



# Elec-Trak<sup>®</sup>

## Tractor

### PRODUCT SERVICE BULLETIN NO. 72-25 (25)

September 8, 1972

#### Power Pack Technical Information

Elec-Trak power packs, being the heart of the Elec-Trak tractor operation, require care and maintenance to give maximum life and serviceability. Some of this must be provided by the dealer before sale. This bulletin presents information for initial inspection, charging, storage, watering, cleaning and testing. Recommended procedures should be thoroughly understood and followed completely.

#### Initial Inspection

Immediately upon receipt, check electrolyte levels to detect possible liquid loss during shipment. If loss is discovered, replenish with acid of same specific gravity to proper level. Inspect incoming batteries for mechanical damage, either visible or concealed, which may have been incurred to the contents of a package which is not in evidence at the time of delivery by the carrier but which is later discovered. If loss or damage is encountered, read Appendix A.

#### Storage

New batteries should be placed in stock, preferably in their shipping cartons, in such a location that the oldest batteries can be used first. Batteries will slowly discharge during storage and must be located so that they can be reached for recharging without moving newer batteries away from in front of them. Selecting a cool, dry storage area will minimize self-discharging. All batteries should be inspected and charged with the external charger before storage. See Appendix B for charging instructions.

The batteries should be segregated by types and the date a battery is received can be marked on the carton or battery with chalk. This date can be helpful in selecting the oldest battery of any type in stock for earliest use. Batteries must be put in service within 150 days of manufacturing shipping date to have full warranty available to purchaser.

The manufacturer's label on each battery can be used to determine the battery's age. This label is coded as follows:

		72	73	74
Jan	A	2	3	4
Feb	B	2	3	4
March	C	2	3	4
April	D	2	3	4
May	E	2	3	4
June	F	2	3	4
July	G	2	3	4
Aug	H	2	3	4
Sept	J	2	3	4
Oct	K	2	3	4
Nov	L	2	3	4
Dec	M	2	3	4

Example: F-2 is June-1972

Loose, flat boards should be used under batteries if the storage area has a concrete floor. This practice prevents moisture accumulation under the batteries and also protects the battery from small stones and objects which could penetrate the case. Under no circumstances should batteries be stacked directly on top of one another; shelving may be used for efficient storage.

All "wet" batteries will slowly discharge on standing and will discharge faster when warm than when cold. At normal temperatures of 80 F, loss of capacity by self-discharge, starting with a fully charged battery, may amount to an average of about 0.001 spg per day over a 30-day period. At the start, it may amount to 0.002 spg loss per day and gradually taper off to less than 0.001 spg loss per day by the end of 30 days. The effect of temperature on self-discharge for the average fully charged new battery in good condition may be about as follows:

at 100 F. . . . .	0.0025 spg per day
at 80 F. . . . .	0.001 spg per day
at 50 F. . . . .	0.0003 spg per day

General Electric Company  
Outdoor Power Equipment Operation  
Corporations Park, Bldg. 702  
Schenectady, N. Y. 12345

GENERAL  ELECTRIC



The above values are approximate for about the first 10 days of standing after being fully charged. To minimize the extent of self-discharge, store batteries in as cool a place as possible, away from hot air ducts or radiators in winter and shielded from direct sunlight in summer.

To make up for the loss of charge while standing in stock, a boosting charge without excessive overcharge should be given batteries whenever they fall below 1.220 spg, (corrected to 80 F for temperature), no matter whether they are to remain in stock or are to be made ready for use. This may be as often as every 30 days at warmer temperatures and less often during colder weather, but the spg should be sampled periodically to establish the exact state of charge. Observe level of electrolyte after charging, and if necessary, add water to the cells to bring to proper level. If electrolyte level is below the perforated cover plate, add water just over this plate before charging and complete filling to proper level after fully charging. Chalk or crayon can be used to date the carton or battery whenever it receives a recharge in stock. This will help to determine which batteries are ready for delivery and which batteries need charging.

#### Cleaning and Protecting

Gases and overflowing electrolyte which may result from the charging process may cause a residue of oxidation to form on the power pack surfaces. Besides causing self-discharge of the cells, the residue may attack power pack terminals and clamps and can cause deterioration and performance problems if left unchecked.

The residue is best neutralized by sponging a sufficient solution of five tablespoons of baking soda to one quart of water to the power pack surfaces. After a few minutes wipe all surfaces dry and clean. After the post clamps have been removed, this neutralizing process should be repeated for the posts and the clamps to ensure all corrosion is removed. The double-ended wire brush supplied in the battery service kit is then used to brighten the battery post and inside of the post clamp. After wire brushing is completed, reconnect the battery clamps to the posts and coat all post and clamp outside surfaces with AP31 Battery Terminal Protection. Do not coat the contact area, only the external surfaces exposed to atmosphere; a heavy coating of AP31 on contact surfaces could impair conductivity.

Prevention measures can be taken to reduce the need of this service. Many times the residue accumulation can be attributed to one or more of the following practices:

1. overfilling of cells
2. excessive charging

3. careless testing of electrolyte
4. repeated tractor operation on very rough terrain

All those concerned should be made aware of proper care to eliminate recurrence of these problems, but even then the gases produced during normal charging may slowly cause clamps and posts to oxidize and should be cleaned.

#### Power Pack Testing

Several methods are used to establish power pack condition and/or serviceability. Specific gravity measurement (spg) provides a quick means of determining whether each cell is accepting full charge or not. Another method, the discharge test, measures the ability of the power pack to deliver a specified number of amperes over a given time. Before applying either test, the power pack should be put through a full charging cycle and should be allowed to reach room temperature. A voltage reading of each battery during discharging can reveal a bad cell. See Appendix C for test procedures.

Acknowledgment is given to the Association of American Battery Manufacturers for much of this technical information.

### APPENDIX A

#### Procedures for Damage in Transit

The carrier or carriers are responsible for batteries lost or damaged in transit. The title to goods rests with the consignee (dealer) when batteries are shipped F.O.B. factory, and only he can legally file claims. When loss or damage is noted at time of delivery, require the person making delivery to note loss or damage on freight bill or affix his signature under consignee's memo of the loss or damage. Submit claim by presenting to carrier who made delivery the following information:

1. Standard Form for Presentation of Loss and Damage Claim
2. Original Bill of Lading
3. Original or Certified Copy of Invoice
4. Original Paid Freight Bill with signed notation of loss or damage

When loss or damage is discovered after delivery:

1. Segregate damaged batteries, cartons or crates.



2. Immediately request carrier to make inspection and confirm request with a letter. If inspection is waived, obtain a written "waiver."
3. If inspection is not made by carrier within five days, make your own inspection report. If possible, use form "Inspection Report of Loss or Damage Discovered after Delivery of Freight."
4. Submit claim by presenting all the four items listed above under the section headed "When loss or damage is noted at time of delivery" and in addition submit "Carrier's Inspection Report" or "Waiver" or your request for inspection and your report on your own inspection. If no acknowledgment of claim is received within thirty days, request same by letter. If no settlement is made within sixty days, review claim for a decision regarding necessary action, legal or otherwise. Two years are allowed in which to file suit after a claim is disallowed in writing by the carrier.

#### Adding Battery Electrolyte

To prevent permanent damage because of spilled electrolyte, add battery grade electrolyte of  $1.260 \pm .010$  specific gravity to just cover the battery plates, and subject the battery to a full charging cycle. Allow 30 minutes after charging and remeasure the specific gravity to be 1.260, and adjust if necessary by adding water if the reading is too high and electrolyte if the reading is too low. Alternate short charging periods and electrolyte adjustments should then be made until each cell in the battery in question has a specific gravity reading of  $1.260 \pm .010$ . This electrolyte can be obtained from automotive supply stores.

### APPENDIX B

#### Charging Information

Fully charge batteries by setting charger knob to the appropriate indicator mark, letting the charger operate until it shuts off. See the tractor Use and Care Manual.

NOTE: Always be sure that the disconnect is in (engaged) when charging batteries installed in tractor.

When using the External Charger Kit to charge batteries out of the tractor, the power disconnect must be open. Only six 6-volt, or three 12-volt batteries may be charged at a time.

The six 6-volt batteries are arranged and connected as shown in Figure 1. Connect the (+) posi-

tive terminal of battery number 1 to the (-) negative terminal of the second battery. Then the (+) positive terminal of the second battery to the (-) negative of the third battery, etc., until all six battery units are connected as shown.

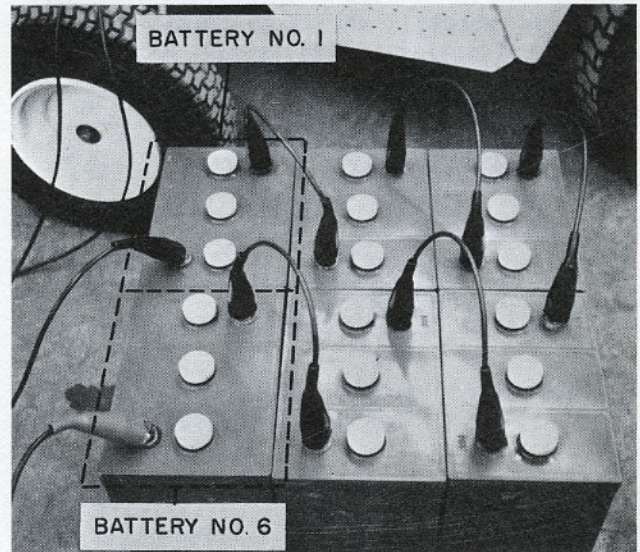


Figure 1. 6-Volt Battery Connections

Disengage the power disconnect on the left side of the control cabinet and insert charger plug into the accessory receptacle. See Figure 2. Connect the red (+) insulated clip of the charge cord to the (+) positive terminal of battery number 6 and the black (-) insulated clip to the (-) negative terminal of battery number 1.

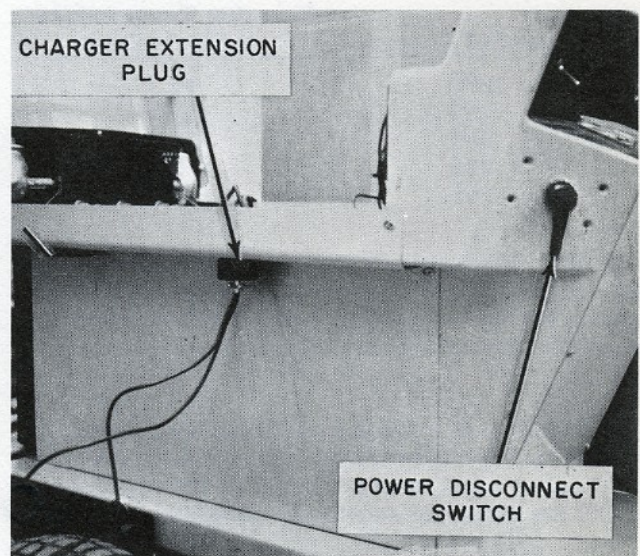


Figure 2. Charging Tractor



Plug tractor line cord into wall receptacle and set timer in normal manner.

To charge three 12-volt batteries, interconnections and charger cord connections are made in similar fashion as shown in Figure 3. After the charger cord is inserted in the accessory outlet, the charger should be started so that it runs for a period equal to one-half that used for 6-volt units.

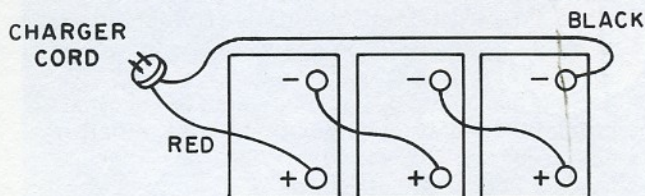


Figure 3. 12-Volt Battery Connections

Add water to each cell of the battery to the specified level as described in the tractor Use and Care Manual. It is important for best battery care to be sure (a) that the perforated plates which may be seen through the filling holes are covered by the water level to a depth of 1/4-3/4" before charging, and (b) that the water level is brought to the bottom level of the indicator ring after charging. In this way, overfilling is prevented but sufficient water is assured. The water filler jug (AP 12) does (b) automatically and quickly.

The tractor or batteries may be stored in the cold provided the batteries are charged. Discharged batteries can freeze in cold temperatures unless recharged at once. The following table illustrates the relationship between amount of charge and freezing temperature of the electrolyte.

Amount of Charge	Freezing Temperature of Electrolyte
100%	-80 F
75%	-42 F
50%	-16 F
25%	- 2 F
10%	+ 7 F

Self-discharge of batteries is practically nonexistent below +40 degrees Fahrenheit, and they can be stored for several months without attention when not used and in any temperature less than +40 F.

If stored in a warm area above 40 F, specific gravity and the water level in the batteries should be checked about once a month. If the spg falls to 1.220 the batteries should be recharged.

After storage of more than a few weeks, it is advisable to give batteries an overnight charge

before using. There is little danger of overcharging batteries when they are cold, so extra charging in the winter is advisable when use is expected within the next 24 to 36 hours.

NOTE: The charging process evolves small amounts of hydrogen gas; therefore, normal precautions like those for gasoline refueling should be used whenever batteries are being charged. (No sparks or open flames near the batteries.) This gas concentration will not occur if there is free air circulation in the immediate area or if the storage area is fairly large so concentration is reduced.

### Watering

During the late stages of the charging cycle, there is a bubbling action or gassing process which allows some water in the electrolyte solution to evaporate, but only water is lost; so it is only necessary to add water to bring up the electrolyte level to the proper point. Distilled water or tap water that is low to average in mineral content is satisfactory for use in the batteries.

Water is to be added only after the batteries are charged. The only exception to this rule is if the electrolyte level should fall below the top of the plates. Sufficient water should be added to bring the electrolyte level just above the plates. The batteries should then be charged, and if necessary, additional water added after charging. (This is because the electrolyte expands during charging.)

Under normal conditions it will only be necessary to check the electrolyte approximately once per month or just before charging if the batteries are in storage. Use of the tractor in higher temperature locations or under very heavy use may require more frequent checks of the level.

Any electrolyte running out of the top of the cells is an obvious sign of overfilling. It is important that the electrolyte level be maintained above the plates but never above the indicator ring. Overfilling can result in dilution of electrolyte, which reduces capacity and life of the power pack. Overfilling can also cause corrosion where spillage of electrolyte occurs. This should be cleaned immediately to keep self-discharging to a minimum.

## APPENDIX C

### Procedures for Testing

#### Specific Gravity (spg)

Power pack electrolyte is heavier than pure water. If a value of 1.000 is assigned for pure



water, the relative weight of an equal volume of any other substance is called the specific gravity of the substance. The electrolyte specific gravity of a new power pack normally varies between 1.110 and 1.260 representing a discharged condition and a charged condition respectively at 80 F. If the spg is higher than 1.260, slightly more ampere hour capacity will result (increasing range), but power pack life will be shortened. While using the power pack after a full charging cycle, the spg gradually decreases to 1.110 when the cells are fully discharged. Continued discharge causing the spg to go lower than the 1.110 point will shorten the power pack life, therefore, deep discharging as well as overcharging should be avoided.

The hydrometer is a direct-reading instrument used to measure the spg. To apply the test it is only necessary to draw a sample of electrolyte from a cell and jiggle the hydrometer to be sure the indicator is floating free and record the indicated spg. Do not maintain liquid level in the hydrometer by squeezing the bulb as this gives inaccurate readings. The spg readings of the cells of any power pack unit should not vary from each other by more than 0.050. If variations do not exceed this figure and the spg in each cell is above 1.250 the unit is in good condition. Considerable variation in specific gravity readings (0.050 points or more) usually indicates sources of trouble internal to the battery. Spg varies with temperature, so for correct readings the electrolyte temperature should be at 80 F. Whenever a variation in spg of over 0.050 points is observed, discharge testing should be applied to determine serviceability. If batteries are new, several recharging cycles may be necessary to equalize cells to reach consistency in readings.

#### Hydrometer Care and Correction

Hydrometers become inaccurate if not cleaned regularly. It is good practice to flush them out with clean water after use. They should be taken apart and cleaned thoroughly every two months. Broken or leaking hydrometer floats prevent correct specific gravity readings. A good hydrometer will read accurately at electrolyte temperatures of 80 F. For every 10 degrees above 80 F, 0.004 specific gravity must be added and 0.004 must be subtracted for each 10 degrees under 80 F to get very accurate readings, but this calibration is not necessary when checking cell spg uniformity. Hydrometers will not give an accurate reading when used immediately after water has been added to the cells. Cycling the power pack twice after the addition of water allows the proper mixing necessary for correct readings. Hydrometer readings should be delayed after charging until the electrolyte temperature falls to 80 F and no reading correction is necessary.

#### Discharge Testing

Two approved methods of discharge testing are available - the automotive type post-to-post hand-held tester and the timer-controlled 36-volt discharge tester. Both testers operate in a similar fashion, i. e. they load the battery under test by drawing current and then measure terminal voltage.

Post-to-post testers normally have scales to indicate the condition of both 6-volt and 12-volt batteries. They are designed to be applied rapidly by holding the polarized probes securely against the posts of the battery under test. Leave battery cables connected for this test. The indication on the appropriate scale gives the battery condition after 3 to 5 seconds as to whether it is good, fair, or poor. Caution should be used not to hold the tester in place for over 5 seconds and in handling it after the test, since its resistive element can become extremely hot in a short length of time. This quick application ability lends itself well to field checking batteries for shorted or dead cells, but gives no control or indication of long discharging periods. In other words, the post-to-post tester may show all batteries to be "good," but the complaint of reduced range may still go unresolved. More elaborate battery testing may show that a battery cell shorts after 45 minutes of use and is the source of the trouble. The 36-volt discharge tester enables the Elec-Trak tractor mechanic to make this test on 6-volt batteries by attaching the polarized leads on the ends of the set of batteries connected in series and starting the tester. The timer of the tester starts immediately and the unit draws a controlled current of 75 amperes until the series terminal voltage reaches 31.5 volts. At that voltage the timer stops and shuts off the current. For a good power pack, this test takes in excess of 60 minutes. During the test the voltmeter is used on the 10-VDC scale to measure the terminal voltage of each battery at 15-minute intervals. This is a comparison check and any terminal voltage that differs from the others significantly (0.5 volts or more) indicates a battery that may need replacement.

Either test must be performed only after the batteries have been fully charged as indicated by a specific gravity measurement of all cells as previously outlined.

The other function that the 36-volt discharge tester performs is that of determining if the entire power pack is capable of supplying a specified number of amperes for a minimum time. The discharge tester supplied for Elec-Trak power pack testing is to be used for testing one set of standard or heavy-duty 6-volt batteries only; 6 batteries connected in series.



The tester consists of a 75-ampere load, a voltage sensing system, and a means of electrically timing the discharge. This unit will give the ampere-hour capability of a battery pack when discharged at a constant 75-ampere rate, which has been standardized as a test condition for batteries used in systems such as electric vehicles. The ampere-hour rating assigned to a battery is based on a discharge current that would require 20 hours for full discharge.

The output of a battery when discharged from full charge to a discharge measured as 1.75 volts per cell will depend on the previous history of the battery. As a battery is used, its capacity will increase at first and then will begin to decrease. The time of this decrease is also affected by the kind of use experienced over the battery life, by the temperature, and by the care and maintenance of the battery. The accepted test for end of life is when a battery discharges from full charge to 1.75 volts per cell in less than 60 minutes, being discharged at a 75-ampere rate.

This tester is used to indicate when the power pack has reached the minimum performance level, below which the entire pack can be replaced under the terms of the warranty. This level requires a

75-ampere rate of discharge to a series terminal voltage of 31.5 volts (18 x 1.75) in less than 60 minutes. Testing for improper charging and/or dead cells should be performed before applying discharge test.

The tester is put into operation as follows:

1. Before applying discharge test, check all cells for proper specific gravity after a full charge cycle.
2. The unit is shipped from the factory set for 75 ampere discharge.
3. Connect red (+) battery clamp on the positive 36-volt post and the black (-) battery clamp on the negative post. (Determine connection points from the Product Service Manual.)
4. With the timer set at zero, press the "Start" button which will initiate the timing cycle and turn on the load.
5. The test will continue until the total battery pack voltage falls to 31.5 volts (1.75 v/cell). At this point the transistorized trigger will terminate the test, stop the timer and turn off the discharging light.