

GasTon

Installation & Operation Manual for GTS-G Range of Gel VRLA Battery (Sealed)

GASTON BATTERY INDUSTRIAL LTD.

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1. 1

- Electrolyte is made of gel materials containing SiO₂, non-fluid or no gradation, and average distribution in plates. Proper excessive electrolyte is filled into the battery to avoid DRY OUT under high temperature or over charging. Good cooling performance can prevent THERMAL RUNAWAY of battery.
- Tubular positive plates can prevent flake of active material. Spines are made of Pb-Ca alloy and are characteristic of good corrosion proof performance. Pasted negative plates and radioactive structure of grids improve the utility ratio of active material and large current discharge performance. Grids are made of Pb-Ca alloy that can effectively reduce the release of hydrogen.
- PVC-SiO₂ separators manufactured by European AMER-SIL Company are applied only for gel battery and are porous and low resistance.
- ABS containers and covers are made by Italian PLASTUM Company and are sealed with resin imported from Germany to prevent leakage of acid and gas.
- Combined copper posts are inner embedded and sealed with imported resin sealing agent. Special sealing structure and protection cover of posts ensures the sealing reliability.
- Safe valves are also imported from Germany. Constant pressure to open and close the valve can enhance the battery reliability and prevent bulge of container and dry out of electrolyte.

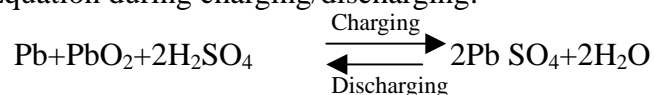
1. 2

- Standby power source for various communication and signal systems such as Telecom, Mobile and Railway and so forth
- Standby power source for electric power system and nuclear power station, power storage for solar and wind power systems
- Standby power source for UPS and emergency illumination
- Standby power source for ships or marine affairs

2. Product Working Theory

2.1 Working and Sealing Theory

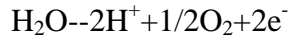
Chemical Equation during charging/discharging:



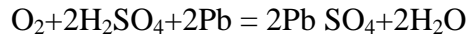
During the later period of charging or under overcharging, hydrogen will be released from the positive plate and oxygen from the negative. We use Pb-Ca alloy grids to restrain the release of hydrogen. Gel electrolyte improves oxygen recombination efficiency inside the sealed battery. No water loss in the battery so that water addition is free during operation.

2.2 Working Steps and Chemical Equations

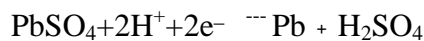
First Step: During the later period of charging or under overcharging, water will be decomposed and oxygen will be released from the positive.



Second Step: Oxygen will spread and arrive at the negative, compose with lead in the negative and sulfuric acid.



Third Step: PbSO_4 is broken down into lead and sulfuric acid in charging.



3. Product Specifications and Technical Parameters

3.1 Dimensions and Weights

Model(Type)	V	Ah	Post	Outside Dimension				±0.5Kg Weight
				(L)	(W)	(h)	(H)	
GTS-200G	2	200	1	103	206	354	380	20.0
GTS-250G	2	250	1	124	206	354	380	24.0
GTS-300G	2	300	1	145	206	354	380	29.0
GTS-350G	2	350	1	124	206	470	496	31.0
GTS-420G	2	420	1	145	206	470	496	36.0
GTS-500G	2	500	1	166	206	470	496	42.0
GTS-600G	2	600	1	145	206	645	671	50.0
GTS-630G	2	630	1	254	210	470	496	53.5
GTS-700G	2	700	1	254	210	470	496	59.5
GTS-770G	2	770	1	254	210	470	496	65.5
GTS-800G	2	800	2	191	210	645	671	68.0
GTS-1000G	2	1000	2	233	210	645	671	82.0
GTS-1200G	2	1200	2	275	210	645	671	97.0
GTS-1500G	2	1500	2	275	210	795	821	120.0
GTS-2000G	2	2000	3	399	212	772	797	160.0
GTS-2500G	2	2500	4	487	212	772	797	200.0
GTS-3000G	2	3000	4	576	212	772	797	240.0

3.2 Product Diagrams

4. Product Performance and Curves

4.1 Performance Curves

- Charge Curve
- Discharge Capacity Vs Temperature
- Discharge Curve under Different Rates
- Coup De Fouet Discharge Curve at 1h Rate
- Coup De Fouet Discharge Curve at 0.5h Rate
- Discharge Curve for 1min
- Discharge Capacity Factor Vs Discharge Time
- Capacity Calculation Factor Curve

4.2 Discharge Currents under Different Rates for Different End of Discharge Voltages

4.2.1: Discharge Currents under Different Rates, EOD Voltage: 1.90V/cell

Model (Type)	15'	30'	1h	2h	3h	4h	5h	6h	8h	10h
GTS-200G	147.5	120.0	85.0	55.0	42.0	34.5	30.0	26.0	20.5	18.0
GTS-250G	184.0	150.0	106.0	69.0	53.0	43.0	38.0	33.0	26.0	22.0
GTS-300G	220.8	180.0	128.0	82.5	63.0	52.0	45.0	39.0	31.0	26.5
GTS-350G	208.0	195.0	145.0	98.0	76.0	63.0	53.0	48.0	39.0	33.0
GTS-420G	250.0	234.0	174.0	117.0	91.0	75.0	64.0	57.0	47.0	39.0
GTS-500G	292.0	273.0	203.0	137.0	106.0	88.0	74.5	67.0	55.0	46.0
GTS-600G	312.0	294.0	234.0	165.0	129.0	108.0	92.5	80.0	64.5	53.5
GTS-630G	327.5	309.0	245.5	173.0	135.5	113.0	97.0	84.0	68.0	56.0
GTS-700G	364.0	343.0	273.0	192.5	150.0	126.0	108.0	93.0	75.0	62.5
GTS-770G	400.0	377.0	300.0	211.0	165.5	138.5	119.0	102.0	82.5	68.5
GTS-800G	416.0	392.0	312.0	220.0	172.0	144.0	123.5	106.5	86.0	71.5
GTS-1000G	520.0	490.0	390.0	275.0	215.0	180.0	154.0	133.0	107.0	89.0
GTS-1200G	624.0	588.0	468.0	330.0	258.0	216.0	184.5	160.0	128.5	107.0
GTS-1500G	600.0	600.0	522.0	390.0	307.5	248.5	211.5	186.0	154.0	127.5
GTS-2000G	800.0	800.0	696.0	520.0	410.0	331.5	282.0	248.0	205.0	170.0
GTS-2500G	1000.0	1000.0	870.0	650.0	512.0	414.0	352.0	310.0	256.0	212.0
GTS-3000G	1200.0	1200.0	1044.0	780.0	614.4	497.0	422.5	372.0	307.5	254.5

Discharge Currents under Different Rates, EOD Voltage: 1.87V/cell

Model(Type)	15'	30'	1h	2h	3h	4h	5h	6h	8h	10h
GTS-200G	163.5	132.0	91.5	58.5	44.5	36.5	31.5	27.5	21.6	18.5
GTS-250G	204.0	165.0	114.0	73.0	56.0	46.5	39.0	34.0	27.0	23.0
GTS-300G	245.0	198.0	137.0	88.0	67.0	55.0	47.8	41.0	32.5	28.0
GTS-350G	250.0	216.0	158.0	106.0	80.5	66.0	57.0	50.0	40.5	34.0
GTS-420G	300.0	259.5	190.6	127.5	97.0	79.5	68.0	59.5	48.6	40.8
GTS-500G	350.0	302.5	237.0	159.0	121.0	99.0	85.0	74.5	60.8	44.0
GTS-600G	360.0	330.0	258.0	177.0	137.0	114.0	97.5	85.0	67.2	56.0
GTS-630G	378.0	346.5	271.0	186.0	143.5	119.5	102.0	89.0	70.5	58.0
GTS-700G	420.0	385.0	301.0	206.5	160.0	133.0	114.0	99.0	78.5	65.0
GTS-770G	462.0	423.5	331.0	227.0	176.0	146.0	125.0	109.0	86.0	71.0
GTS-800G	480.0	440.0	344.0	236.0	182.5	152.0	130.0	113.0	89.6	74.5
GTS-1000G	600.0	550.0	430.0	295.0	228.0	190.0	162.0	141.0	112.0	93.0
GTS-1200G	720.0	660.0	516.0	354.0	274.0	228.0	194.5	169.5	134.4	112.0
GTS-1500G	720.0	720.0	594.0	432.0	340.0	274.0	233.0	204.0	163.2	136.0
GTS-2000G	960.0	960.0	792.0	576.0	453.0	365.0	310.5	272.0	217.6	181.0
GTS-2500G	1200.0	1200.0	990.0	720.0	566.0	456.0	388.0	340.0	272.0	226.0
GTS-3000G	1440.0	1440.0	1188.0	864.0	679.5	547.5	466.0	408.0	326.4	272.0

Discharge Currents under Different Rates, EOD Voltage: 1.83V/cell

Model(Type)	15'	30'	1h	2h	3h	4h	5h	6h	8h	10h
GTS-200G	185.6	145.6	98.5	62.0	47.0	38.0	32.5	28.5	23.0	19.5
GTS-250G	232.0	182.0	123.0	77.5	58.5	47.5	41.0	35.5	29.0	24.0
GTS-300G	278.5	218.5	147.6	93.0	70.2	57.0	49.0	43.0	34.5	29.0
GTS-350G	290.0	244.0	175.0	113.0	85.0	70.0	60.0	52.5	42.5	34.5
GTS-420G	348.0	292.8	210.0	135.6	102.0	84.0	72.0	63.0	51.0	42.6
GTS-500G	406.0	341.6	245.0	158.5	119.0	98.0	84.0	73.5	59.5	49.7
GTS-600G	444.0	378.0	288.0	192.0	145.8	120.0	101.5	88.0	70.5	58.5
GTS-630G	466.5	397.0	302.5	202.0	153.0	126.0	107.0	92.5	74.0	61.5
GTS-700G	518.0	441.0	336.0	224.0	169.0	140.0	118.5	102.5	82.0	68.5
GTS-770G	570.0	485.0	370.0	246.0	186.0	154.0	130.0	113.0	90.0	75.0
GTS-800G	592.0	504.0	384.0	256.0	194.5	160.0	135.5	117.0	94.0	78.0
GTS-1000G	740.0	630.0	480.0	320.0	243.0	200.0	169.0	146.0	117.0	97.0
GTS-1200G	888.0	756.0	576.0	384.0	292.0	240.0	202.8	175.5	140.5	116.5
GTS-1500G	912.0	840.0	678.0	480.0	372.0	300.0	253.5	218.5	171.6	144.0
GTS-2000G	1216.0	1120.0	904.0	640.0	496.0	400.0	338.0	291.5	228.8	192.0
GTS-2500G	1520.0	1400.0	1130.0	800.0	620.0	500.0	422.0	364.0	286.0	240.0
GTS-3000G	1824.0	1680.0	1356.0	960.0	744.0	600.0	506.5	436.8	343.5	288.0

Discharge Currents under Different Rates, EOD Voltage: 1.80V/cell

Model(Type)	15'	30'	1h	2h	3h	4h	5h	6h	8h	10h
GTS-200G	201.6	153.6	102.0	63.6	50.0	39.5	33.5	28.8	23.5	20.0
GTS-250G	252.5	192.0	127.5	79.5	62.5	49.0	41.5	36.0	29.0	25.0
GTS-300G	302.5	230.5	153.0	95.5	75.0	58.8	49.8	43.5	34.8	30.0
GTS-350G	320.0	265.0	185.0	117.0	87.5	72.0	61.5	53.5	43.0	36.5
GTS-420G	384.0	318.0	222.0	140.5	105.0	85.8	73.8	64.2	51.6	42.5
GTS-500G	448.0	371.0	259.0	163.8	122.5	100.5	86.5	74.9	60.5	50.0
GTS-600G	492.0	420.0	312.0	199.2	150.0	122.5	103.8	90.0	72.0	60.0
GTS-630G	517.0	441.0	328.0	210.0	157.5	129.0	109.0	94.5	76.0	63.0
GTS-700G	574.0	490.0	364.0	232.0	175.0	143.0	121.0	105.0	84.0	70.0
GTS-770G	631.0	539.0	400.0	256.0	192.5	157.0	133.0	115.5	92.5	77.0
GTS-800G	656.0	560.0	416.0	265.6	200.0	163.5	138.5	120.0	96.0	80.0
GTS-1000G	820.0	700.0	520.0	332.0	250.0	204.0	173.0	150.0	120.0	100.0
GTS-1200G	984.0	840.0	624.0	398.5	300.0	244.8	207.6	180.0	144.0	120.0
GTS-1500G	1008.0	924.0	738.0	506.5	390.0	313.5	263.0	226.8	180.0	150.0
GTS-2000G	1344.0	1232.0	984.0	675.5	520.0	418.0	350.5	302.5	238.5	200.0
GTS-2500G	1680.0	1540.0	1230.0	844.0	625.0	522.0	438.0	378.0	298.0	250.0
GTS-3000G	2016.0	1848.0	1476.0	1012.0	780.0	626.5	525.5	453.6	357.6	300.0

Discharge Currents under Different Rates, EOD Voltage: 1.75V/cell

Model (Type)	15'	30'	1h	2h	3h	4h	5h	6h	8h	10h
GTS-200G	227.2	164.8	110.0	65.6	50.0	40.0	34.0	29.6	24.0	20.0
GTS-250G	284.0	206.0	137.5	82.0	62.5	50.0	42.5	37.0	30.0	26.0
GTS-300G	340.8	247.2	165.0	98.4	75.0	60.0	51.0	44.4	36.0	30.0
GTS-350G	368.0	290.0	196.0	121.5	90.5	74.0	63.0	55.0	44.0	37.0
GTS-420G	441.6	348.0	235.2	145.8	108.6	88.8	75.6	66.0	52.8	44.5
GTS-500G	515.2	406.0	274.4	170.5	126.7	103.6	88.2	77.0	61.6	51.8
GTS-600G	564.0	468.0	336.0	208.2	156.0	126.0	105.6	92.4	73.2	61.0
GTS-630G	592.0	491.0	352.5	218.5	164.0	132.0	111.0	97.0	76.8	64.0
GTS-700G	658.0	546.0	385.0	243.0	182.0	147.0	123.0	108.0	85.5	71.0
GTS-770G	723.0	600.0	423.5	267.0	200.0	162.0	134.0	118.5	94.0	78.0
GTS-800G	752.0	624.0	448.0	277.6	208.0	168.0	140.8	123.2	97.6	81.0
GTS-1000G	940.0	780.0	560.0	347.0	260.0	210.0	176.0	154.0	122.0	101.0
GTS-1200G	1128.0	936.0	672.0	416.5	312.0	252.0	211.2	184.8	146.4	121.0
GTS-1500G	1200.0	1056.0	825.0	540.0	403.0	326.4	272.4	234.0	184.8	152.5
GTS-2000G	1600.0	1408.0	1100.0	720.0	544.0	435.2	363.2	312.0	246.4	203.5
GTS-2500G	2000.0	1760.0	1375.0	900.0	630.0	544.0	454.0	390.0	308.0	254.0
GTS-3000G	2400.0	2112.0	1650.0	1080.0	816.0	652.8	544.3	468.0	369.6	305.0

Discharge Currents under Different Rates, EOD Voltage: 1.70V/cell

Model(Type)	15'	30'	1h	2h	3h	4h	5h	6h	8h	10h
GTS-200G	249.6	172.0	111.0	66.8	50.0	40.4	34.5	30.0	24.0	21.0
GTS-250G	312.0	215.0	137.5	83.5	62.5	50.5	42.5	37.0	30.5	26.0
GTS-300G	374.5	258.0	165.5	100.5	75.0	60.6	51.0	44.5	36.0	30.5
GTS-350G	408.0	312.0	202.0	124.5	92.0	74.5	63.5	55.0	44.5	38.0
GTS-420G	489.6	374.5	242.5	149.5	110.5	89.5	76.5	66.0	53.0	45.0
GTS-500G	571.5	436.8	282.8	174.5	129.0	104.5	90.0	77.0	62.0	52.0
GTS-600G	636.0	516.0	351.0	241.5	159.0	126.6	106.5	92.5	73.5	62.0
GTS-630G	667.5	542.0	368.5	253.5	167.0	133.0	111.5	97.0	77.0	65.0
GTS-700G	742.0	602.0	409.5	250.0	185.5	148.0	124.0	108.0	85.5	72.0
GTS-770G	816.0	662.0	450.0	275.0	204.0	162.5	136.5	119.0	94.0	78.0
GTS-800G	848.0	688.0	468.0	285.6	212.0	168.8	141.6	123.5	97.6	82.0
GTS-1000G	1060.0	860.0	585.0	357.0	265.0	211.0	177.0	154.0	122.0	102.0
GTS-1200G	1272.0	1032.0	702.5	428.5	318.0	253.5	212.5	184.8	146.5	122.0
GTS-1500G	1368.0	1164.0	876.0	566.5	420.0	334.8	278.5	238.8	186.0	154.0
GTS-2000G	1824.0	1552.0	1168.0	755.5	560.0	446.5	371.5	318.5	248.0	205.0
GTS-2500G	2280.0	1940.0	1460.0	944.0	700.0	558.0	464.0	398.0	310.0	256.0
GTS-3000G	2736.0	2328.0	1752.0	1132.0	840.0	669.6	556.8	477.6	372.0	307.5

5. Charge Method

5.1 Equalizing Charge

5.1.1 Initial Charge

Batteries lose some charge during shipping as well as during the storage period. The battery should be given initial charge before put into operation.

If storage time is within 6 months, charge with 2.35V/cell for 8 hours

If storage time is within 12 months, charge with 2.35V/cell for 12 hours

If storage time is within 24 months, charge with 2.35V/cell for 24 hours

5.1.2 Equalizing Charge after Deep Discharge

A battery should be given an equalizing charge after deep discharge. There are Constant Voltage Method and Constant Current Method from which we can make a better choice according to the charger's performance.

- Constant Voltage Method: charge voltage is 2.35V/cell (25±5C) and charge current is no

larger than $2.5I_{10A}$. Charge current will decrease during the process of charging. When charge current is less than $0.1I_{10A}$, the battery will turn to float charge. If the environmental temperature is beyond this range in a rather long time, charge voltage should be adjusted according to this coefficient, -3mV/C/cell . (Refer to Fig.5.3)

- Constant Current Method: charge current is $0.5I_{10A}\sim 2.5I_{10A}$. The battery will turn to float charge when terminal voltage reach 2.40V/cell (25C). Charge capacity should be 1.2-1.3 times of discharge capacity.

5.2

Float voltage should be 2.23V/cell at $25\pm 5\text{C}$. If environment temperature is beyond this range in a rather long time, charge voltage should be corrected according to the coefficient, -3mV/C/cell Reduce the float voltage if temperature is too high and raise it if temperature is too low. (Refer to Fig.5.3)

5.3 Float Voltage & Equalizing Voltage at Different Temperatures

Temperature	Float Voltage per cell	Equalizing Voltage per cell
-15C~10C	$2.35\pm 0.005\text{V}$	$2.47\pm 0.005\text{V}$
0C~10C	$2.30\pm 0.005\text{V}$	$2.42\pm 0.005\text{V}$
10C~20C	$2.25\pm 0.005\text{V}$	$2.37\pm 0.005\text{V}$
20C~30C	$2.23\pm 0.005\text{V}$	$2.35\pm 0.005\text{V}$
30C~45C	$2.20\pm 0.005\text{V}$	$2.32\pm 0.005\text{V}$

6. Product Installation

6.1 Preparations before Installation & Points for Attention

- Batteries are charged to leave the factory. Avoid vibration and collision in shipping and handling. One should hold tightly the bottom of the battery when handling. Any force on terminals is FORBIDDEN.
- KEEP a ventilation environment for batteries and DO NOT expose batteries to an environment where flames and static electricity is liable to emerge.
- MAKE SURE that the environment temperature is in the range of $-15\text{C}\sim 45\text{C}$. Temperature of $10\text{C}\sim 30\text{C}$ is recommended.

- Tools such as torque spanners, screw drivers and so on should be insulated before use in case of short circuit. Wear rubber gloves and safety goggles when installing.
- USE Automatic Constant Voltage Chargers that can keep a voltage regulation precision of $\pm 2\%$ when load variation ranging in 0-100%.
- MAKE SURE OF right polarities of batteries in connection.
- USE torque spanner to fix bolts with torque moment of $15N \cdot M$ or so.
- DO NOT connect batteries that differ in types, voltage or capacity, or produced by different manufacturers.
- To install batteries as near as possible to the load in case of voltage drop and energy loss.

6.2 Installation

6.2.1 Vertical Installation Rack

- MAKE SURE that the environment for installation and operation is proper for batteries according to 6.1.
- Have a check on batteries and spare parts according to spare parts list before installation.
- MAKE SURE of the right location of ground bolt holes on installation racks. Drill ground bolt poles and fix the ground bolts.
- Fix racks on the ground bolts and tightly wring all the bolts and screws.
- Install units of the general voltage output terminal to the right place on installation rack and tightly fix them.
- Clear terminals and cables, put batteries into the rack or cabinet (keep a distance of 10mm between batteries), and connect terminals and cables with M10 bolts, torque moment of spanner is about $15N \cdot M$.
- Test the voltage and polarity of every single cell as well the whole battery group. Connect the voltage monitor cable of the group and every single battery after confirmation.
- Label serial number on the battery, insulate connecting cables and label identical markings, and clear the working spot.
- Examine battery chargers to make sure that battery management pattern is right. Test the environment temperature and adjust float voltage, equalizing voltage as per fig.5.3. Examine the protection device of chargers to avoid over discharge of batteries.

6.2. 2 Horizontal Installation Cabinet

- MAKE SURE that the environment for installation and operation is proper for batteries according to 6.1.
- Have a check on batteries and spare parts according to spare parts list before installation.
- Take apart doors and fenders of the installation cabinets.
- MAKE SURE of the right location of ground bolt holes on installation racks. Drill ground bolt poles and fix the ground bolts.
- Fix cabinets on the ground bolts and tightly wring all the bolts and screws.
- Clear terminals and cables, put batteries into the rack or cabinet (keep a distance of 10mm between batteries), and connect terminals and cables with M10 bolts, torque moment of spanner is about 15N*M.
- Test the voltage and polarity of every single cell as well the whole battery group. Connect the voltage monitor cable of the group and every single battery after confirmation.
- Label serial number on the battery, insulate connecting cables and label identical markings, install the door, and clear batteries, surface of cabinets and the working spot.
- Examine battery chargers to make sure that battery management pattern is right. Test the environment temperature and adjust float voltage, equalizing voltage as per fig.5.3. Examine the protection device of chargers to avoid over discharge of batteries.

7. Operation and Maintenance

- 7.1
- Take monthly examination on float voltage of battery groups and keep records. If any voltage deviation or temperature variation happens, modify the charge parameters according specific requirements.
- Take monthly examination on real power, real working voltage and current of battery load. If any value does not meet the set parameter, proper correction should be done on the load to avoid over discharge. If the real load power increases too much, then batteries capacity should be increased accordingly.
- Examine the connection part between battery terminals and cable every three months to avoid loose connection.

7.2 Common Faults and Resolutions

Description	Reason	Resolution
In the initial stage of operation, voltage of a single battery or the whole group drops rapidly when discharging.	<ul style="list-style-type: none"> ● Loose connection of bolts on terminals ● Dirt on the surface of terminals or connectors increases voltage drop of connection. 	<ul style="list-style-type: none"> ● Wring the bolts till they are tightly fixed. ● Clear the terminals and connectors and reinstall the bolts.
Discharge is under normal condition in the initial operation, but the load will soon be cut off electricity.	The lowest limit for battery protection voltage set on the switch device is too high.	Correct the lowest limit for battery protection voltage to be a lower value. The recommended range is 1.85-1.98V
The real voltage of the battery group is 4V less than the calculated value.	A cell in the group is connected with polarities in reverse.	Find out and rectify the wrongly connected cell. If the cell has been used for a long time before it is found out, the cell should be over discharged first and recharged then. If the cell cannot reach its normal capacity, it should be replaced.
Large difference of float voltage between single cells.	Minor difference among the inner structures of batteries or in shipping and storage.	<ul style="list-style-type: none"> ● After float charge for 3 months in the initial stage of operation, voltages will tend to be the same. ● Discharge the battery group and release about 20% of the capacity. Then recharge batteries under constant voltage and charging time can be properly prolonged.

- If any injury, leakage or heating happens and affect battery operation, please contact with

our servicemen. Call, mail and email are all available.

(Please refer to the inside back cover for details)

9. Product Installation Method, Dimensions and Diagrams.

8.1 Installation Method and Dimensions

8.2 Installation Diagrams