PYL – General Instructions for Operations Personnel

GS Yuasa Energy Solutions, Inc.

GS YUASA
Creating the Future of Energy

CONTENTS

1. PURPOSE

This document is issued to provide general information relating to this specific product line for installation and maintenance personnel. For the purposes of this document a 12V bloc or battery will be referred to as a module.

2. PYL SERIES

The PYL series is specially designed for telecommunications applications. The PYL series is part of an extensive line of maintenance free, gas recombinant VRLA batteries offered by GS Yuasa Energy Solutions, Inc. The 10-year design life PYL is the most cost-effective battery solution over the total life cycle for installation in your network.

WARNING: Cancer and Reproductive Harm. Wash hands after handling. www.P65Warnings.ca.gov

3. COMPANY INFORMATION

GS Yuasa Energy Solutions, Inc. is a U.S. subsidiary of GS Yuasa Corporation of Japan. The parent company, GS Yuasa Corporation is a global supplier of high quality, long life Valve Regulated Lead Acid batteries (VRLA) batteries as well as many other types of lead acid batteries and other battery chemistries. GS Yuasa is the world leader in motorcycle and standby storage batteries providing solutions for powersports, telecommunications, UPS, renewable energy, and emergency lighting. Offices are in Roswell, Georgia, located 25 miles North of Atlanta, Georgia.

Office hours are 8:00AM ET – 5:00PM Eastern Time Monday through Friday. The mailing address and contact information are below. For technical support, customer service or assistance with this or any other GYES product:
Call: 866-472-2879
Email: customerservice@gsyuasa-es.com

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4. CERTIFICATIONS

Batteries are UL 1989 listed, GR 4228 compliant, Verizon TPR-9802 compliant, and NEBS certified. Specific technical questions regarding certifications may be referred to our Engineering Department. Call 866-472-2879 or email customerservice@gsyuasa-es.com.

- NEBS Certified
- GR-4228-CORE
- GR-1089
- GR-63
- Verizon TPR-9802
- UL 1989 Listed
- UL 94 V-0 Case

5. SAFETY AND HANDLING

The following precautions should be observed when handling and working with batteries. It is recommended you follow your Company's Safety Procedures and Practices.

1. Protect terminals from shorting during transportation.
2. Never charge a visibly damaged module (individual 12V battery or bloc).
3. Never charge a frozen module.
4. Keep sparks or other sources of ignition away from module.
5. Use insulated tools to reduce the risk of shorting while installing or removing module.
6. Do not lay tools or metals objects on the top of module.
7. Remove watches, rings and other jewelry when working around modules.
8. Eye protection and protective footwear are recommended and may be required by your employer.
9. Verify circuit polarity and string connections before connecting to the power system.
10. Use proper lifting technique, mechanical lifting equipment or assistance as required when removing or installing modules.
11. Disconnect the module or string of modules from the DC power system or common DC bus prior to removal.
12. The operating area should be ventilated.
13. Modules contain diluted sulfuric acid.

    CAUTION: While the module case is in tact, it is unlikely the user will come in contact with the acid contained inside. Should acid come in contact with eyes, flush the eye with water or eye wash solution and seek medical attention. Should acid come in contact with skin, wash with affected area with water and neutralize immediately to avoid chemical burns.

6. EQUIPMENT FOR INSTALLATION AND REMOVAL

The following are recommended for personal protection and safe installation or removal of modules.

1. Insulated hand tools.
2. Fire extinguisher.
3. Acid spill kit.
4. Eye protection.
5. Eye wash.
6. Mechanical lifting equipment may be required in certain applications such as controlled environmental vaults.

7. TRANSPORTATION

Module terminals should be protected from shorting during transportation. New modules should remain in the original packaging material to protect the case and terminals until they are to be installed. Shock or 'bruising' caused by dropping or rough handling of a module can cause internal damage to plates, inter-cell straps, or compromise the integrity of the case. Modules being removed from service should likewise be protected when being transported from the job site or to the recycler. The PYL series is rated 'NON-SPILLABLE' and should be so labeled during shipping. **The Safety Data Sheet (SDS)** is available for download at the following link: http://www.gsyuasa-es.com

8. DELIVERY INSPECTION

Upon receipt inspect the pallet and packaging for visible damage. Inspect the module terminals and terminal hardware for damage or missing parts. Many shipments include installation kits; application specific installation manual, terminal bolt kits, cable assemblies, lugs, module trays or module stands. The entire shipment should be verified to ensure all components associated with the shipment are present. If missing components or damage is discovered, contact your freight carrier or GYES for instructions.

9. STORAGE

Modules should be stored in a cool, clean and dry place not to exceed the range from -20**o** to 40**o**C. Modules shipped directly to the customer do not require refresh charging upon receipt. Modules stored for extended periods may require a refresh charge prior to installation or further storage (**Table 9.0-A**). Should the OCV be less than **12.5V**, apply a refresh charge by charging the battery for 48 hours at 13.6V at a current not to exceed 25% of rated capacity.

> **NOTE:** Charging should be conducted in a cool, dry and well ventilated location. The batteries should not be exposed to direct sunlight during charging or storage. Temperatures should optimally be in the range of 70-77**o**F. The charging current should be regulated to 25% of the rated capacity of the battery. For example, a 100Ah battery rated at the 8 hour rate should not be charged at a current above 25A.

Batteries should not be allowed to fall below 12.5V during storage. Batteries between 12.1V and 12.4V **may be recovered** and further stored by applying a refresh or boost charge. In the unlikely event batteries are stored beyond the point where the OCV falls below 12.1V, contact **GYES Customer Service**.

Table 9.0-A. Storage Period Based on Temperature

Average Storage Temperature (Centigrade)	Typical Storage Period before Refresh Charging	Recommended Interval to Measure OCV
</= 25°	12 Months	6 months
26°-30°	8 Months	4 months
31°-35°	6 Months	3 months
36°-40°	4 Months	2 months

Customers wishing to measure conductance to evalute incoming stock may also use **Table 9.0-B**.

> **NOTE:** The values found in **Table 9.0-B** are based on characterization of current stock by GYES using the Midtronics Essential (CTE-1000) and Ultra (CTU-6000).

Table 9.0-B. Typical Out-of-Box Conductance Values

Model	Siemens/MHOS Out-of-box
PYL12V45FS	890
PYL12V80TT	1131
PYL12V90TT	1502
PYL12V90FS	1294
PYL12V100FA	1237
PYL12V100FS Rel 2	1208
PYL12V100FS Rel 3	1333
PYL12V100FT	1593
PYL12V140TT	1988
PYL12V155FT	1776
PYL12V160FT	1887
PYL12V175FT	1758
PYL12V185FT	2207
PYL12V200FT	2136

10. CHARGING

Performance and life is in part influenced by the power system and the operating temperature. This is especially true for batteries used in telecommunications standby float applications. The operating temperature range for the PYL series is -40°C to +55°C (short term excursions to 65°C are permissible).

Float voltage and properly functioning temperature compensation are the keys to long battery life. The recommended float voltage range at 25°C is found on the product label for each model of the **PYL series**. High temperature compensation begins at 26°C and low temperature compensation begins at 24°C. The exact points at which temperature compensation begin can be varied slightly as long as the battery is kept within the recommended float range adjusted for temperature.

The rate of increase for **low temperature** compensation is +0.003V per degree centigrade per cell (+3mV/°C/cell) and the rate of decrease for **high temperature compensation** is -3mV/°C/cell. As example a typical 48V power system would be adjusted to begin **high temperature compensation** at 26°C at the rate of -0.072V (72mV) per degree centigrade. If the temperature probe at the string measured 30°C and the float was adjusted to 54.0V at 25°C, the power system should decrease or 'temperature compensate' the float voltage from 54.0V to 53.64V. Likewise, if the battery temperature falls to 15°C the power system would increase the float from 54.0V to 54.72V. This is of course based on an example float of 54.0V at 25°C. **NOTE:** Your Company may have specific guidelines for float voltage and temperature compensation calculated to keep the module or string within the **recommended** range adjusted for temperature.

Excessive current while recharging the module or string after a discharge event may cause internal heating.
The maximum recommended recharge current for the PYL series is found in **Table 10.0-A**.

Table 10.0-A. Recommended Recharge Current

Model	Minimum Current (A)	Maximum Current (A)
PYL12V45FS	4.5	11.3
PYL12V55TT	5.4	13.5
PYL12V80TT	8	20
PYL12V90TT	9	22.5
PYL12V90FS	9	22.5
PYL12V100FA	10	25
PYL12V100FS	10	25
PYL12V100FT	10	25
PYL12V140TT	14	35
PYL12V155FT	15.5	38.8
PYL12V160FT	16	40
PYL12V175FT	17.5	43.8
PYL12V185FT	18.5	46.3
PYL12V200FT	20	50

11. INSTALLATION CONSIDERATIONS

In this section are general considerations for battery installation.

1. Review your Company's Safety Practices and **Section 5** "SAFETY AND HANDLING".
2. Acceptance prior to installation should include a visual inspection for damage or abnormalities in addition to verifying the OCV is **12.5V or above (Section 9** "STORAGE").

NOTE: No other pre-installation acceptance testing is required. Customers who wish to perform conductance testing may establish a reference baseline value or use the values in **Table 11.0-A**. These values are based on characterization of current stock by GYES using the Midtronics Essential (CTE-1000) and Ultra (CTU-6000).

Table 11.0-A. Typical Conductance Reference Values

Model	Siemens/MHOS 30 Days on float
PYL12V45FS	854
PYL12V80TT	1163
PYL12V90TT	1566
PYL12V90FS	1395
PYL12V100FA	1252
PYL12V100FS Rel 2	1180
PYL12V100FS Rel 3	1349
PYL12V100FT	1659
PYL12V140TT	2015
PYL12V155FT	1976
PYL12V160FT	1903
PYL12V175FT	1784
PYL12V185FT	2255
PYL12V200FT	2023

3. Do not install modules in an airtight enclosure.
4. Modules may be installed in an electronics equipment cabinet where required.
5. Lift and move modules carefully to avoid personal injury or damage to the module.

   NOTE: In some cases, this may require two technicians or mechanical lifting equipment. Never lift a module by the terminal or an attached battery cable or battery supply harness.
6. Do not install modules that have been dropped, damaged or show any indication of leakage or corrosion at the terminals.

   NOTE: Damage to the case or terminals may result in premature failure or shorten the life of the module.
7. Do not install modules near sources of ignition.

   NOTE: Under abnormal operating conditions, VRLA modules may generate flammable hydrogen gas. Gassing due to overcharging may occur due to a power system malfunction, improperly adjusted float voltage or temperature compensation or a shorted cell.
8. Verify the polarity is correct before connecting the load or power system to a module or string of modules.
9. Do not mix new and old modules together in the same series string.

   NOTE: GYES recommends modules greater than 1.5 years in service not be mixed in the same series string due the risk of string imbalance. As modules age, charge acceptance will also change.
10. Modules being connected in series to form a string should be at or near the same state of charge.
11. Modules installed as a string should be numbered starting with module #1 at the main positive then sequentially number each module to the last module at the main negative terminal of the string.
12. Allow at minimum 2mm spacing between modules where the additional space is available on the module tray or inside the module compartment. Additional separation is desirable when available.
13. Clean terminals and cable connections with a brass wire brush before assembly.

    NOTE: The application of electrical grade grease such as Sanchem No-Ox-ID A-Special is permitted.
14. Damaged or corroded lugs or cabling should be repaired or replaced before installing a new module or string of modules.
15. Connections to module terminals should be made using the recommended torque specified on the product label (**Table 11.0-B**).

    CAUTION: Excessive torque may lead to post seal failure.

NOTE: Some modules may be equipped with a pre-installed battery cable assembly for certain applications. These terminal bolts or nuts were tightened at our facility using calibrated wrenches and do not require re-torque. Re-torque is not required for any GYES terminal hardware. However, if required by your Company the values in **Table 11.0-B** may be used.

Table 11.0-B. Torque Specifications

Model	Top Bolt in-lbs	Top Bolt Nm	Top Bolt Socket	Front Bolt in-lbs	Front Bolt Nm	Front Bolt Socket
PYL12V45FS	43.4	4.9	10mm	26.55	3.0	8mm
PYL12V55TT	43.4	4.9	10mm	NA	NA	NA
PYL12V80TT	43.4	4.9	10mm	NA	NA	NA
PYL12V90TT	43.4	4.9	10mm	NA	NA	NA
PYL12V90FS	90	10.17	13mm	43.4	4.9	10mm
PYL12V100FA	NA	NA	NA	43.4	4.9	10mm
PYL12V100FS	NA	NA	NA	43.4	4.9	10mm
PYL12V100FT	43.4	4.9	10mm	43.4	4.9	10mm
PYL12V140TT	43.4	4.9	13mm	NA	NA	NA
PYL12V155FT	90	10.17	13mm	43.4	4.9	10mm
PYL12V160FT	90	10.17	13mm	43.4	4.9	10mm
PYL12V175FT	90	10.17	13mm	43.4	4.9	10mm
PYL12V185FT	90	10.17	13mm	43.4	4.9	10mm
PYL12V200FT	90	10.17	13mm	43.4	4.9	10mm

16. Verify the power system float voltage and temperature compensation are set correctly (**See Table 11.0-C below and Section 10** “CHARGING”).

NOTE: Your Company may have specific guidelines for float voltage and temperature compensation calculated to keep the module or string within the recommended range adjusted for temperature.

Table 11.0-C. Float and Temperature Compensation

VpC @ 25°C	High Temp Start	Low Temp Start	Slope
2.25-2.3	26°C	24°C	3mV/°C/Cell

12. MAINTENANCE AND REPLACEMENT

12.1 *Routine Maintenance*

Routine maintenance is not required by GYES. Visual inspection of the module casing and terminals may be included as part of your Company's site or power system routine practices. This visual inspection should be used to identify physical abnormalities such as corrosion, swelling, cracking, or leaking which indicate a need for further testing or evaluation of the modules and power system. Re-tightening module terminal hardware is not required. However, if your Company requires re-torque as part of a routine maintenance, the terminals should be carefully tightened with a torque wrench to the specification found on the product label.

The life of the module is greatly influenced by the power system. In all cases float voltage should be set and adjusted for temperature (**See Section 10** "CHARGING"). In non-environmentally controlled applications, temperature compensation is required. It is imperative the power system be adjusted correctly for float and temperature compensation and a thermal or temperature probe installed on the string.

The ability of the power system to correctly adjust the float for temperature is dependent on the power system's temperature or thermal probe. Module temperature is best read by a thermal probe placed on the side of the battery for 'paddle type' probes or on the negative terminal for 'ring-type' probes. Periodic or routine maintenance of the power system is essential to maximizing life.

Battery recharge current limit should be adjusted where required to limit the current during a recharge event. **See Section 10** "CHARGING" for maximum recharge current recommendation.

12.2 *End of Life*

Modules or a module string should be replaced when they have reached End of Life. The EOL is defined as 80% of rated capacity as determined by a constant current discharge test.

13. DISPOSAL

Lead acid battery recycling is an environmental success story. More than 95% of all battery lead is recycled. Cooperation between suppliers and customers make this closed loop life cycle possible. Batteries should be recycled in accordance with applicable government regulations. For more information about recycling, contact GYES or see **www.americasbatteryrecyclers.org** or **www.batterycouncil.org**.

ABOUT GS YUASA ENERGY SOLUTIONS, INC.

GS Yuasa Energy Solutions, Inc. is an American subsidiary of GS Yuasa Corporation, the world's second largest battery company and a 100+ year old Japanese corporation. GS Yuasa Energy Solutions (GYES) was formed in 2019 to address the growing energy storage and reserve power markets. GYES brings together and leverages GS Yuasa Group's advanced technologies with proven American market successes in lithium, telecom, UPS, alarm & security, and energy storage into a single business unit.

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