IEC 62485-2 / EN 50272-2 ventilation requirement / heat dissipation

Battery **92 x SBM 830**

During the last stage of high-rate charging (end of charge and during overcharge), the battery is emitting gases (oxygen-hydrogen mixture). The purpose of ventilating a battery location or enclosure is to maintain the hydrogen gas concentration below the 4% hydrogen threshold. Battery accommodation rooms are to be considered as safe from explosions, when by the natural or forced ventilation the concentration of hydrogen gas is kept below this safety limit. Note that specific local regulations for battery installation and ventilation may be valid in your area.

Hydrogen gas (H2) Concentration	4%	**standard**	IEC 62485-2 / EN 50272-2
LEL Value	100%		

Ventilation air flow Q

$$Q = v \times q \times s \times n \times I_{gas} \times C_{rt} \times 10^{-3}\ (m^3/h)$$

Variable	Description	Value
v x q x s	v = dilution factor to avoid a 4% hydrogen concentration ((100 % - 4%) / 4%)	24
	q = maximum generated hydrogen for 1 Ah of overcharge per cell assuming no gas recombination	0.42×10^{-3} m³/Ah
	s = general safety factor	5
n	Number of cells	92
$I_{gas} = I_{float/Boost} \times f_g \times f_s$	Current producing gas during overcharge when charged with constant voltage	
	I_{float} = current for the float charge under fully charged condition at 1.4 V to 1.43 V at + 20 °C	1 mA/Ah
	I_{Boost} = current for the boost charge under fully charged condition at 1.5 V to 1.55 V at + 20 °C	10 mA/Ah
	f_g = gas emission factor, proportion of current at fully charged state producing hydrogen	1
	f_s = safety factor taking into account faulty cells and an ageing	5
$I_{gas} = I_{commissioning}$	Current for commissioning at constant current charge at 0,2 C_5 A	200 mA/Ah
C_{rt}	Rated capacity	830 C_5 Ah

	At float	At boost	Commissioning
Air flow Q (m³/h)	19.24	192.43	769.71

Note: The charger must be protected against malfunction. If not, the ventilation should be calculated to suit the greatest current available from the charger.

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Number of air changes per hour

	Length (m)	Width (m)	Height (m)	Volume (m^3)
Battery room volume	10	5	4	200
Occupied volume	2.2	1.2	1	2.64
Free air volume				197.36

	At float	At boost	Commissioning
Number of air changes per hour	19.24 / 197.36 =0.10	192.43 / 197.36 =0.98	769.71 / 197.36 =3.90

Natural ventilation

The amount of ventilation air flow shall preferably be ensured by natural ventilation, otherwise by forced ventilation. For natural ventilation, battery rooms or enclosures require an air inlet and an air outlet with a free area of opening calculated by the formula A > 28 x Q (cm^2). The air velocity is assumed to be 0.1 m/sec.

	At float	At boost	Commissioning
Free area of openings - inlet & outlet (cm^2)	19.24*28=538.8	192.43*28=5388	769.71*28=21551.8

The above calculations are done according to the IEC 62485-2 standard.
Always check local regulations.

Tuesday, July 30, 2024

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Battery **92 x SBM 830**

H2 emissions

The calculated H2 emission value is the amount of H2 that will be released from the cells under normal charging conditions without safety factors.

H2 Emission = 0.42 x 0.001 x Crt x Ihydrogen x n dm^3/h (litre/h)

Actual gassing = 0.63 x 0.001 x Crt x Ihydrogen x n dm^3/h (litre/h)

Variable	Description	Value
$I_{hydrogen} = I_{float/Boost} x(1-R_v)$	Current producing gas during overcharge when charged with constant voltage	
	I_{float} = current for the float charge under fully charged condition at 1.4 V to 1.43 V at + 20 °C	1 mA/Ah
	I_{Boost} = current for the boost charge under fully charged condition at 1.5 V to 1.55 V at + 20 °C	10 mA/Ah
	R_v = recombination degree, proportion of hydrogen that is recombined into water	0.3
$I_{hydrogen} = I_{commissioning}$	Current for commissioning at constant current charge at 0,2 C_5 A	200 mA/Ah
n	Number of cells	92
C_{rt}	Rated capacity	830 C_5 Ah

	At float	At boost	Commissioning
H2 Emission (dm^3/h)	22.4	224	6414
H2+O2 Emission (dm^3/h)	33.7	337	9621

Heat dissipation

The heat dissipation during float is normally used for dimensioning the cooling system. The cells will also generate heat during discharge and recharge but the generated heat will be absorbed by the plates and the electrolyte and will slowly dissipate to the surrounding air.

	At float 1.43V Per cell	**At boost** 1.45V Per cell	**At discharge** av.current of 221A av.voltage of 1.15V Per cell
Heat dissipation per system (W)	27.8	336.6	N/A

IEC 62485-2 / EN 50272-2 ventilation requirement / heat dissipation

Battery **92 x SBM 830**

Safety distance according to IEC 62485-2 chaper 7.7

$$d = 28,8 \times \sqrt[3]{I_{gas}} \times \sqrt[3]{C_{rt}} \text{ mm}$$

Variable	Description	Value
$I_{gas} = I_{float/Boost} \times f_g \times f_s$	Current producing gas during overcharge when charged with constant voltage	
	I_{float} = current for the float charge under fully charged condition at 1.4 V to 1.43 V at + 20 °C	1 mA/Ah
	I_{Boost} = current for the boost charge under fully charged condition at 1.5 V to 1.55 V at + 20 °C	10 mA/Ah
	f_g = gas emission factor, proportion of current at fully charged state producing hydrogen	1
	f_s = safety factor taking into account faulty cells and an ageing	5
C_{rt}	Rated capacity	830 C_5 Ah

	At float	At boost
Safety distance (mm)	462	997

NOTE The required safety distance d can be achieved by the use of a partition wall between battery and sparking device.