

IULa Charging Characteristic for gel-type VRLA Batteries with grid type (GiV) and tubular type (PzV/PzVB) plates

*We reserve the right to discontinue or change specification any time without notice or obligation.
This specification does not concern legal or safety standards.*

1 Charging characteristic:

IULa (according to DIN 41773)

Regime	Switching	Error message and interrupt
I1 – phase I1 : permitted values for PzV / PzVB $0,6 * I_N \leq I1 \leq 0,75 * I_N \equiv$ $12A/100Ah C_5 \leq I1 \leq 15A/100Ah C_5$ I1 : permitted values for GiV $0,6 * I_N \leq I1 \leq 0,9 * I_N \equiv$ $12A/100Ah C_5 \leq I1 \leq 18A/100Ah C_5$	U = 2,35V/cell (T = 30°C) duration : t1 t1 max. 9h	U ≥ 2,50V/cell t1 > 9h
U – phase U = 2,35V/cell (T = 30 °C)	I2 (see below) duration : t2 (t1 + t2) max : 12h	U ≥ 2,50V/cell (t1 + t2) > 12h
I2 – phase I2 = constant I1 : permitted values for PzV / PzVB $0,055 * I_N \leq I1 \leq 0,0675 * I_N \equiv$ $1,1A/100Ah C_5 \leq I1 \leq 1,35A/100Ah C_5$ I1 : permitted values for GiV $0,055 * I_N \leq I1 \leq 0,08 * I_N \equiv$ $1,1A/100Ah C_5 \leq I1 \leq 1,6A/100Ah C_5$	duration: t3 Duration of t3 is equally the duration of main charging time, but minimum 1 h and maximum 4 h. $1h \leq t3 = t1 + t2 \leq 4h$	U ≥ 2,8V/cell t3 > 4h (t1 + t2 + t3) > 16h
Option: Float charge U _{Float} = 2,30V/cell (T = 30°C) or I _{Float} = I2	Without time limit U _{on} = 2,15V/cell U _{out} = 2,30V/cell (T = 30 °C) Without time limit	U ≥ 2,50V/cell
Equalisation charge Total voltage ≤ 48V: Equalisation charge is not necessary. Total voltage > 48V: Equalisation charge every 4 weeks. I _p = 2 * I2 I = 0A	duration tp1: 15min with I _p duration tp0: 15min with I = 0A 24 pulses = 24 * (15min I _p + 15min 0A) duration of equalisation charge t _{EC} = 12h	U ≥ 2,8V/cell t _{EC} > 12h

$$I_N = C_5 / 5 \text{ h}$$

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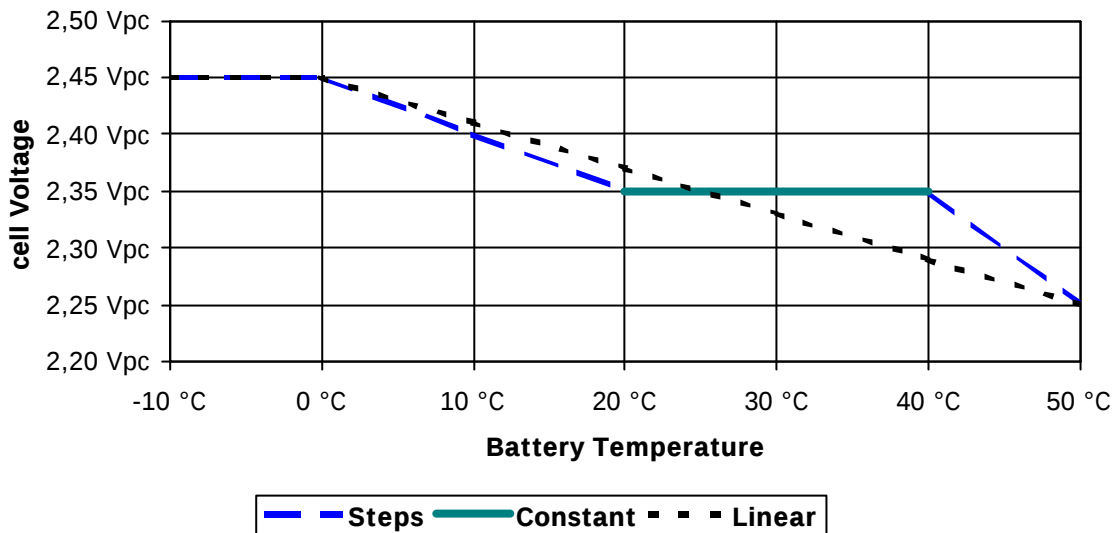
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- Regulations : According to DIN 41773
- Generally: A discharge of the battery after the end of charge or pausing during float charge caused by charger, electric switching devices, ventilation system, displays etc. should be prevented.
- 3 – phase chargers: Connection to mains must be independent of rotation of the field.
- Soft Start to prevent damage at contacts due to sparks
- Indication/Display: charging/ charging finished / float charge / error
- Battery temperature during charging: $-20^{\circ}\text{C} \leq T < 50^{\circ}\text{C}$
at $T > 50^{\circ}\text{C}$ charging has to be stopped
- Temperature differences between single monoblocs
 $dT = T_{\max} - T_{\min} : dT \leq 5\text{K}$
- Temperature range and temperature compensated charge voltage:
 - 1) If the temperature of the battery is permanently in the range of $20 - 40^{\circ}\text{C}$ a temperature compensated voltage is not necessary.
 - 2) If the battery temperature differs permanently from this range the charging voltage has to be compensated.
Characteristic of temperature controlled voltage:
 $T = (T_{\max} + T_{\min}) / 2$
 - 2a) $T \leq 0^{\circ}\text{C} \equiv 2,45\text{V/cell}$
 $T = + 50^{\circ}\text{C} \equiv 2,25\text{V/cell}$
In between linear with slope of:
 $dU / dT = - 4\text{mV/K/cell}$
 - 2b) $T \leq 0^{\circ}\text{C} \equiv 2,45\text{V/cell}$
 $T = +20^{\circ}\text{C} \equiv 2,35\text{V/cell}$
 $T = +40^{\circ}\text{C} \equiv 2,35\text{V/cell}$
 $T = +50^{\circ}\text{C} \equiv 2,25\text{V/cell}$
In between linear
- AC ripple: $I_{\text{eff}} \leq 0,25 * I_N \equiv 5 \text{ A} / 100 \text{ Ah (C}_5\text{) for } 50 - 100\text{Hz}$
- Increase of temperature during charging: maximum 10°C
- Tolerances: according DIN 41773
For fluctuations of mains voltage of $\pm 10\%$ and for fluctuations of mains frequency of $\pm 2\%$:
 $U : \pm 1\%$
 $I : \pm 1\%$
time : $\pm 5\text{min.}$ For $tp1$ and $tp0$: $\pm 1\text{min.}$
Temperature : $\pm 1\text{K}$
 $\leq 10 \text{ mA/100 Ah (C}_5\text{)}$
- Drain
- (current from battery into charger):
- Protection in case of reversed polarity: In case of reversed polarity the charger must not work.
- Protection in case of short circuit: In case of a short circuit of the battery via the charger a fuse or equivalent circuit breaker has to open the circuit fast.
- Recharge of deep discharged batteries: The recharge of deep discharged batteries with a voltage of $U \geq 0,625 * U_{\text{nominal}}$ has to be possible.

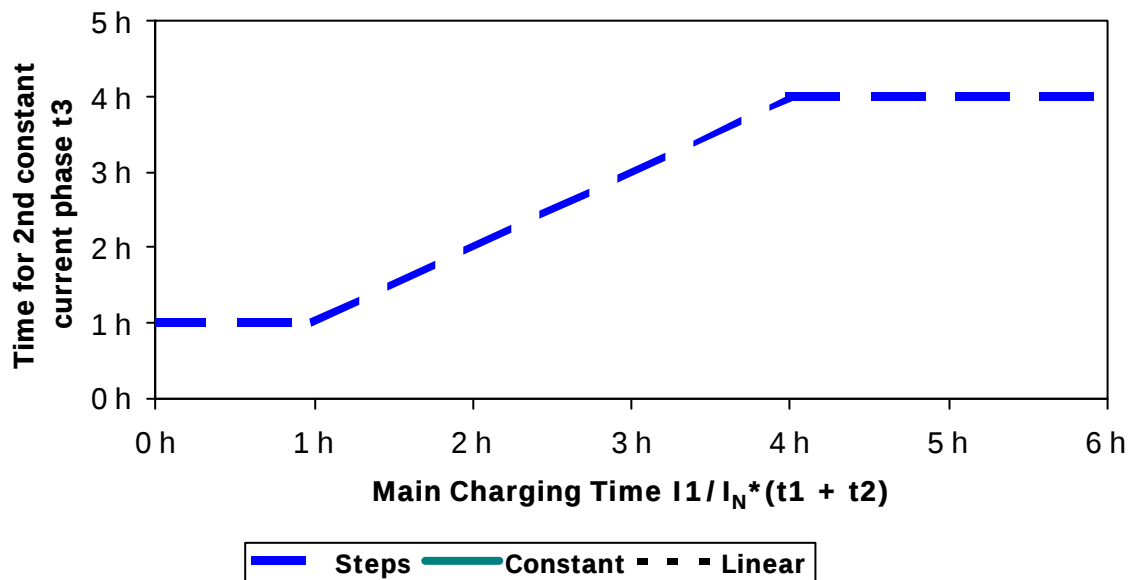
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Charging Voltage for GiV and PzV / PzVB Batteries for IULa- charging characteristic



Timing of 2nd constant current phase in dependance of Main Charging Time



2 Application

This charging technology should be applied to the battery types *dryfit*[®]- traction, *dryfit*[®]- traction block *dryfit*[®]- A500C and DTP drivemobil[®] Gel in cyclic motive power application. It is not permitted to apply it to stationary batteries. For Electric and Hybrid Road Vehicle application see appropriate specification.