GNB Flooded Classic®

INSTALLATION
&
OPERATING
INSTRUCTIONS

FOR TCXG TUBULAR LEAD-CALCIUM BATTERIES

SECTION 93.10G 2014-09

GNB® INDUSTRIAL POWER

YOUR GNB INDUSTRIAL POWER REPRESENTATIVE

SALESPERSON ______________________________

TELEPHONE ______________________________

LOCATION ______________________________

GNB SERVICE ASSISTANCE
1-800-241-4895

INDEX

CAUTION! Before proceeding with the unpacking, handling, installation and operation of a lead-acid storage battery, the following general information should be reviewed together with the recommended safety precautions.

A lead-acid battery is an electrochemical device that contains electrolyte. The electrolyte is corrosive and can cause injury.

Lead-acid batteries, when installed, are capable of high voltage that can cause electrical shocks to personnel.

All lead-acid batteries in the course of normal operation generate gases that could be explosive.

SECTION 1

1.0 SAFETY

1.1 Follow your company's safety instructions when working with or near industrial lead-acid batteries. Thoroughly familiarize yourself with industry and government guidelines for charging, handling, and maintaining industrial batteries.

1.2 Assign battery and charger care to properly trained personnel. The battery contains sulfuric acid. Avoid sulfuric acid contact with skin, eyes, or clothing. Wear a rubber apron, gloves, boots, and goggles or face shield when handling, checking, filling, or charging batteries.

1.3 Keep water readily available for flushing spilled electrolyte from eyes or skin. Obtain medical attention immediately.

1.4 Batteries produce hydrogen. Keep open flames away. Do not check electrolyte level with a cigarette lighter or match. Use a flashlight or permanent lights only. Do not smoke or create sparks when working on batteries.

1.5 Platform lifts of adequate capacity to handle cell weights and dimensions may be used provided they are stable and capable of reaching needed heights and used on smooth and level floor conditions.

1.6 Never lay metal tools, such as wrenches or other material on top of batteries.

1.7 Insulate tool handles to protect against shorting.

1.8 Make sure that all battery connections are properly prepared and tightened to prevent possible injury to personnel or failure of system.

1.9 If acid is spilled on the floor, apply a strong neutralizer, like baking soda. Check local regulations regarding disposal of neutralized waste.

SECTION 2

2.0 RECEIVING BATTERIES

2.1 Immediately upon receipt of shipment, examine for possible damage caused in transit. Damaged packing material or staining from leaking electrolyte would indicate rough handling. If such conditions are found, make notation on delivery receipt before signing. If battery damage is found, request an inspection by the carrier and file a damage claim. Also notify your GNB® Industrial Power representative.

2.2 Shortly after receipt (within 15 days), examine all batteries for concealed damage. Pay particular attention to packing materials exhibiting damage or electrolyte staining. Perform examination prior to installation and disposal of packing materials. Examine cells for container damage, misaligned elements, broken plates, or any other visible damage.

SECTION 3

3.0. STORAGE

3.1. If the battery is not to be installed at the time of receipt, it is recommended that it be stored indoors in a cool [16°C (60°F) to 32°C (90°F)], clean, and dry location. Do not top load pallets as possible battery damage may occur.

3.2. Prior to planned installation of the battery, the accessory parts should be opened and checked against shipping invoice (or battery system drawings) for completeness. Checking parts before storage will eliminate potential delays during installation.

3.3. The storage interval from date of shipment to the date of installation/initial charge should not exceed six (6) months. (Assumes 77°F/25°C average storage temperature. Assume three months maximum storage time for 90°F/32°C average temperatures.) Storage beyond the stated period can result in sulfated plates, which can be detrimental to battery life and performance. Failure to store the battery in accordance with the above recommendations may void the warranty.

SECTION 4

4.0 BATTERY ASSEMBLY AND INSTALLATION

4.1 SITE

It is recommended that the battery be installed indoors in a clean and dry location. The battery should be shielded from direct sunlight, heating units or steam pipes as they can cause temperature gradients in the electrolyte and negatively impact battery performance. The floor should be level and capable of supporting the weight of the batteries (and rack).

4.2 VENTILATION

All lead-acid batteries in the course of normal operation generate gases that could be explosive. Ventilation should be provided in the battery room to prevent hydrogen gas from exceeding a concentration of 1%. Concentrations above this value can result in an explosive mixture that can be ignited by sparks from adjacent electrical equipment. All air moved by ventilation should be exhausted to the outside and not be allowed to re-circulate into other confined areas.

4.3 TEMPERATURE

A battery location having an ambient temperature of 25°C (77°F) will result in optimum battery life. Batteries operated above this temperature will suffer reduced life, while batteries operated below this temperature may exhibit suppressed capacity. Though brief temperature excursions between 0°C (32°F) and 40°C (104°F) can be tolerated, the normal operating temperature is between 16°C (60°F) and 32°C (90°F).

4.4 ELECTROLYTE LEVEL

During normal operation, the electrolyte level should be between the high and low marks on the battery container. Upon receipt of the battery, the electrolyte level may be a bit lower than this mark; after charging, it may be higher. The reason is that gas bubbles formed during charge will adhere to the battery plates, displacing and raising the electrolyte level. Do not attempt to adjust the electrolyte either immediately upon receipt or immediately after the initial charge.

4.5 CELL POSITIONING

By now, it is assumed that the rack has been assembled. Determine the desired position of the positive and negative terminals. Measure and mark the center of the rack. Determine the number of battery blocks that will fit on a step/tier of the rack. If that number is odd, position the centerline of the first battery block on the centerline of the rack step/tier. If the number is even, position the end of battery block on the centerline of the rack step/tier. Work from the center out, positioning the positive terminal next to the negative terminal of the adjacent cell.

If a lubricant is needed to facilitate battery positioning, use only Dow Corning 111. Lubricants that contain solvents may damage the battery containers and void warranty.

4.6 FLASH ARRESTORS

After the batteries have been positioned on the rack (but before the inter-unit and inter-tier connections have been made), replace the shipping caps with the provided flame/flash arrestors.

4.7 CONTACT SURFACES

Gently clean the contact surfaces of the battery terminal posts using a 3M Scotch Brite or similar scouring pad. Coat the electrical contact surfaces lightly with provided No-Ox grease.

4.8 ELECTRICAL CONNECTIONS

Install and torque the provided M8 stainless steel hardware and torque the cell connector (or terminal plate) to the post. Target connection torque is 100 - 110 inch-lbs. (11.3-12.0 N-m). Re-torque the stainless steel hardware 24 hours after the initial tightening to account for relaxation of the lead-hardware connection.

Electrical connections must be clean to minimize voltage drop and prevent connector heating. If corrosion is observed, DO NOT RE-TORQUE! The connection must be disassembled, cleaned, neutralized, and then re-torqued.

Install the inter-tier cables as necessary. Do not connect cables directly to the battery post. Utilize the terminal plates provided for main terminal and inter-tier connections. Re-check to be certain that the batteries are connected positive terminal to negative terminal throughout the string. Before connecting the battery string to the charger/load, measure the total voltage at the battery terminals. The voltage should be equal to the number of cells times the voltage of one cell. For example, 60 cells times 2.09 volts per cell = 125.40 volts (1.250 SG) or 60 cells times 2.05 volts per cell = 123.0 volts (1.215 SG).

4.9 CONNECTION RESISTANCE

Connection resistance or micro-ohm (μΩ) measurements should be taken at the time of installation and annually thereafter. Initial measurements at installation become benchmark values. Future values are compared to this benchmark as an indication of connection integrity. Re-torque of connections should be performed annually or when connection resistance increases to more than 20% over the benchmark value.

4.10 Labels and Markings

Numerals and polarity markings should not be applied until after the cells have been installed on the rack. It is recommended that they be applied to jar surfaces only, and not to cell covers or rack rails.

2. Clean the plastic jar surface, in the area where the numeral is to be located, by using a cloth dampened with a washing soda solution. Immediately dry the area using a soft dry cloth to remove residual washing soda.
CAUTION!! Do not use any solvent type materials as they may cause damage to the plastic jar material.

3. It is a general practice to designate the positive terminal cell as #1 with succeeding cells in series in ascending order.

4.11 INITIAL CHARGE

The first charge that the battery receives after shipping, storage and installation is very important as it may affect the life of the battery. Determine the maximum charge voltage output that the charge system can provide and charge the battery in the least amount of time possible according to Table A. This maximum voltage divided by the number of cells connected in series is the maximum charge voltage per cell (VPC). If long periods of continuous charging are not possible at the installation, (e.g. photovoltaic applications) the battery should be charged where such capability exists.

The recommended times given in TABLE A are considered minimum. Charge the cells until the charge current tapers and stabilizes for 3 hours. Then, charge the battery for the times and voltages given in TABLE A.

SECTION 5

5.0 EQUALIZING CHARGE

An equalizing charge is a special charge given to the battery in operation when one of the following conditions exist:

- The specific gravity of cells is more than 10 points lower than its full charge value.
- The on-charge voltage of any cell is more than 0.05 VPC below the average.
- It is desired to recharge the battery in the least amount of time possible.
- It has been a year since the last equalizing charge.

5.1. Equalize the cells until the charge current tapers and stabilizes for 3 hours, then charge according to the values given in TABLE B.

TABLE A – Initial Charge Voltage per Cell (VPC) and Time after Current Stabilization for 1.215 and 1.250 SG TCXG

	Time (hours)	
VPC	**1.215 SG**	**1.250 SG**
2.32	222	412
2.35	166	304
2.38	126	222
2.41	96	164
2.42	88	148
2.50	42	78

TABLE B – Equalizing Voltage per Cell (VPC) and Time after Current Stabilization for 1.215 and 1.250 SG TCXG

	Time (hours)	
VPC	**1.215 SG**	**1.250 SG**
2.32	111	206
2.35	83	152
2.38	63	111
2.41	48	82
2.42	44	74
2.50	21	39

NOTE: Time Periods listed in tables A and B are for cell temperatures from 70°F (21°C) to 90°F (32°C). For temperatures 55°F (13°C) to 69°F (20.5°C) double the number of hours. For temperatures 40°F (4°C) to 54°F (12°C) use four times the number of hours listed.

SECTION 6

6.0 SPECIFIC GRAVITY

6.1 The Specific Gravity (SG) of a fully charged battery is 1.215 ± 0.010 or 1.250 ± 0.010. Specific gravity is used to determine the cell's state of charge (SOC). The value decreases as the battery is discharged and increases as the battery is recharged.

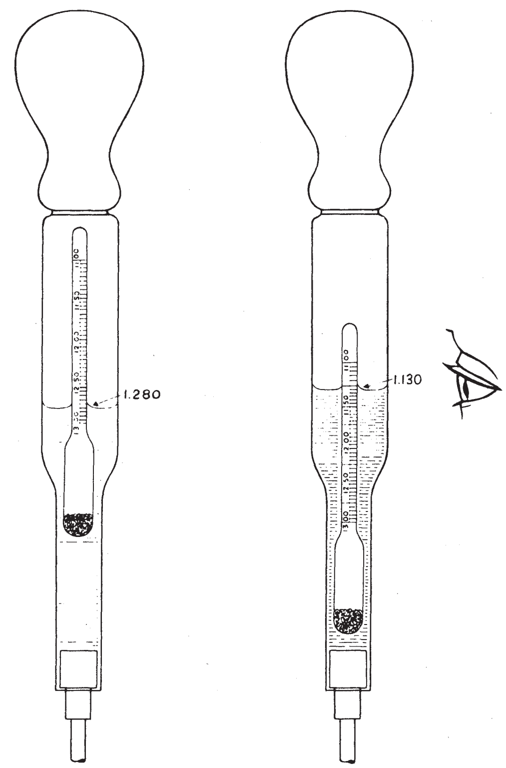

Figure 1

6.2 Specific gravity is expressed to the third decimal place, e.g.1.250, and is measured by a hydrometer float enclosed in a glass barrel/rubber bulb syringe. Holding the hydrometer vertically, draw sufficient electrolyte into the barrel. The reading should be taken when a) no hand pressure is being exerted on the bulb and b) the float is not touching the side of the hydrometer glass. The gravity is then read on the hydrometer scale at the flat surface of the electrolyte. (See Figure 1).

6.3 When making specific gravity readings, corrections must be made for variations in the temperature of the electrolyte. For each 1.67°C (3°F) difference in temperature of the electrolyte above 25°C (77°F), add one point (0.001) to the hydrometer reading. Conversely, for each 1.67°C (3°F) difference below 25°C (77°F), subtract one point (0.001) from the observed hydrometer reading.

Example:

Hydrometer Reading	Cell Temperature	Correction	Reading Corrected to 25°C (77°F)
1.253	20°C (68°F)	-.003	1.250
1.257	30°C (86°F)	+.003	1.260
1.254	35°C (95°F)	+.006	1.260

SECTION 7

7.0 OPERATION

7.1 <u>Operating the battery outside the specified float voltage range can be detrimental to battery life and performance. Failure to operate the battery within the specified float range may void the warranty.</u>

TABLE C – Recommended Float Voltages @ 25°C (77°F)

SG	Float VPC
1.215	2.17-2.25
1.250	2.25-2.35

7.2 Ideally, 108% to 115% of the ampere-hours removed during discharge from a battery should be restored upon recharge to insure 100% state of charge.

SECTION 8

8.0 CELL VOLTAGE VARIATION

8.1 Temperature. Cell voltage non-uniformity can be caused by cell temperature variation throughout the string. To properly analyze battery voltage uniformity within the string, voltage readings should be corrected for (battery electrolyte) temperature. The battery temperature correction factor for voltage equals 0.003 volts for each degree Fahrenheit (0.0055 V/°C) using a base 77°F (25°C).

The correction factor is added to the measured battery voltage above 77°F(25°C). The correction factor is subtracted from the measured battery voltage below 77°F(25°C). Operate the the battery such that its corrected voltage is in the range given for its specific gravity.

Example:

Cell Voltage Readings	Cell Temperature	Voltage Correction Factor	Corrected Cell Voltage @ 25°C (77°F)
2.300	20°C (68°F)	-0.027	2.273
2.300	30°C (86°F)	0.027	2.327
2.300	35°C (95°F)	0.054	2.354

8.2 Damp Covers. Cell Voltage variation can occur when the battery covers become wet or damp. Electrolyte spilled from specific gravity measurements can cause parasitic current paths across the tops of cell covers. These paths reduce the quantity of current going through the battery and result in undercharging and voltage variation. Eliminate the paths by cleaning the battery cover with a solution of baking soda and water (1 pound soda per gallon of water). Apply a cloth dampened with the solution and neutralize acid until fizzing stops, then wipe area with a clean cloth dampened only with water to remove the soda. Do not get any of the baking soda solution inside the battery.

SECTION 9

9.0 WATER ADDITIONS

9.1 The water in the electrolyte of a battery is lost by evaporation and through hydrolysis into its component hydrogen and oxygen gases. Both the water vapor and electrolytic gases are liberated to the environment through the cell vent. Periodically it will be necessary to add water to the battery. When necessary to add water to the battery, do so before the battery is equalized. This will allow added water and electrolyte to properly mix.

9.2 The use of distilled or de-ionized water is recommended to minimize the chance of adding harmful impurities into the battery.

SECTION 10

10.0 TAP CONNECTIONS

GNB advises against tapping portions of the battery as this condition may cause unbalanced charging. The untapped portion may get overcharged while the tapped portion may become undercharged resulting in poor performance and reduced life.

SECTION 11

11.0 Pilot Bloc

11.1 A pilot bloc is selected in the series string to reflect the general condition of all blocs in the battery regarding specific gravities, float voltage and temperature. It serves as an indicator of the battery condition between scheduled maintenance periods.

11.2 It is recommended that a different pilot bloc be selected each year.

SECTION 12

12.0 Records

12.1 A complete recorded history of the battery operation is required. These records will show when corrective action may be required to eliminate charging, maintenance or environmental problems. These records will also be required for consideration of warranty.

12.2 Data should be recorded on the Stationary Battery Maintenance Report shown at the end of this manual. Report headings should be filled in completely during the actual dates(s) of installation.

12.3 Upon completion of the initial charge and with the battery floating at the recommended float voltage for one week, read and record individual cell voltages, connection resistances, specific gravities (corrected to 25°C / 77°F), ambient temperature plus cell temperatures and electrolyte levels for 10% or more of the cells. The cell temperature readings should be taken at each step/tier of the rack to reflect the actual conditions.

12.4 The first set of readings will be the basis for comparison with subsequent readings to reflect possible operating problems and the need for corrective action.

12.5 Monthly - Observe the general appearance and cleanliness of the battery. Record battery terminal voltage. Check electrolyte levels and adjust if necessary. Check for cracks in the battery and any signs of leakage. Note any evidence of corrosion at terminals and/or connectors. Record pilot cell voltage, specific gravity and temperature.

12.6 Quarterly - Supplement the monthly inspection and record keeping with all battery voltages and specific gravities. Check and record the electrolyte temperature of one cell on each level of the rack(s).

12.7 Annual - Supplement Quarterly reports by tightening all bolted connections to the specified torque values. Record connection resistances of each battery post to battery post, battery post to terminal. Remake any connections that are more than 20% above installation base value. Check integrity of the rack.

12.8 Record dates of any equalizing charges as well as total quantity of water when added. Always record any maintenance and/or testing conducted.

SECTION 13

13.0 Capacity Testing

When a capacity discharge test is desired, it is recommended that it be performed in accordance with the latest revision of IEEE-450, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.

An equalizing charge, as described in Section 7.2 must be completed within 7 days prior to the capacity test. The batteries must be returned to float charging immediately after the equalize charge completes. Allow the batteries to float at least 72 hours prior to capacity discharge.

After the capacity discharge has completed, the batteries can be recharged in the shortest amount of time by applying an equalize charge

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GNB Flooded **Classic**

STATIONARY BATTERY MAINTENANCE REPORT

Date ____________________

Operating Company ____

Address ____

Battery location and/or number ____

No. of Cell ______________ Type ______________ Date New ______________ Date Installed ______________

Serial No. ______________________ Date & amount of water added ______________________

INDIVIDUAL CELL READINGS

(To be recorded at least quarterly)

Charger Output ______________ Air Temperature ______________ °F

Total Battery Voltage ______________________ Panel Meter ______________

Cell No.	Volts	Sp. Gr.	Conn. Resist.	Cell No.	Volts	Sp. Gr.	Conn. Resist.	Cell No.	Volts	Sp. Gr.	Conn. Resist.
1				65				129			
2				66				130			
3				67				131			
4				68				132			
5				69				133			
6				70				134			
7				71				135			
8				72				136			
9				73				137			
10				74				138			
11				75				139			
12				76				140			
13				77				141			
14				78				142			
15				79				143			
16				80				144			
17				81				145			
18				82				146			
19				83				147			
20				84				148			
21				85				149			
22				86				150			
23				87				151			
24				88				152			
25				89				153			
26				90				154			
27				91				155			
28				92				156			
29				93				157			
30				94				158			
31				95				159			
32				96				160			
33				97				161			
34				98				162			
35				99				163			
36				100				164			
37				101				165			
38				102				166			
39				103				167			
40				104				168			
41				105				169			
42				106				170			
43				107				171			
44				108				172			
45				109				173			
46				110				174			
47				111				175			
48				112				176			
49				113				177			
50				114				178			
51				115				179			
52				116				180			
53				117				181			
54				118				182			
55				119				183			
56				120				184			
57				121				185			
58				122				186			
59				123				187			
60				124				188			
61				125				189			
62				126				190			
63				127				191			
64				128				192			

PILOT CELL READINGS Cell No.____

Are Specific Gravity Readings Corrected for Temperature? Yes—No

for Level? Yes—No

DAILY RECORD

Date	Time	Batt. Term. Volts	Pilot Cell Temp.	Pilot Sp. Gr.	Air Temp.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

WEEKLY RECORD

Date	Time	Pilot Cell Volts	Batt. Term. Volts	Air Temp.

Remarks and Recommendations ______________________

READINGS TAKEN BY ______________________

WHEN ADVICE IS DESIRED PLEASE FORWARD A DUPLICATE OF THIS REPORT TO YOUR GNB REPRESENTATIVE

GB-1000F

NOTES

GNB Industrial Power –
The Industry Leader.

GNB Industrial Power, a division of Exide Technologies, is a global leader in network power applications including communication/data networks, UPS systems for computers and control systems, electrical power generation and distribution systems, as well as a wide range of other industrial standby power applications. With a strong manufacturing base in both North America and Europe and a truly global reach (operations in more than 80 countries) in sales and service, GNB Industrial Power is best positioned to satisfy your back up power needs locally as well as all over the world.

Based on over 100 years of technological innovation the Network Power group leads the industry with the most recognized global brands such as ABSOLYTE®, GNB® FLOODED CLASSIC®, MARATHON®, RELAY GEL®, SONNENSCHEIN®, and SPRINTER®. They have come to symbolize quality, reliability, performance and excellence in all the markets served.

GNB Industrial Power takes pride in its commitment to a better environment. Its Total Battery Management program, an integrated approach to manufacturing, distributing and recycling of lead acid batteries, has been developed to ensure a safe and responsible life cycle for all of its products.

GNB Industrial Power
USA – Tel: 888.898.4462
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