ACTIVATING INSTRUCTIONS

For Dry-Charge Batteries

Installation _____ Order number _____
Type Battery _____ Number of Plates _____
Number of Cells in Battery _____ Nominal Voltage _____
Ampere Hour Rating _____ at the _____ hour rate
Electrolyte required per cell _____ Gal. _____ specific gravity
Finish charge rate _____ amperes
Specific gravity at end of charge _____ to _____ corrected to 77°F.

STORAGE

Dry Charged cells or batteries may be stored up to 12 months from date of shipment from the C&D Technologies, Inc. factory. They must be stored in a dry, cool location. Do not remove the plastic film held in place by the vent cap until it is time to add the electrolyte. Dry charged cells must remain sealed to prevent premature loss of charge. Check cells for damage during shipment and submit a damage claim to the carrier if necessary. Then store the cells in a safe location to avoid damage.

Store all other accessories and racks (if ordered) with the battery to permit convenient assembly when required.

SUPPLEMENTAL INFORMATION AND CAUTION LABELS

WARNING

Read these instructions completely before unpacking batteries (RS-1476) for information on receiving, unpacking handling and installation.

Battery must be activated within 12 months from date received.

Store in a cool location.

Do not connect any load to battery until both activating and initial charge have been completed to prevent possible irreparable damage. Cells must be charged within 24 hours after adding electrolyte.

Dry charged cells are shipped with sealed vent plugs. These must be kept tightly in place during storage to minimize tendency of charged plates to gradually discharge. However, plastic film must be removed and discarded at time of activation and charge.

After cells have been properly installed on the rack(s) connect the battery to the charger. Do not connect the load. Remove and discard the vent plug (plastic film) seals. Sealed vent plugs must not be in place during charging. An explosion can result. Discard the vent plugs and install the flame arrestors.

Electrolyte is added to the battery and it is then charged within 24 hours at a rate in amperes that will finally produce 2.60 to 2.70 volts per cell at END OF CHARGE. This high voltage per cell is required to bring all cells properly into line and assure that both the positive and negative electrodes are electrically balanced.

Depending upon the type of charging equipment available various methods and procedures may be preferred in order to accomplish initial charge. It is desirable to limit charging current to five amperes per 100 ampere hours of rated cell capacity. If the charging equipment has current limit adjustment, the cells may be charged at 2.60 to 2.70 volts per cell following activation and cool down after adding electrolyte. When no current limit adjustment is available, start the charge at float potential by connecting all cells in series as in the final battery assembly and continue charge for four to five days or until the cells are fully charged.

CAUTION

It will still be necessary to reconnect the cells for higher voltage charge, 2.60 to 2.70 volts per cell for final formation charge as described in later sections.

ACTIVATION — ADDING ACID

Refer to the RS-758 Instruction Card to determine the quantity and specific gravity of the acid required to fill your particular type of C&D power systems.

ADDING ELECTROLYTE

DANGER

Wear approved goggles, rubber gloves, rubber boots and a rubber apron when handling electrolyte. Always have fresh water available in case electrolyte is splashed on skin, clothing or eyes. If electrolyte is splashed into eyes, flush eyes with water from a safety fountain or cold water tap. See a doctor immediately. Always add acid to water and stir constantly to mix thoroughly when preparing electrolyte. If water is added to acid, a violent reaction will occur and injure the handler.

CAUTION

Normally, electrolyte shipped with battery has a specific gravity 0.005 - 0.010 points below the nominal specific gravity of the fully charged battery. Cells should be filled to the high level line with the electrolyte as shipped . . . do not dilute or add acid of a higher specific gravity. Allow cells to stand at least one hour after filling with electrolyte, BUT NOT MORE THAN 24 HOURS.

Start initial charge immediately following filling of cells with electrolyte and cool down after chemical reaction of electrolyte with cell element(s). If user supplies his own electrolyte, the sulfuric acid used must meet U.S. Federal Specification O.S.-801, Table I. Only distilled water should be mixed with the acid.

Mix electrolyte in a clean plastic, rubber or lead container. Allow electrolyte to cool to about 90°F before filling cells.

On occasion, concentrated acid is supplied when requested. The acid must be mixed with distilled water to provide the proper filling specific gravity specified at the top of the instruction card, RS-758.

TABLE II

Desired Specific Gravity	Parts Of Water To Be Added To One Part Of Acid	
	*1.835 Sp. Gr.	1.400 Sp. Gr.
1.200	4.2	1.1
1.220	3.7	0.9
1.240	3.3	0.7
1.260	2.9	0.6
1.280	2.6	0.5
1.300	2.4	0.4

***DANGER**

1.835 specific gravity is extremely hazardous to handle. Be certain to follow applicable safety procedures.

TABLE I
LIMIT OF IMPURITIES

Impurity	Calculated As	Maximum Limit, Percent Class 1	Class 2	Class 3	Class 4
Organic Matter	—				
Platinum	Pt				
Fixed Residue	—	0.03	0.016	0.012	0.009
Sulfurous Acid	SO_3	.004	.0022	.0016	.0013
Iron	Fe	.005	.0027	.0020	.0016
Copper	Cu	.005	.0027	.0020	.0016
Zinc	Zn	.004	.0022	.0016	.0013
Arsenic	As	.0001	.00005	.00004	.00003
Antimony	Sb	.0001	.00005	.00004	.00003
Selenium	Se	.002	.0011	.0008	.0006
Nickel	Ni	.0001	.00005	.00004	.00003
Manganese	Mn	.00002	.000011	.000008	.000006
Nitrates	NO_3	.0005	.00027	.00020	.00016
Ammonium	NH_4	.001	.0005	.0004	.0003
Chloride	Cl	.001	.0005	.0004	.0003

When electrolyte has been added to all cells, check the total battery voltage. It should be approximately 2.05 volts times the number of cells. If less than this value, check the cell polarities. One or more cells may be connected in reverse.

CHARGING EQUIPMENT — CONSIDERATIONS

Proper charging equipment must be available to provide the 2.60 - 2.70 volts per cell required for initial charging. **Specifically, placing dry-charged cells directly on float or normal equalize potentials will not provide adequate charge.**

INITIAL CHARGE

There are two basic types of chargers used to charge stationary batteries . . . constant voltage types and constant current types. Regardless of the type of charger used, the objective is to establish an initial charge rate that produces at least 2.60 to 2.70 volts per cell **at the end of charge without causing battery temperature to exceed 120°F.** If this temperature is approached, the charge rate must be reduced. Methods for accomplishing this are discussed below.

Depending upon the type of charging equipment available, various methods and procedures may be preferred in order to accomplish initial charge. It is desirable to limit charging current to five amperes per 100 ampere hours of rated cell capacity. If the charging equipment has current limit adjustment the cells may be charged at 2.60 to 2.70 volts per cell following activation and a cool down after adding electrolyte. When no current limit adjustment is available, start the charge at float potential by connecting **all** cells in series as in the final battery assembly and continue charge for four to five days or until the cells are fully charged.

CAUTION

It will still be necessary to reconnect the cells for higher voltage charge, 2.60 to 2.70 volts per cell for final formation charge as described in later sections.

At the end of the final charge, the specific gravity, corrected to 77°F, should be within the limits shown on the front of the instruction card, RS-758. If any of the cells are below the low limit, continue the charge until the specific gravity of the lowest cell stops rising. Any cells that now have a specific gravity below the low limit must have their gravity adjusted by removing electrolyte and adding acid with a specific gravity of 1.400. **(Never add 1.835 specific gravity acid directly to cell.)** It is recommended that this adjustment be made by a C&D serviceman. On some occasions, one or more cells will show a specific gravity above the high limit. When this occurs, it can be adjusted downward by removing electrolyte and replacing it with distilled water.

CONSTANT VOLTAGE METHOD

Most constant voltage chargers have voltage limiting systems in their control circuitry. This makes it necessary to charge the battery in two steps to get a final potential of at least 2.60 to 2.70 volts per cell.

Step 1: The positive lead of the charger is connected to the positive terminal of the battery. Connect the negative lead to the negative post of the cell shown in the table below:

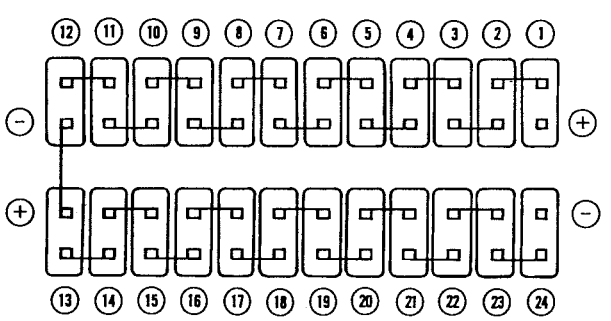
TABLE III

No. of cells in battery*	23	24	25	26	58	60	120
Cell no. for negative connection	19	20	21	22	49	50	100

*Based upon 2.20 V/C charger output, and number (1) cell positive connection to charger.

Start charge and check voltage across several cells (every fifth cell for smaller batteries, every tenth cell for larger ones). Charging potentials should range between 2.60 to 2.70 volts per cell at end of charge. Check cell voltage and cell temperature every hour. Step 1 activation charge is normally completed in 12 to 16 hours. However, if cell voltages do not stabilize at calculated value of 2.60 to 2.70 volts per cell continue charge for up to three days for cells that have lost much of their stored charge.

NOTE: Most of the initial charge should have occurred at float potential charge which was conducted in the first stage of charging for four to five days.



24-CELL CONNECTION

Figure 25

Step 2: The negative lead of the charger is connected to the negative terminal of the battery. Connect the positive lead to the positive post of the cell shown in the table below. Cell number one is at the positive end.

TABLE IV

No. of cells in battery*	23	24	25	26	58	60	120
Cell no. for positive connection	5	5	5	5	9	10	19

*Based upon 2.20 V/C charger output, and number (1) cell positive connection to charger.

Check the voltages of sample cells that were not previously charged. Add a cell if any of the cell voltages are above 2.72 volts. Continue checking cell voltages and temperatures every hour. Add another cell or two if necessary. Step 2 should also be completed in 12 to 16 hours. However, if cell voltages do not stabilize at 2.60 to 2.70 volts per cell continue charge for up to three days for cells that have lost much of their stored charge.

CONSTANT CURRENT METHOD

Connect the positive lead of charger to positive terminal of battery and negative lead to negative terminal. Adjust the charger to the finish charge (5A/100 AH) rate shown for your battery on the front of the instruction card. Check cell temperature every hour and do not allow it to exceed 120°F. If temperature gets too high, reduce the charge rate or interrupt the charge temporarily. Charge should be completed in 12 to 16 hours. However, if cell voltages do not stabilize at 2.60 to 2.70 volts per cell continue charge for up to three days for cells that have lost much of their stored charge.

FINAL CONNECTION OF BATTERY

Following initial charging the properly prepared battery should be reconnected to the charger, positive terminal of battery to positive terminal of charger and negative of battery to negative of charger. Adjust charger to nominal float voltage and continue operation as described in RS-1476 Stationary Battery Operation and Installation.

CHARGING POTENTIALS

CAUTION

Regardless of your particular charging capability or connection procedure, make certain that every cell receives 2.60 to 2.70 volts per cell until cell voltage ceases to rise above this value and specific gravities stabilize. STARTING VOLTAGE WILL BE LESS THAN CALCULATED VALUE because cells will require more current initially and charger may go into current limit.

The tables shown above are examples based on 2.20 volts per cell. Your charger voltage may be higher particularly if your battery is of higher specific gravity. Check your voltage and calculate the proper cell number to receive initial charge at 2.60 to 2.70 volts per cell.

In cases where a battery may have been stored for longer than 12 months or in hostile, ambient conditions charging time may be lengthened to two to three days before voltages and specific gravities stabilize.

EMERGENCY LIGHTING BATTERIES

Emergency lighting batteries are available in six to 12 volt sets. Normally the charger has no provision for varying voltage or current. Therefore, after activating with electrolyte as discussed earlier, discharge battery through load (usually emergency light) for one to one and one-half hours. Then place on normal float charge.

This procedure is **not** preferred to the above but in many cases is all that is practical.

ALLOWABLE TEMPERATURE RISE

Cell temperatures should be monitored throughout the initial charge and not permitted to rise above 120°F (49°C). If temperatures increase beyond this limit do one or more of the following:

1. Reduce charging voltage.
2. Add a cell or two.
3. Stop charge (subtract time from total hours of initial charge) and restart after cells cool to 90°F (32°C) or less.

CRITERIA FOR FULLY CHARGED CELL(S)

A fully charged battery is one in which at the end of initial charge all cells will stabilize at 2.60 to 2.70 volts per cell over three successive hourly readings and in which temperature corrected specific gravities stabilize at or near nominal specific gravity.

A visual inspection should also be made of the positive plate straps and posts. Properly activated and charged cells will exhibit a very dark blackish brown color of the positive grid frames, connector strap (inside cell) and posts leading up to the cover. This film is known as lead dioxide and forms a passive protective layer for the positive plate members. The absence of lead dioxide is a sign of improper charging and early failure of the cells so affected.

CONNECTION FOR NORMAL OPERATION

When the activating procedure is complete, connect the battery and charger to the load. It will perform the same as a battery that was delivered filled with electrolyte. For normal operation and other information see Section IV of Section 12-800 for stationary cells and batteries.

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