TPPL TECHNOLOGY

NexSys® TPPL

NEXSYS®
TPPL BATTERY

OWNER'S MANUAL

EnerSys®
Power/Full Solutions

www.enersys.com

c UL us LISTED

CONTENTS

INTRODUCTION

The information contained in this document is critical for safe handling and proper use of NexSys® TPPL batteries for powering electrical industrial trucks. It contains a global system specification as well as related safety measures, codes of behavior, a guideline for commissioning and recommended maintenance. This document must be retained and available for users working with and responsible for the battery. All users are responsible for ensuring that all applications of the system are appropriate and safe, based on conditions anticipated or encountered during operation.

This owner's manual contains important safety instructions. Read and understand the sections on safety and operation of the battery before operating the battery and the equipment into which it is installed.

It is the owner's responsibility to ensure the use of the documentation and any activities related thereto, and to follow all legal requirements applicable to themselves and the applications in the respective countries.

This owner's manual is not intended to substitute for any training on handling and operating the industrial truck or NexSys® TPPL battery that may be required by local laws and/or industry standards. Proper instruction and training of all users must be ensured prior to any contact with the battery system.

Refer to the abbreviations and terms at the end of this document.

For service, contact your sales representative or call:
1-800-ENERSYS (USA) 1-800-363-7797
www.enersys.com
www.experiencenexsys.com

Your Safety and the Safety of Others is Very Important

⚠ WARNING You can be killed or seriously injured if you don't follow instructions.

RATING DATA

NexSys® TPPL batteries are for small traction applications. The batteries are lead-acid and, valve-regulated utilizing our TPPL (Thin Plate Pure Lead) technology with carbon additive in active material formulation.

Rating Data

1. Nominal capacity C5/C6:	See type plate
2. Nominal voltage:	See type plate
3. Discharge current:	C5/5h or C6/6h
4. Rated temperature:	30°C

Unlike conventional (vented) lead cells and batteries with free liquid electrolyte, NexSys® TPPL batteries have immobilized electrolyte. Instead of a vent plug, a valve is used to regulate the internal gas pressure, which prevents the ingress of oxygen and allows the escape of excess charging gases should an overcharged condition occur. When operating VRLA batteries, the same safety requirements should be followed as for vented batteries. This will help protect against hazards from explosion of electrolytic gas and corrosive electrolyte.

Cell or bloc valves should never be removed. These batteries do not require watering and no attempt to add water should be made.

Any data, descriptions or specifications set forth herein are subject to change without notice. Before using the product(s), the user is advised and cautioned to make their own determination and assessment of the suitability of the product(s) for the specific use in question, and is further advised against relying on the information contained herein as it may relate to any general use or indistinct application. It is the ultimate responsibility of the user to ensure that the product is suitable and the information is applicable to the user's specific application. The product(s) featured herein will be used under conditions beyond the manufacturer's control and therefore all warranties, either express or implied, concerning the fitness or suitability of such product(s) for any particular use or in any specific application, are disclaimed. The user expressly assumes all risk and liability, whether based in contract, tort or otherwise, in connection with the use of the information contained herein or the product itself.

Safety Precautions

	• Pay attention to the operating instructions and keep them close to the battery. • Work on batteries must only be carried out by skilled personnel!
	• Use protective glasses and wear safety clothing when working on batteries. • Adhere to the current accident prevention rules in the country where the battery is used or IEC 62485-3, EN 50110-1.
	• No smoking! • Do not expose batteries to naked flames, glowing embers or sparks, as these may cause the battery to explode. • Avoid sparks from cables or electrical apparatus as well as electrostatic discharges.
	• Acid splashes into the eyes or on the skin must be washed immediately with an abundance of clean water. After abundant flushing, consult a doctor immediately! • Clothing contaminated by acid should be washed in water.
	• Risk of explosion and fire. • Avoid short circuits: do not use non-insulated tools, do not place or drop metal objects on top of the battery. Remove rings, wristwatches and articles of clothing with metal parts that might come into contact with the battery terminals.
	• Electrolyte is highly corrosive. • In the normal operation of this battery, contact with acid isn't possible. If the cell containers are damaged, the immobilized electrolyte (absorbed in the separator) is corrosive like the liquid electrolyte.
	• Batteries are heavy. Ensure secure installation! Use only suitable handling equipment. • Lifting hooks must not damage the cells, connectors or cables. • Do not place batteries in direct sunlight without protection. Discharged batteries can freeze. For that reason, always store in a frost-free zone.
	• Dangerous electrical voltage! • Avoid short circuits: NexSys® TPPL batteries are capable of high short circuit currents. • Caution – metal parts of the battery are always live: do not place tools or other objects on the battery!
	• Pay attention to the hazards that can be caused by batteries.

Ignoring the operating instructions, and repair with non-original parts will render the warranty void. All failures, malfunctions and fault codes of the battery, the charger or any other accessories, must be notified to EnerSys® service immediately.

⚠ WARNING Do NOT use any type of oil, organic solvent, alcohol, detergent, strong acids, strong alkalis, petroleum-based solvent or ammonia solution to clean the jars or covers. These materials may cause permanent damage to the cell or battery jar and cover and will void the warranty.

Failure to follow these operation and maintenance instructions or using parts that are non-original will void the NexSys® TPPL battery warranty.

Commissioning

NexSys® TPPL cells and batteries are supplied in a charged condition. The battery should be inspected to ensure it is in proper physical condition.

Check:

1. The battery compartment and the battery should be in a clean condition.
2. The battery end cables have good contact with the terminals and the polarity is correct.

Use special coding systems for maintenance-free batteries for the charging plug and socket devices to prevent accidental connection to the wrong type of charger.

Never directly connect an electrical appliance (i.e. warning beacon) to a part of the battery. This could lead to an imbalance of the cells. This will damage all cells in the battery and void the battery warranty. A DC-DC converter must be used to supply any low voltage loads.

NexSys® TPPL battery units that are assembled into strings must use flexible cable connections with adequate length to ensure there is no stress on the terminal due to battery movement. EnerSys®-approved fasteners must be used. The valves on the top of the battery must not be sealed or covered. NexSys® TPPL batteries may be installed in any direction except inverted. Only batteries with the same state of discharge should be connected together.

Charge the battery (see “Charging” on page 8) before the first discharge. Sufficient controls should be enacted (colored connectors, Wi-iQ® device, etc) to ensure the battery is only charged using an EnerSys®-approved charger with the appropriate approved NexSys® TPPL battery charging profile.

The specified torque loading for the bolts/screws of the end cables and connectors are detailed in the table below:

NexSys® TPPL Battery Type	Standard Terminal	Terminal Torque		Terminal Adapter	Terminal Torque Nm	
		Nm	lbf in		Nm	lbf in
12NXS26 12NXS36 12NXS38 12NXS50 12NXS62 12NXS90 12NXS120	M6 Female	6.8	60	SAE	6.8	60
12NXS61 12NXS85	M6 Female	9.0	80	N/A	N/A	N/A
12NXS86	3/8–16" Female	6.8	60	SAE	6.8	60
12NXS137 12NXS157	M6 Female	9.0	80	M6 Front Terminal	9.0	80
12NXS166 12NXS186	M8 Female					
All 2-Volt Cells	M10x1.5 Female	25.0	222	None	N/A	N/A

Operation

The nominal rated capacity is at a battery temperature of 30°C (86°F) for C5 or 25°C (77°F) for C6. The optimum lifetime of the battery depends on the operating conditions (temperature and depth of discharge). Higher temperatures shorten the life of the battery; lower temperatures reduce the available capacity. The capacity of the battery falls considerably under an internal temperature of 5°C (41°F). Optimal battery life is obtained when the battery is operated, charged and stored in an ambient temperature between 5°C (41°F) and 30°C (86°F); and discharges are equal to or lower than 60% of the nominal C6 capacity. Operation of the battery outside of the optimum temperature range may require the use of a Wi-iQ® device and NexSys®+ charger for proper temperature-adjusted charging. The acceptable ambient operating temperature range for the discharge of NexSys® TPPL batteries is between -29°C (-20°F) and 45°C (113°F). The acceptable ambient charging temperature range is between 0°C (32°F) and 45°C (113°F). Consult an EnerSys® representative for the proper equipment selection for your application.

The battery obtains its full capacity after about 3 charging and discharging cycles. The valves on the top of the battery must not be sealed or covered during storage or operation. Electrical connections (i.e. plugs) must only be made or broken while the battery is in the open circuit condition (not charging or discharging).

Discharging

Discharges over 60% DOD of the rated capacity are categorized as deep discharges and are not acceptable as they reduce the life of the battery. Discharged batteries MUST be recharged immediately and MUST not be left in a discharged condition. The cycle life of the battery will depend on the DOD; the higher the average DOD, the shorter the cycle life.

Partially discharged and fully discharged batteries can freeze, which irreversibly damages the battery. Limit the discharge to a maximum of 60% DOD in cold climates, and recharge immediately.

The battery may be fitted with a Protection from Over-Discharge™ (POD™) device to provide visual and audible warning signals. An observed warning signal indicates the battery has reached its maximum discharge level and must be charged immediately.

The following load cut-off settings must be used :

- 50% DOD at an average loaded voltage of 1.98 volts per cell, or
- 60% DOD at an average loaded voltage of 1.96 volts per cell

when discharged at average loads with currents in the range of I4 to I8. At average currents outside of this range, please seek advice from an EnerSys representative for energy cut-off settings.

CHARGING AND CARE

Charging

NexSys® TPPL batteries MUST be charged using an EnerSys-approved charger with the appropriate approved NexSys® TPPL battery charging profile. Failure to do so will affect the performance and life of the battery and invalidate any warranty. The specific charging profile developed for recharging NexSys® TPPL batteries allows opportunity charging as often as needed without damaging the batteries. Charge rate must be maintained between 0.18C6 and 0.40C6 for 2-volt cells and 0.18C6 and 0.70C6 for 12-volt blocs, depending on the battery and charger type. NexSys® TPPL batteries have extremely low gas emission rates. Nevertheless, provisions must be made for venting of the charging gases. Battery container lids and vehicle compartments must always provide adequate ventilation. To allow for some recombination inefficiency, NexSys® TPPL batteries should be considered to have a gassing rate of 1A per 100 Ah.

Equalizing Charge: EnerSys-approved chargers include specific features to ensure that the battery remains properly charged and equalized.

Care of the Battery

NexSys® TPPL batteries are maintenance-free and it is not possible to add water nor measure SG of the battery. The electrolyte is immobilized and the density of the electrolyte cannot be measured. Never remove the safety valves from the battery. In case of accidental damage to the valve, contact your EnerSys representative for replacement.

The battery should always be kept clean and dry. Any liquid in the battery tray must be extracted and disposed of in the prescribed manner. Damage to the insulation of the tray should be repaired after cleaning to prevent corrosion.

Daily:
- Recharge the battery after every discharge.
- Check the condition of the plugs and cables, and make sure that all insulation covers are in place and are in good condition.

Weekly:
- Allow up to 6 hours for a full charge at least once per week.
- Visually inspect for signs of dirt and mechanical damage to all component parts of the battery, paying particular attention to the battery charging plugs and cables.

Quarterly:
At the end of the charge, take end-of-charge voltage readings, measure and record:
- The voltage of the complete battery.
- The voltages of individual cells or blocs.

If significant changes from earlier measurements or differences between the batteries are found, please contact an EnerSys representative.

If the run time of the battery is not sufficient, check the following:
- That the required work is compatible with the battery capacity.
- That the battery has been plugged in at all opportunities.
- The settings of the charger.

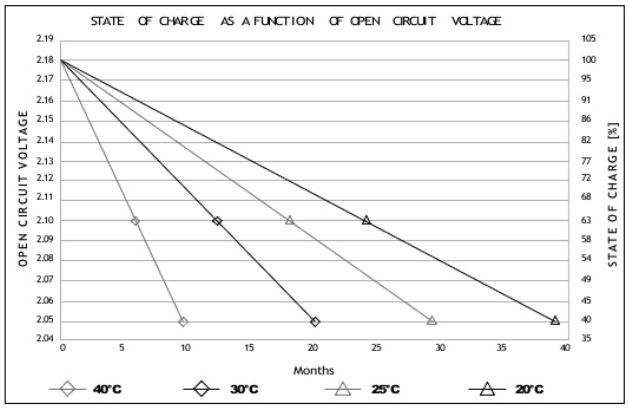
Annually: Check the torque loading of the bolts/screws on bloc-type products. Test the insulation resistance of the battery. Insulation resistance of the battery thus determined must not be below a value of 50 Ω per volt of nominal voltage. For batteries up to 20V nominal voltage the minimum value is 1000 Ω.

Storage

Batteries are shipped from the manufacturer fully charged. The state of charge will decrease with storage. All batteries lose their stored energy when allowed to be in open-circuit, due to parasitic chemical reactions. The rate of self-discharge is non-linear and decreases with decreasing state of charge. It is also strongly influenced by temperature. High temperatures greatly reduce storage life. It is recommended that the fully charged battery should be stored in a cool dry place, ideally below 20°C (68°F), but no lower than 5°C (41°F).

If the vehicle is going to be unused for periods in excess of 48 hours, the ignition key must be removed and any auxiliary equipment (such as lights, beacons, onboard computer, etc.) must be switched off. If the truck or battery is going to be decommissioned for a period of one month or longer, all electronic devices (such as Wi-iQ device, POD device) must be professionally disconnected by an EnerSys service representative.

The NexSys® TPPL product has a maximum inspection-free storage time of 18 months, if stored at or below 20°C (68°F) with no electronic devices connected. After this time a refresh charge should be administered. However, it is advisable to conduct an inspection and Open Circuit Voltage (OCV) check after 12 months and recharge if the OCV is less than 2.10 volts per cell. When stored at temperatures in excess of 30°C (86°F), the battery should be OCV checked every six months. The graph below shows the relationship between temperature, storage time and OCV.



A new battery may be stored for up to two years without degradation of performance provided that an OCV check is conducted every 12 months and refresh charges are administered as needed.

Malfunctions

If malfunctions are found on the battery or the charger, please contact an EnerSys representative. The measurements taken in Quarterly Section of Care of the Battery will identify problems and help establish a base to correct them.

Disposal

NexSys® TPPL batteries must be recycled. End-of-life batteries must be packaged and transported in accordance with prevailing transportation rules and regulations. End-of-life batteries must be disposed of in compliance with local and national laws by a licensed or certified lead battery recycler.

www.enersys.com

GLOB-EN-OM-NEX-TPPL 1023

EnerSys®

Power/Full Solutions