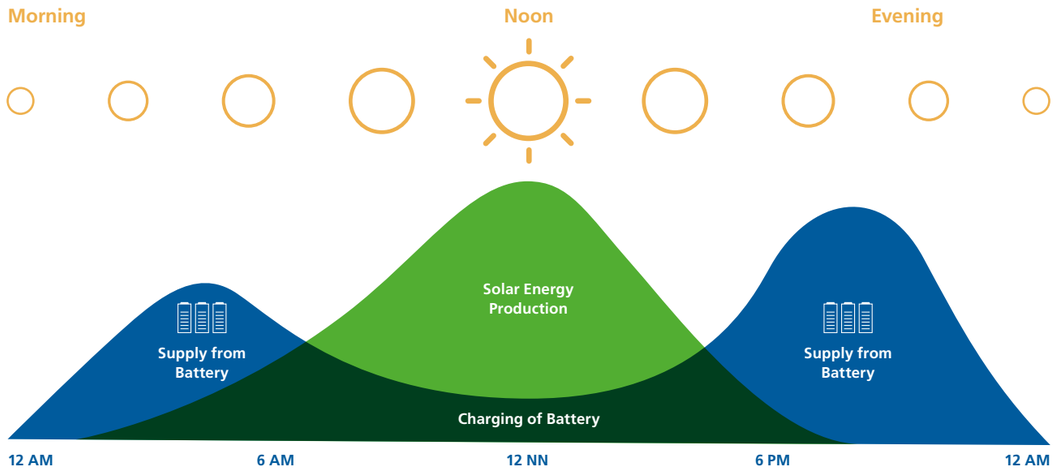

# RELIABLE EVEN UNDER THE HARSHEST CONDITIONS

Impressed Current Cathodic Protection or ICCP is an important technique used to prevent the corrosion of steel structures, such as underground or buried pipelines. It works by overcoming the galvanic current inherent in corrosion processes with an opposing current. Pipeline operators are increasingly using renewable energy for this purpose, in which case they often integrate a battery system to store the energy generated by, for example, PV arrays.

GAZ® Ni-Cd batteries serve these systems under the relentless desert sun of the Arabian Peninsula, withstanding both the extreme heat of the day and the bitter cold of the night. And yet, GAZ® battery systems work reliably in such unforgiving environment, providing power to one of the most critical infrastructures in the world.

**GAZ® SOL Ni-Cd batteries deliver excellent performance even in the harshest of environments and with predictable and lower Total Cost of Ownership when Combining Renewable Energy with Battery in remote ICCP Applications.**

Ni-Cd pocket plate cells perfectly fit this and other, similarly demanding applications, surpassing Lead-Acid and Li-ion batteries in many aspects. GAZ® Ni-Cd batteries are designed to last over 20 years, while Lead-Acid and Li-ion batteries may need replacing several times. Furthermore, GAZ® Ni-Cd cells are designed to operate in temperatures between -20 °C and +50 °C without requiring a temperature-controlled environment. Without any such high recurring OPEX, the Life Cycle Cost (LCC) of GAZ® Ni-Cd batteries is exceptionally favorable.




## SOL Single Cell
## Technical Specifications

| SOL Type Models | IEC-61427 Capacity | IEC-62259 Capacity | Cell Dimensions [Tolerance ±2mm] | | | | Connection Type | Nr. Of Terminals | Type of Terminals | Electrolyte Volume | Filled Cell Weight | Internal Resistance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| In Plastic Containers | [Ah $C_{120}$] | [Ah $C_5$] | l | w | h | h1 | M = Nut | Poles / Cell | Connector | Approx. [± 5%] | Approx. [± 5%] | IR at 100% SoC |
| | [Ah] | [Ah] | mm | mm | mm | mm | S = Screw | [Nr.] | Type | [L] | [Kg] | [mΩ] |
| SOL 30 G | 30 | 28 | 46 | 85 | 237 | 262 | M | 2 | M10 | 0,36 | 1,51 | 9,32 |
| SOL 50 G | 50 | 47 | | | | | M | 2 | M10 | 0,79 | 2,58 | 5,87 |
| SOL 60 G | 60 | 57 | 85 | 85 | 237 | 262 | M | 2 | M10 | 0,74 | 2,74 | 5,02 |
| SOL 73 G | 73 | 67 | | | | | M | 2 | M10 | 0,68 | 2,90 | 4,30 |
| SOL 85 G | 85 | 78 | | | | | S | 2 | M8 | 1,28 | 4,29 | 3,38 |
| SOL 100 G | 100 | 93 | 53 | 134 | 364 | 392 | S | 2 | M8 | 1,12 | 5,02 | 2,99 |
| SOL 120 G | 120 | 111 | | | | | S | 2 | M8 | 1,10 | 4,77 | 2,27 |
| SOL 125 G | 125 | 116 | | | | | S | 2 | M8 | 1,58 | 6,19 | 2,44 |
| SOL 150 G | 150 | 140 | 69 | 134 | 364 | 392 | S | 2 | M8 | 1,57 | 6,04 | 1,97 |
| SOL 170 G | 170 | 157 | | | | | S | 2 | M8 | 1,47 | 6,40 | 1,62 |
| SOL 190 G | 190 | 175 | | | | | S | 2 | M8 | 3,70 | 9,56 | 1,47 |
| SOL 205 G | 205 | 187 | | | | | S | 2 | M8 | 3,41 | 10,16 | 1,51 |
| SOL 230 G | 230 | 210 | | | | | S | 2 | M8 | 3,51 | 10,13 | 1,38 |
| SOL 255 G | 255 | 235 | | | | | S | 2 | M8 | 3,39 | 10,5 | 1,08 |
| SOL 275 G | 275 | 250 | | | | | S | 2 | M8 | 3,08 | 11,2 | 1,13 |
| SOL 290 G | 290 | 265 | 108 | 164 | 364 | 392 | S | 2 | M8 | 3,21 | 11,1 | 0,96 |
| SOL 305 G | 305 | 280 | | | | | S | 2 | M8 | 3,13 | 11,3 | 1,01 |
| SOL 330 G | 330 | 300 | | | | | S | 2 | M8 | 3,03 | 11,6 | 0,83 |
| SOL 350 G | 350 | 320 | | | | | S | 2 | M8 | 2,95 | 11,9 | 0,90 |
| SOL 365 G | 365 | 335 | | | | | S | 2 | M8 | 2,85 | 12,2 | 0,81 |
| SOL 375 G | 375 | 345 | | | | | S | 2 | M10 | 4,83 | 15,9 | 0,81 |
| SOL 400 G | 400 | 365 | | | | | S | 2 | M10 | 5,04 | 16,4 | 0,74 |
| SOL 420 G | 420 | 385 | | | | | S | 2 | M10 | 4,61 | 16,7 | 0,71 |
| SOL 455 G | 455 | 415 | | | | | S | 2 | M10 | 4,46 | 17,2 | 0,67 |
| SOL 475 G | 475 | 435 | | | | | S | 2 | M10 | 4,68 | 17,5 | 0,63 |
| SOL 500 G | 500 | 455 | 164 | 158 | 364 | 392 | S | 2 | M10 | 4,56 | 17,9 | 0,56 |
| SOL 505 G | 505 | 465 | | | | | S | 2 | M10 | 4,50 | 18,1 | 0,56 |
| SOL 520 G | 520 | 475 | | | | | S | 2 | M10 | 4,16 | 18,0 | 0,54 |
| SOL 535 G | 535 | 490 | | | | | S | 2 | M10 | 4,38 | 18,4 | 0,52 |
| SOL 555 G | 555 | 505 | | | | | S | 2 | M10 | 4,33 | 18,6 | 0,50 |
| SOL 580 G | 580 | 530 | | | | | S | 2 | M10 | 4,20 | 19,0 | 0,50 |
| SOL 595 G | 595 | 540 | | | | | S | 4 | M10 | 8,46 | 26,8 | 0,46 |
| SOL 620 G | 620 | 565 | | | | | S | 4 | M10 | 8,31 | 27,2 | 0,46 |
| SOL 640 G | 640 | 585 | | | | | S | 4 | M10 | 8,15 | 27,9 | 0,47 |
| SOL 660 G | 660 | 600 | | | | | S | 4 | M10 | 8,10 | 27,9 | 0,44 |
| SOL 685 G | 685 | 625 | 176 | 246 | 382 | 408 | S | 4 | M10 | 7,97 | 28,4 | 0,43 |
| SOL 710 G | 710 | 645 | | | | | S | 4 | M10 | 7,94 | 28,4 | 0,39 |
| SOL 735 G | 735 | 670 | | | | | S | 4 | M10 | 7,75 | 29,0 | 0,38 |
| SOL 770 G | 770 | 705 | | | | | S | 4 | M10 | 7,56 | 29,5 | 0,40 |

* All dimensions and weights stated are subject to usual manufacturing tolerances. The right is reserved to make any alterations without prior notice.



## SOL Single Cell
## Technical Specifications

| SOL Type Models | IEC-61427 Capacity | IEC-62259 Capacity | Cell Dimensions [Tolerance ±2mm] | | | | Connection Type | Nr. Of Terminals | Type of Terminals | Electrolyte Volume | Filled Cell Weight | Internal Resistance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| In Plastic Containers | [Ah $C_{120}$] | [Ah $C_5$] | l | w | h | h1 | M = Nut | Poles / Cell | Connector | Approx. [± 5%] | Approx. [± 5%] | IR at 100% SoC |
| | [Ah] | [Ah] | mm | mm | mm | mm | S = Screw | [Nr.] | Type | [L] | [Kg] | [mΩ] |
| SOL 800 G | 800 | 735 | | | | | S | 6 | M10 | 13,2 | 39,3 | 0,37 |
| SOL 825 G | 825 | 755 | | | | | S | 6 | M10 | 13,2 | 39,8 | 0,36 |
| SOL 860 G | 860 | 790 | | | | | S | 6 | M10 | 12,9 | 40,7 | 0,34 |
| SOL 880 G | 880 | 800 | | | | | S | 6 | M10 | 12,9 | 40,4 | 0,32 |
| SOL 925 G | 925 | 850 | | | | | S | 6 | M10 | 12,7 | 41,0 | 0,32 |
| SOL 960 G | 960 | 875 | 176 | 368 | 382 | 418 | S | 6 | M10 | 12,4 | 42,2 | 0,31 |
| SOL 985 G | 985 | 900 | | | | | S | 6 | M10 | 12,4 | 42,1 | 0,30 |
| SOL 1020 G | 1020 | 935 | | | | | S | 6 | M10 | 12,2 | 42,9 | 0,30 |
| SOL 1050 G | 1050 | 960 | | | | | S | 6 | M10 | 12,1 | 42,8 | 0,28 |
| SOL 1100 G | 1100 | 1010 | | | | | S | 6 | M10 | 11,8 | 43,8 | 0,28 |
| SOL 1160 G | 1160 | 1060 | | | | | S | 6 | M10 | 11,5 | 44,5 | 0,24 |
| SOL 1180 G | 1180 | 1080 | | | | | S | 8 | M10 | 15,2 | 51,6 | 0,27 |
| SOL 1235 G | 1235 | 1130 | | | | | S | 8 | M10 | 14,9 | 52,4 | 0,22 |
| SOL 1285 G | 1285 | 1175 | | | | | S | 8 | M10 | 14,6 | 53,9 | 0,23 |
| SOL 1315 G | 1315 | 1200 | | | | | S | 8 | M10 | 14,5 | 53,8 | 0,21 |
| SOL 1370 G | 1370 | 1250 | 176 | 448 | 382 | 418 | S | 8 | M10 | 14,3 | 54,9 | 0,21 |
| SOL 1400 G | 1400 | 1275 | | | | | S | 8 | M10 | 14,2 | 54,7 | 0,22 |
| SOL 1450 G | 1450 | 1330 | | | | | S | 8 | M10 | 13,8 | 56,0 | 0,19 |
| SOL 1550 G | 1550 | 1420 | | | | | S | 8 | M10 | 13,4 | 57,0 | 0,20 |
| SOL 1615 G | 1615 | 1475 | | | | | S | 10 | M10 | 18,3 | 66,7 | 0,18 |
| SOL 1660 G | 1660 | 1515 | | | | | S | 10 | M10 | 18,2 | 66,6 | 0,18 |
| SOL 1720 G | 1720 | 1575 | | | | | S | 10 | M10 | 17,9 | 68,0 | 0,17 |
| SOL 1770 G | 1770 | 1605 | 176 | 558 | 382 | 418 | S | 10 | M10 | 17,8 | 67,8 | 0,18 |
| SOL 1830 G | 1830 | 1675 | | | | | S | 10 | M10 | 17,3 | 69,4 | 0,16 |
| SOL 1950 G | 1950 | 1775 | | | | | S | 10 | M10 | 16,8 | 70,7 | 0,15 |

* All dimensions and weights stated are subject to usual manufacturing tolerances. The right is reserved to make any alterations without prior notice.

### Electrical characteristics:

**Complies with IEC 62259** – Secondary cells and batteries containing alkaline or other non-acid electrolytes – Nickel-cadmium prismatic secondary single cells with partial gas recombination.

**Complies with IEC 60623** – Secondary cells and batteries containing alkaline or other non-acid electrolytes – Vented nickel-cadmium prismatic rechargeable single cells.

**Complies with IEC 61427-1** – Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid application.

The nominal $C_5$ capacity as per IEC 62259 of GAZ® SOL range batteries is based on the available ampere hours (Ah) at a discharge rate of 5 hours to a final discharge voltage of 1.00 V per cell at 20 ± 5 °C. But GAZ® SOL cells are designated for equivalent 120 hours discharge rate to a final discharge voltage of 1.00 V per cell at 20 ± 5 °C as per IEC 61427-1.

### Safety

**Complies with EN 50272-2/ IEC 62485-2** – Safety requirements for secondary batteries and battery installations Stationary batteries – The protective covers for terminals and connectors, the insulated cables are compliant with IP2 level protection against electrical shocks according to safety standards.

# APPLICATIONS AND PARAMETERS

GAZ® SOL cells are designed to cope with all specifics of operating alongside PV installations and suitable for daily cycles at shallow depth-of-discharge. The batteries are usually recharged when the SUN is available on a consecutive day. But when solar irradiation is unavailable or insufficient for up to 10 days or more GAZ® SOL batteries can provide all the application load continuously for such designed autonomy period. They can also cycle daily even at relatively high depth-of-discharge, as it is the case with some micro-grid installations.

### Nominal voltage per cell

1.20 V per cell

### Discharging conditions

The rated capacity discharge performances as well as the nominal capacities $C_5$ and $C_{120}$ are applicable for a fully charged cell in accordance with IEC 62259 and IEC 61427-1.

### Charging Recommendation – SOL Range

**A. Constant Voltage Charging**

Recommendation for Solar charge controller

Boost or Single Level

Recharge voltage of SOL cells can be set based on the application daily Depth-of-Discharge, available solar irradiation and sun-hours, as varies regionally and seasonally.

Constant Voltage: 1.50–1.60 V/cell
Current Limit: 0.1 $I_t$ A dc

**NOTE:** Higher recharge voltage setting will improve the chargeability and charge duration but increase electrolysis and water consumption.

Float Mode (where applicable)
Float Voltage: 1.40–1.42 V/cell
Float Current: 1 to 2 mA/Ah cell capacity

| Battery system | Charging voltage per cell |
|---|---|
| 5–10% daily depth of discharge | 1.50 |
| 10–15% daily depth of discharge | 1.55 |
| 15–25% daily depth of discharge | 1.60 |

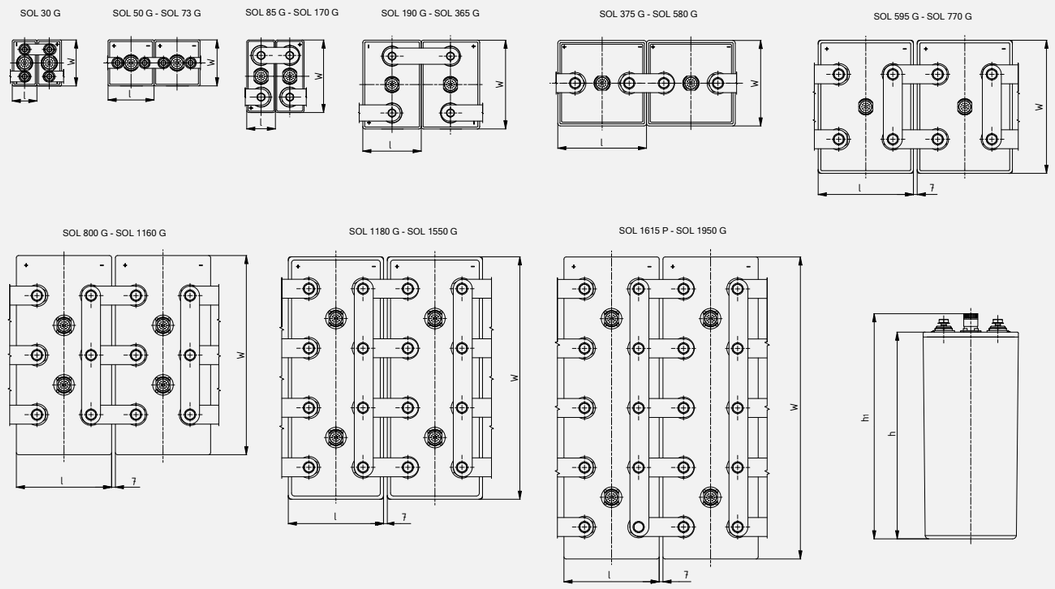
### Typical Charging Voltages

| System Voltage | Number of cells | Charging Voltage vs daily DoD (% of rated $C_{120}$ Capacity) | | |
|---|---|---|---|---|
| | | 5 to 10% | 10 to 15% | 15 to 25% |
| 12 V | 10 | 15.0 V | 15.50 V | 16.0 V |
| 24 V | 19 | 28.5 V | 29.45 V | 30.4 V |
| 48 V | 37 | 55.5 V | 59.20 V | 59.2 V |
| 96 V | 75 | 111,0 V | 114,70 V | 118,4 V |

**B. Constant Current mode**

Charging for IEC-62259 Capacity Test

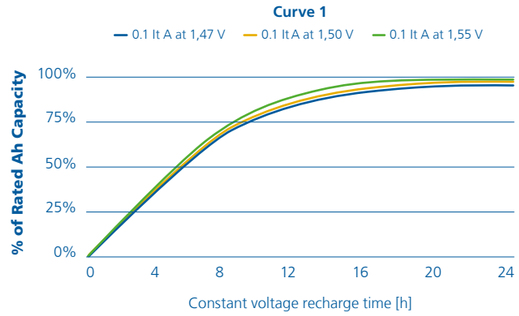
Constant Current: 0.1 $I_t$ A dc for 16 h
Voltage Limit: No Limiting or > 1.70 Vpc
Charging Temperature: 20 ± 5 °C






# SUPERB CHARGEABILITY

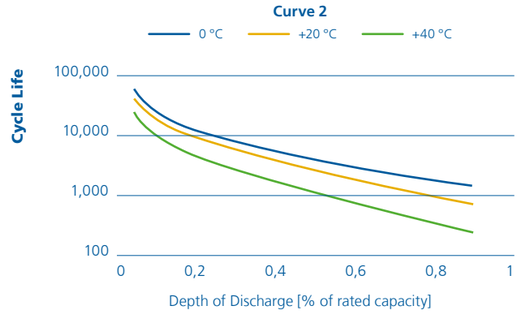
Thanks to their optimal anodic to cathodic active mass ratio, GAZ® SOL cells can accept more capacity input with lower recharge voltage limit below 30 °C, For their higher constant-current recharge ratio for usage with MPPTs or Solar Charge controller, SOL cells can be recharged comparatively faster. Note that increased operating temperature during charging can reduce recharge efficiency and increase refilling frequency. See curve 1.




# CYCLE PERFORMANCE AT TEMPERATURES

GAZ® SOL Range cells are designed to perform over 20 years in cycling applications. The cycling capability varies as shown in Curve-2. Operation in elevated temperature reduce the expected service life. Though the degradation rate of GAZ® SOL cells are much lower than other electro-chemistries. For operation at sustained increased temperature a higher aging factor should be considered in battery sizing based on desired service life.

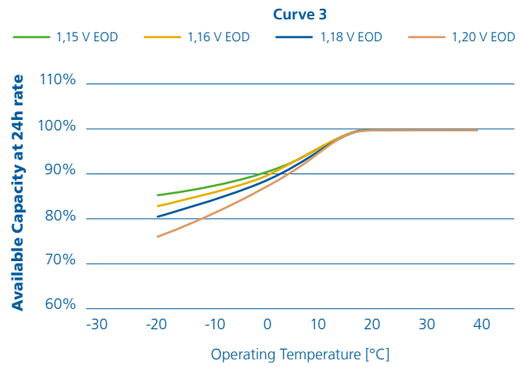
The daily Depth-of-Discharge (DOD) rate also influence the total cycle life. Increased daily discharge level in cycling reduces the cycle life. Typically in renewable applications battery systems are exposed to large number of relatively shallow cycles, where GAZ® SOL cells provides more than 20 years of service life.




# PERFORMANCE AT LOWER TEMPERATURES

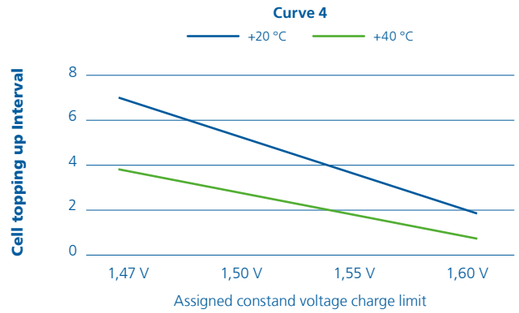
In remote sites of PV applications, the battery discharge and provide backup energy during No-Sun hours. Typically in such remote locations temperature can drop below sub-zero level. Performance of GAZ® SOL Range cells at lower temperatures are much higher than other battery systems.

Curve-3 shows Performance of GAZ® SOL Range at lower temperatures with different End-of-Dischege voltages.




# TYPICAL TOPPING UP INTERVAL

GAZ® SOL Range cells are delivered with large quantity of reserve electrolyte. In addition with internal gas recombination capability the water top-up requirements for remote sites can be extended based on recharge voltage and operating temperature as shown in Curve-4.



# OUR COMMITMENT TO THE ENVIRONMENT

At GAZ®, as one of the leading manufacturer of Ni-Cd batteries for over 100 years, we pay rightful attention to the environmental footprint of our batteries. Proper recycling prevents pollution but also enables the recovery of materials that can be reused. Starting from the optimized design, GAZ® Ni-Cd batteries are composed of harmonized production elements that make their recycling more efficient and cost-effective without compromising the product performance and design lifetime.

The recycling efficiency reaches nearly 80% of the cell weight, which is higher than the prescribed recycling efficiency of 75% by regulations applicable to Ni-Cd batteries.

All GAZ® batteries are disposed of with certified long-term partners in compliance to regional regulations. GAZ® also provides a recycling testimonial with unique recycling case number for complete traceability.

**Regulatory compliance**

- ✓ **EU Declaration of Conformity** – GAZ® confirms and bear the responsibility of self-declaration of conformity of produced Ni-Cd cells according to recently adopted EU Battery Regulation.
- ✓ **RoHS** – Even though accumulators are not within the scope of EU's Restriction of Hazardous Substances (RoHS) regulation, GAZ® voluntarily declares that the substances restricted by RoHS are not present in our batteries except for their electrochemical core.
- ✓ **REACH** – About EU's Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), GAZ® voluntarily declares that our Ni-Cd accumulators contain more than 0.1% w/w of Cadmium (Cd) substances depending on delivery status.

/ SOL Single Cell Ni-Cd Battery Range

# CONTACTS

IN UNITY IS ENERGY®


**GAZ Energy a.s.**

Tovární 319
735 81 Bohumín
Czech Republic

E: sales@gaz-gmbh.com

**www.gaz-gmbh.com**

**GAZ Geräte – und Akkumulatorenwerk Zwickau GmbH**

Reichenbacher Str. 62–68
080 56 Zwickau
Germany

P: +49 375 86 0
E: sales@gaz-gmbh.com

**www.gaz-gmbh.com**

**GAZ Middle East Industry Company**

Gushat Tower, Floor-3
Prince Hammoud Street,
Aqrabiyah
P.O.BOX – 3631
319 52 Al Khobar
Kingdom of Saudi Arabia

E: sales@gaz-gmbh.com

**www.gaz-gmbh.com**

**GAZ Energy, LLC.**

4404-A West 12th Street
Houston, TX, 77055
United States of America

P: +1 (346) 460 3482
E: sales@gaz-gmbh.com

**www.gaz-gmbh.com**

IN UNITY IS ENERGY®

GAZ Geräte - und Akkumulatorenwerk Zwickau GmbH
Reichenbacher Str. 62-68, 08056 Zwickau, Germany
T: +49 375 86 0, F: +49 375 86 440, E: sales@gaz-gmbh.com

www.gaz-gmbh.com

Ver.: 3/2025