



Technical Data Bulletin

OH&ESD

#178—Maintenance and Care of 3M™ Powered Air Purifying Respirator (PAPR) Battery Packs

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Introduction

Battery packs are a key component of a Powered Air Purifying Respirator (PAPR) system. They provide a light weight, mobile power source to run the motor blower. The battery chemistries offered by 3M have been selected to meet the needs of our customers and provide adequate power to the PAPR system to meet air flow regulatory requirements.

3M PAPR Batteries/Chargers

3M™ PAPR Battery Packs are designed to deliver consistent power over their expected service life. Current cell chemistries used in rechargeable 3M PAPR battery packs are nickel cadmium, nickel metal hydride, and lithium ion. Because of the different charge algorithms, voltages and amperages, battery packs must only be charged with 3M chargers approved for use with that specific pack. (See table below)

3M PAPR Battery Packs	Available Chargers
Nickel Cadmium (NiCd)	
<ul style="list-style-type: none"> ▪ GVP-111 (GVP) 	<ul style="list-style-type: none"> ▪ GVP-112
<ul style="list-style-type: none"> ▪ BP-17IS (Breathe Easy™ PAPR, Powerflow™ PAPR) ▪ 007-00-15 (Air-Mate™ PAPR) ▪ 520-01-02 (Airstream™ PAPR) 	<ul style="list-style-type: none"> ▪ 520-03-73 (1 unit) ▪ 520-03-72 (5 unit) ▪ 520-01-61 (10 unit) ▪ 521-01-43 (Powerflow only) <p>In Canada:</p> <ul style="list-style-type: none"> ▪ 520-01-61SGL (1 unit) ▪ 520-01-61F1V (5 unit)
Nickel Metal Hydride (NiMH)	
<ul style="list-style-type: none"> ▪ 15-1099-07 (Adflo™ PAPR) 	<ul style="list-style-type: none"> ▪ 15-0099-08 (1 unit) ▪ 15-0099-08N6 (6 unit)
<ul style="list-style-type: none"> ▪ BP-15 (Breath Easy™ PAPR, GVP) 	<ul style="list-style-type: none"> ▪ BC-210
Lithium Ion (Li-ion)	
<ul style="list-style-type: none"> ▪ TR-330 (Versaflo™ TR-300 PAPR) ▪ TR-332 (Versaflo™ TR-300 PAPR) 	<ul style="list-style-type: none"> ▪ TR-341N ▪ TR-344N

3M product 520-04-57 is a **non-rechargeable** lithium manganese dioxide battery pack primarily intended for use by emergency first responders.

General Recommendations

Additional recommendations for proper use are listed in specific battery chemistry sections.

- Always read and follow the *User Instructions* that accompany the battery pack and charger.
- Use only the 3M charger(s) specified for that model battery pack.
- Battery pack capacity may be reduced if stored or used in high temperature environments or near radiant heat sources.
- All rechargeable 3M PAPR battery packs can be charged any time during the discharge cycle. Battery memory (also known as voltage depression) is not a significant factor.
- Do not allow water to enter the battery pack receptacles. Water will damage the battery assembly. Battery packs can be cleaned with a damp cloth and mild detergents. Solvents and strong detergents may damage the battery pack case.
- Do not charge battery packs in an enclosed cabinet without ventilation. Do not stack batteries together or on top of charger when charging. Heat naturally generated during charging may damage battery pack cells and must be allowed to dissipate.
- Battery pack capacity can be checked by running the PAPR motor/blower unit with appropriate filters/cartridges and the airflow indicator installed and recording the time until the airflow falls below six cubic feet per minute for loose-fitting headgear, or four cubic feet per minute for tight-fitting headgear. The TR-330 and TR-332 capacity also can be checked directly with the status indicator on the battery pack.
- Do not attempt to discharge the battery pack by short-circuiting.
- For long-term storage, disconnect battery pack from the motor/blower unit.

Nickel Cadmium (NiCd) Batteries

A NiCd battery will take 8 to 16 hours to charge depending on discharge state. Each 3M NiCd battery pack model provides up to 500 charge/discharge cycles. However, the life of 3M NiCd battery packs will be significantly reduced when they are exposed to high heat over an extended period of time. In addition to the general recommendations, these guidelines contained in the User Instructions should be followed to maximize battery life:

Operational Use

- **Operating temperature:** 10° F (-12° C) to 120° F (49° C).
- **Charging temperature:** 50° F (10° C) to 77° F (25° C). (Internal battery pack temperature.) At higher temperatures, the battery pack may not accept a full charge.
- Do not completely discharge battery packs (less than 1 volt output or “deep discharging”). This will damage the battery cells and will not improve capacity.
- If a battery pack feels hot, let it cool ½-hour before charging.

Storage

- **Storage temperature:** - 4° F (-20° C) to 115° F (45° C). R. H. < 85%
- A NiCd battery in storage, off charger, loses up to 1 % of its charge each day. Batteries subjected to prolonged storage (longer than 12 months) without recharging may lose their capacity to hold a full charge.

- Do not leave inactive or non-regularly used battery packs continuously on the charger for more than 2 weeks. Although the chargers shift to a trickle charge they do not turn off. Continuous trickle charging generates heat which may cause premature deterioration of battery cells. Possible options to maintain battery pack charge include putting chargers on a timer to charge for 8 hours once per week or for 1 hour once per day.

Note: The GVP-112 and 521-01-43 chargers do not switch to trickle charge. GVP-111 and BP-17IS batteries should not be left on these chargers longer than 3-4 days.)

Nickel Metal Hydride (NiMH) Batteries

NiMH chemistry allows quick charging (90% in 2 hours) and reduction in the use of certain toxic materials (e.g. cadmium). In addition to the general recommendations above, these maintenance guidelines that are also contained in the User Instructions should be followed to maximize battery life.

Operational Use

- **Operating temperature:** 10° F (-12° C) to 120° F (49° C). Run times will be reduced at temperature extremes.
- **Charging temperature:** 50° F (10° C) and 90° F (32° C). (Internal battery pack temperature) Beyond this range, the battery may not accept a full charge.
- New batteries should be charged immediately upon receipt. New battery packs may require three charge/discharge cycles prior to attaining full capacity.
- Depleted battery packs should be recharged immediately after use to help maintain battery cell function. The battery pack should be allowed to go to full charge before next use.
- NiMH batteries should not be allowed to go into a deep discharge state (less than 10% charge).
- 3M NiMH batteries provide up to 400 charge/discharge cycles. The life of 3M NiMH batteries will be significantly reduced if exposed to high heat over an extended period of time.
- If a battery feels hot, let it cool for 1/2 hour before charging. If the chargers sense the batteries are too hot they will go into a standby mode until the battery has cooled.

Storage

- **Storage temperature:** -4° F (-20° C) to 115° F (45° C). R.H. < 85%. Storage of the battery pack outside of this range will shorten its service life.
- Battery packs not intended for immediate or regular use should be charged upon receipt and stored on an active charger or placed on regular recharge schedule (every 3 months of non-use). Prolonged storage of battery packs without regular recharge may damage the battery pack cells.
- NiMH batteries stored at room temperature lose approximately 1- 2% of their charge per day after charging. The rate of self-discharge will increase as storage temperature increases. Storage should be in dry conditions (less than 85% relative humidity).
- **The BP-15** battery pack may remain connected to the charger for an extended period of time. This is the recommended storage method for maximum battery performance. Refer to the BP-15/BC-210 *User Instructions* for further information.
- **The Adflo™** battery pack may remain on the charger for several days after completion of charging but for maximum battery life disconnect the charger after a full charge has been

received. Refer to the Adflo *User Instructions* for further information.

Lithium Ion Batteries

Lithium ion battery packs offer quick charging (100% in less than 3.5 hours), light weight and compact size. In addition to the general recommendations, the following guidelines contained in the User Instructions should be followed:

Operational Use

- **Operating temperature:** 23° F (-5° C) to 129° F (54° C). Do not expose battery pack to temperatures above 129° F (54° C). Run time will be reduced when used at temperature extremes. Battery pack will shut down at temperatures above 140° F (60° C)
- **Charging temperature:** 32° F (0° C) to 104° F (40° C) (internal battery pack temperature) Do not charge outside of this range. Optimal internal battery charging temperature is 68° F to 77° F (20° C to 25° C). Repeated charging outside the optimal temperature range will reduce battery pack run time and cycle life.
- If a battery feels hot, let it cool for 1/2 hour before charging. If the chargers sense the batteries are too hot they will go into a standby mode until the battery has cooled.
- 3M Li-ion battery packs provide up to 250 charge cycles. A fully charged battery pack run time will be reduced when used at environmental temperature extremes, and due to naturally occurring aging of the battery pack.
- Consider replacing the battery pack when capacity drops below 80% as shown on the battery pack charge indicator.
- Check all applicable local, national, and international regulations before transporting lithium ion battery packs.

Storage

- **Storage Temperature:** -22° F (-30° C) to 122° F (50° C); Optimal: 59° F (15° C). Dry conditions R.H. < 85%.
- The battery pack may remain connected to the charger for an extended period of time. However, for long-term storage, to maximize battery pack life, 3M recommends storing the battery pack off the charger at approximately 40% charge as shown by the battery pack charge indicator. Battery pack should be disconnected from the motor/blower during storage.

Lithium Manganese Dioxide Battery

3M non-rechargeable lithium battery 520-04-57 is NIOSH approved with several Breathe Easy PAPR assemblies (refer to NIOSH approval label for list of approved combinations). This battery is used primarily by first responders/receivers. The non-rechargeable lithium battery is expected to provide 12 hours of service when new.

Storage

- **Storage Temperature:** -40°F (-40° C) to 158° F (78° C). Exceeding this temperature range may cause permanent damage to the battery.

- During storage at room temperature, it will lose approximately 1% of its charge per year. Therefore, a battery stored at 68° F (20° C) for 10 years will lose up to 10% of its charge. Note: The discharge rate increases significantly at higher storage temperature.

Disposal of PAPR Battery Packs

Damaged or worn-out batteries should be disposed of in accordance with local, state and federal regulations at an approved hazardous waste recycling or disposal facility following guidance of applicable 3M *User Instructions*. 3M participates in the RBRC program which provides for 3M™ PAPR batteries to be dropped off (free of charge) at participating recycling collection sites.

Please dispose of batteries according to federal, state and local regulations. Contact the Battery Recycling Information Hotline at 1-800-822-8837 for proper disposal instructions.

(www.rbrc.org)

PAPR Battery Management

The purpose of a PAPR battery management system is to assure a reliable supply of fully charged and functioning batteries to respirator users and to maximize the service life of batteries through proper maintenance procedures. Correct battery management can help enhance worker productivity and reduce battery replacement costs. Battery management systems should be tailored to the specific needs of each work site and will vary depending on the number of respirators in use, availability of personnel and workspace, equipment contamination, and other factors. Most successful systems fit into one of the two general outlines below.

- **End-User Battery Management**

This system places the responsibility for battery management on the individual respirator user. Each user is assigned a battery. The user connects the battery to a charger at the end of each work shift and disconnects it at the beginning of the next shift. Batteries can be charged in small, ventilated lockers equipped with outlets or in a central charging area. If a central charging area is used, clearly marking batteries or segregating batteries by work shift will help avoid accidental use of uncharged batteries. A reserve of replacement batteries should be stocked and maintained in a charged state to replace damaged or worn-out batteries. Follow the charge/storage recommendations for the type of battery pack in use.

- **Central Battery Management**

This system places responsibility for battery management on one or more trained individuals at the facility. These individuals frequently have overall responsibility for respirator cleaning and management. Central battery management becomes more efficient with larger numbers of respirator users. It saves workers time and minimizes battery damage from improper charging. Users exchange their discharged batteries for freshly charged batteries at their convenience.

For More Information on Other 3M Products

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