

Installation Engineering Handbook 18
Western Electric Company, Incorporated
Kearny Works

Section **17A**
9-18-70
Replaces Section
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and TI 17A of
4-24-68

INSTALLING STORAGE BATTERIES
GENERAL, RECEIVING, INSPECTING AND CLEANING

SEE C1-47.207-23 CONTENTS

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2. SCOPE

2.1 This section deals with general battery information. It covers precautions and definition of terms frequently used during the installation period and lists the tools needed for installing batteries. Contained herein are specific instructions and requirements pertaining to the inspection of cells upon receipt from the common carrier, their initial cleaning and the origination of the Storage Battery Report.

3. GENERAL

3.1 The installation of a storage battery consists of a series of operations which, as indicated in the Table of Contents, are covered in the associated sections in the 17 series. Each section furnishes the requirements and methods for that operation. The 17 series cover the time from the delivery of the cells to the job location, through the inspecting, cleaning, placing and connecting period, up until the time of charge.

3.2 Job designation information will be found on job drawings. The general information on designating battery cells and equipment may be found in the Equipment Designations Handbook.

3.3 When installing batteries permanently do not place cells of different manufacturers in the same string. An exception to this requirement is that C&D cells may be used to replace defective KS-15886 EXIDE cells. Do not install permanently cells with lead-antimony grids and cells with lead-calcium grids in the same string. Unlike strings, however, may be placed in parallel. See Section 18A for KS numbers and identification of lead-antimony and lead-calcium cells.

3.31 When replacing cells in a string the replacing cells shall have the same ampere-hour capacity (KS and List Number), the same number of plates and shall be of the same manufacturer. The manufacturer will ascertain that replacing cells contain the same number of plates as the remainder of the string.

3.32 Check to determine that the cells furnished agree with those ordered in the job specifications. Check for quantity, KS and List Numbers.

3.4 After completing the 17 series of sections proceed to the 18 series for the charge and turnover requirements necessary before the battery can be released to the operating company.

4. CAUTIONS4.1 PRELIMINARY CAUTIONS

4.11 STORAGE BATTERY CELLS DIFFER FROM OTHER SOURCES OF POWER AND ARE DELIVERED TO THE POINTS OF INSTALLATION AS A LIVE UNIT.

4.12 A STORAGE BATTERY CELL GIVES NO INDICATION BY ITS APPEARANCE OF THE POTENTIAL POWER STORED IN IT. AND IN THIS RESPECT DIFFERS FROM A ROTATING GENERATOR WHICH IS OBVIOUSLY GENERATING POWER.

4.13 SUPERVISORS SHOULD MAKE IT CLEAR TO ANYONE HANDLING, UNPACKING OR INSTALLING CHARGED AND FILLED CELLS THAT THEY CONTAIN ELECTROLYTE (SULPHURIC ACID AND APPROVED WATER) AND ARE FULLY CHARGED HAVING A CURRENT CAPACITY CAPABLE OF CAUSING SERIOUS BURNS OR FLASHES IF SHORT CIRCUITED.

4.14 BATTERY GASES, WHICH ARE PRESENT DURING A CHARGE OR WHICH REMAIN NEAR THE CELL AT THE COMPLETION OF A CHARGE, WHICH EXIST IN SUFFICIENT CONCENTRATION CAN BE EXPLODED. THE GAS MAY BE IGNITED BY A FLASH RESULTING FROM THE OPENING OR CLOSING OF A CIRCUIT CONNECTION TO THE CELL, ACCIDENTALLY OR OTHERWISE; BY A SPARK FROM STATIC ELECTRICITY OR BY AN OPEN FLAME WHILE WORKING NEAR THE BATTERY.

4.15 TO DIRECT ATTENTION TO THE POSSIBLE SOURCE OF DANGER FROM BATTERY GASES, IT IS RECOMMENDED THAT ONE OR MORE

WARNING SIGNS, LETTERED IN LARGE CHARACTERS AS FOLLOWS, BE POSTED IN A CONSPICUOUS LOCATION NEAR THE BATTERY:

WARNING: BATTERY GASES ARE FLAMMABLE. NO SPARKS OR OPEN FLAME NEAR CELLS.

4.16 AVOID THE DANGER OF POSSIBLE EXPLOSION BY EXERCISING THE FOLLOWING PRECAUTIONS WHICH APPLY WHEN WORKING ON OR NEAR CELLS DURING INSTALLATION, AS WELL AS THOSE CELLS ALREADY INSTALLED AND CONNECTED TO OFFICE CIRCUITS.

4.2 Explosions

4.21 Batteries give off a certain amount of hydrogen and oxygen in explosive mixtures. The design of battery cells fitted with explosion control devices reduce to a minimum the possibility of an explosion that would injure personnel, or cause damage to the cell, or create a hazard to other equipment. With these features a spark, flame or arc can ignite only a small amount of gas unless it accumulates near the cell in large quantities.

4.22 Shipping plugs must be in place when the cell connections and interconnections are made. Otherwise the explosion control devices must be installed and those devices depending on at least minimum electrolyte level for their activation, must have the associated cell filled to that minimum level.

4.23 When a static charge or spark is released (discharged) by a person or object in the presence of this gas and the gas is of sufficient concentration it will ignite. If it occurs in a confined space this will cause an explosion.

4.231 Static electricity can be built up on a person, tool or instrument especially in dry, cold weather. The presence of humid air aids in bleeding off any charge that tends to accumulate.

4.232 Refrain from discharging possible static accumulation at or near filling funnels and vents.

4.233 When working on a connected string, discharge static from the person or any object before touching it to the cell.

4.2331 Static can be discharged by touching a grounded surface such as the metal battery stand when this in turn is grounded through connecting iron work.

4.2332 When the stand is not grounded touch the ground or "near ground potential" side of the battery conductors.

4.2333 If the ground or low voltage terminal is out of reach, a higher voltage terminal may be used by protecting the hand with two layers of dry cleaning cloth.

4.24 Avoid opening or making any cell connection, working on or near any cell, or use of open flame until the charge has been discontinued or reduced to a float value on a working battery and adjacent cells have been covered with wet cloths. Dissipate possible concentration of gas near the cells. When opening or making a cell connection, plan to have the other end of the conductor open, if possible to avoid chance of spark or flash near the cell. Insulate tools or metallic objects and use carefully to avoid sparking.

4.25 After initial installation or reassembly of explosion control devices and certainly before any float, charge or discharge of a battery, examine vents carefully to determine each are properly assembled and securely seated.

4.26 The added precautions necessary when working around wet type counter cells under load are covered in Section 15 of this handbook.

4.3 Against Personal Injury

4.31 Truckmen should be informed that discoloration of the shipping crates may be due to electrolyte and that the acid content of this stain may injure hoisting ropes, clothing and personnel.

4.32 For personal protection and protection of clothing use R-3055 Safety Goggles, rubber gloves, aprons, over-shoes and protective clothing as required. The above protection is recommended when handling electrolyte, moving old cells or when handling cracked jars in which leaks are suspected. One type of coverall which has been found to give exceptionally good service is sold under the trade name of "Worklon." See Installing Equipment.

4.33 Use plain water as a wash for any electrolyte entering the eyes and secure medical attention.

4.34 Use soda solution to neutralize any electrolyte coming in contact with the person.

4.35 To neutralize electrolyte on clothing, use approximately one part ammonia to two parts water to avoid white spots left by soda. Use caution when opening ammonia bottles since considerable pressure sometimes builds up in the bottle and ammonia or concentrated vapor is dangerous if gotten in the eyes or nose.

4.36 Avoid body contact with any glass jar, empty or otherwise, particularly when removing an old jar. Should a glass jar break there exists the hazards of cuts from sharp glass. Encircling the jar with layers of clean canvas is recommended as an aid in pulling jars from the stand. See Handbook 22.

4.4 Against Equipment Damage

4.41 Floor mounted cells (KS-5562) may be tipped as much as 30° momentarily in order to get through windows or past other obstructions, provided the shipping plugs are in place. Other cells containing electrolyte should not be tipped more than 15° from vertical for more than a few moments.

4.42 While handling cells keep shipping plugs securely in place to reduce evaporation and to prevent damage from splashing electrolyte.

4.43 Protect all cells while working in their vicinity, with suitable covering of wooden frameworks or other non-conducting material.

4.44 Use strong sode solutions to neutralize electrolyte spilled on equipment.

4.45 In no case should soda solution or ammonia be allowed to enter a cell. In no case shall, grease, NO-OX-ID"A" compound or silicone compound be allowed to come in contact with any ceramic vent. Avoid contact of plastic on plastic cell parts with petrolatum or solvents such as kerosene, gasoline, petroleum spirits, cleaning compounds, and the thinner in waxes and polishes.

4.46 An adequate supply of soda and sawdust should be available. Should a cell be broken releasing its electrolyte the soda can be freely used to neutralize the acid and the sawdust can be used to soak it up and also prevent the spreading of the electrolyte into areas where damage might be done. Do not use sand as objectionable gases may be released when sand and electrolyte are combined.

4.47 Do not store cells in locations where some are subjected to one temperature and others are at an appreciably different temperature, such as heated and unheated quarters, close to radiators, etc.

4.48 Cells should not be exposed to direct heat radiation. Sunlight may adversely affect the finish of rubber cell containers. Heat from direct sunlight or nearby radiators will increase the local action in any type cell. It is especially objectionable for the local action of a cell or a few cells to be appreciably greater than for the remainder of the string. Where cells are being installed adjacent to radiators or where direct sunlight will fall on them the condition should be called to the attention of the telephone company who may wish to provide shields for the radiators and blinds for windows. It is desirable that cells be so placed that not more than 5°F difference in electrolyte temperature will prevail between any cells in the same string.

4.49 Do not lift cells by means of intercell connectors, cell posts or covers. The posts of some cells are made of pure lead and bend very easily. Do not rock, pry skid or slide KS-5562 floor mounted cells. Use only the R-2694 battery

lift for moving these cells once they have been removed from the skid. Exercise care when handling cells so as not to crack, scratch or otherwise damage cell jars. Use protective materials to prevent any part of the jar from coming into contact with hard materials such as bare floors, steel racks, metal parts of lifting devices and tools.

4.5 Service Interruptions

4.51 Make no changes on any live working power equipment in an operating office, except at approved time and with method approved by the operating company's representative. The supervisor for such work must personally and continually supervise the operation. See procedure to prevent service interruptions in Handbooks 0 and 22.

4.6 Battery Water

4.61 Additions of unapproved water have been known to ruin a storage battery.

4.62 Determine from the telephone company that water for use in storage batteries is approved. Each battery manufacturer has established arrangements for analyzing questionable water samples.

5. BATTERY REPORT ID-1285

NOTE: An ID-1285 Storage Battery Report shall be maintained on each battery throughout application of the 17 and 18 series of handbook sections and shall include all information required by these sections.

5.1 Originate an ID-1285 form and complete the appropriate blanks covering Town and State, Office (type or name), Job Order Number, KS and List Number of the cells and the Date the Cells were Shipped as indicated on the packing slip when this is available. When this is not available use the date stamped on the individual cells. As an example if the date code were 6-64 or 0664 the Date Cells Shipped would be June 1964 and the day can be considered the first day of the month. The Date Code may be found on the post, intercell connector or cell cover. Record the Street Address, Telephone Company and the Battery Designation; i.e., 48 Volt "A", 24V "B", etc. Indicate the Supplier and record the Supplier's Order Number (Battery Manufacturers Order Number). If Supplier's Order Number is not available leave this space blank as the Job Order Number will suffice. Refer to Figure 1 for an example of a typical battery report.

5.11 The Supplier's Order Number is needed on the battery report since a copy is sent to the factory on cells larger than 100 ampere hour capacity. The factory retains these records for reference should questions arise or should it become necessary to replace or add cells. These records aid the factory in selecting new cells that are compatible with the existing string.

STORAGE BATTERY REPORT

THIS COPY FOR _____

TOWN AND STATE Maryland Park, Md.		OFFICE #5 X Bar	JOB ORDER NO. 69394-H	KS LIST 15544 508	MEASURED END ☐ ARBITRARY LENGTH ☐	PILOT CELL NO.	DATE CELLS SHIPPED 5-17-58	NO. OF STRINGS CHARGED IN PARALLEL	SHEET OF SHEETS
STREET ADDRESS 716 Pleasant Street		TELEPHONE COMPANY C & P of Maryland	SUPPLIERS ORDER NO. WE-13016-A	C&D ☐ EXD ☒ GLD ☐	SUPPLIER	VOLTAGE REGULATION MAN ☐ AUTO ☐	CONNECTED TO WORKING EQUIP. YES ☐ NO ☐	DATE CHARGE STARTED 19	BATTERY DESIG. 48 Volt "B"

INDIVIDUAL CELL MEASUREMENTS						PILOT CELL MEASUREMENTS					
CELL NO.	ELEC. LEVEL	INITIAL CHARGE									
		17A		18B OR 18C							
		(NOTES ON BACK)		DATE		DATE					
		AS REC.	CORR.	VOLTS IN EXCESS OF 2.00	TEMP.	VOLTS IN EXCESS OF 2.00					
		☐ 1/4 INCHES		MEAS.	CORR.	°F	MEAS.	CORR.			
1	L	W01									
2	L	W02									
3	M1										
4	L										
5	L										
6	L										
7	L										
8	L										
9	M2										
10	L										
11	L										
12	L	W02									
13	L										
14	L										
15	L										
16	L										
17	L	W01									
18	L										
19	L	W01									
20	L	W02									
21	L										
22	L	W02									
23	L										

PAR. 5.4, 5.5, 6.26 & 6.27
ELECTROLYTE COULD BE SEEN
JUST BELOW TOP OF PLATES.
2 PINTS ADDED COVERING PLATES.

SYMBOL		1		2	
L					
M					
3					
M 0					
M 7					

NOTE 2
SYMBOLS FOR "AS RECEIVED" COLUMN

INDICATES LEVEL ANYWHERE BETWEEN 1/2 INCH OF PLATE EXPOSURE AND MINIMUM LEVEL. OMIT SECOND SYMBOL.

OR

PREFIX "M" INDICATES MINIMUM LEVEL REFERENCE

NUMERICAL SUFFIX WHEN USED WITH PREFIX "M" INDICATES HEIGHT IN QUARTERS OF AN INCH ABOVE MINIMUM LEVEL REFERENCE. (INDICATE TO NEAREST QUARTER OF AN INCH)

EXAMPLES:

M 0 MINIMUM LEVEL

M 7 1.3/4 INCHES ABOVE MINIMUM LEVEL

SYMBOL			1			2			3		
W	1	9									
R	0	7									
W	2	7									
R	0	7									

NOTE 3
SYMBOLS FOR "CORRECTED" COLUMN

IN THE APPROPRIATE BOX, INDICATE WITH AN "X", THE UNIT OF MEASUREMENT USED.

FIRST SYMBOL - ALL CELLS

WATER ADDED

ELECTROLYTE REMOVED

ELECTROLYTE ADDED

SECOND AND THIRD SYMBOL FOR HARD RUBBER CELLS

SECOND AND THIRD SYMBOL INDICATES PINTS.

IF LESS THAN 10 PINTS, SHOW A ZERO (0) AS SECOND SYMBOL.

SECOND AND THIRD SYMBOL FOR PLASTIC CELLS

SECOND AND THIRD SYMBOL INDICATES NUMBER OF QUARTERS OF AN INCH. IF LESS THAN 10 QUARTERS (2-1/2 INCHES), SHOW A ZERO (0) AS SECOND SYMBOL.

EXAMPLES:

WITH 1/4 INCHES AS THE UNIT OF MEASUREMENT:

W 1 9 4.3/4 INCHES OF WATER ADDED

R 0 7 1.3/4 INCHES OF ELECTROLYTE REMOVED

WITH PINTS AS THE UNIT OF MEASUREMENT:

W 2 7 27 PINTS OF WATER ADDED

R 0 7 7 PINTS OF ELECTROLYTE REMOVED

* Cell 13 returned to mfg. due to excessive spillage. Replacement received 6-12 on supplier's order WE-13023-A. Emergency cells charged in series with regular string.

DATE OF TURNOVER _____ 19 ____

APPROVED BY _____ DATE _____

REMARKS: _____

MEASUREMENTS BY _____

AVERAGE _____

AVERAGE _____

FIG. 1 TYPICAL STORAGE BATTERY REPORT SHOWING HEADINGS AND ELECTROLYTE LEVEL INFORMATION
(PAR. 5., 7.25, 7.27)

(RP-18341-M)

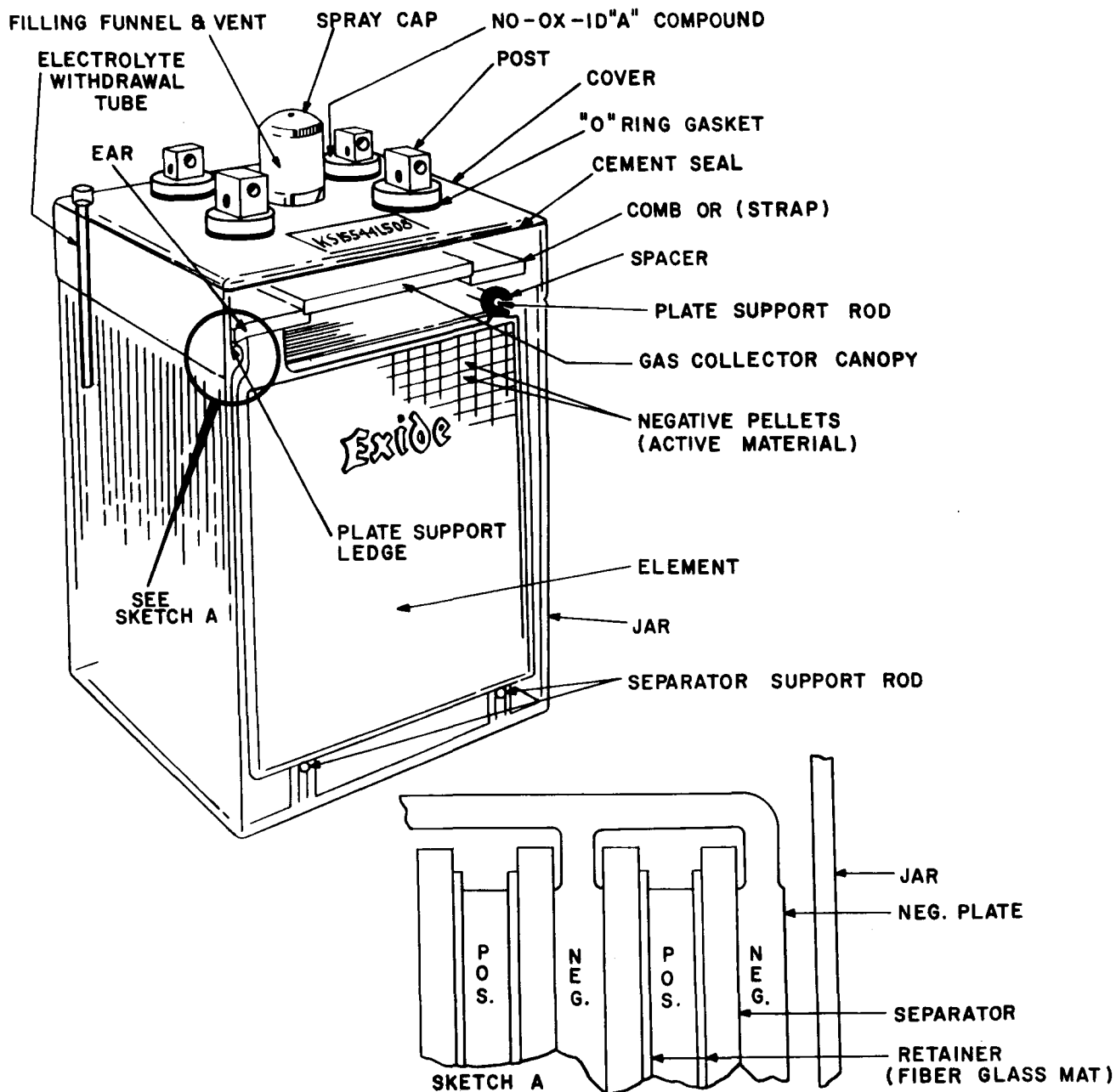
(OVER FOR NOTES)

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17A



RP-19942

FIG. 2 IDENTITY OF RACK MOUNTED CELLS PARTS - TYPICAL
(PAR. 7.152, 7.153 & 7.155)

5.2 When the cells are delivered to the job location, permanent or temporary identification of each cell is required.

5.21 Serial numbers are now being placed on large cells and may be found on small cells. They may be located on top of the cell post steel stamped below the date (Gould batteries) or printed on adhesive labels attached to the cell cover. When provided, list these serial numbers on the back of the ID-1285 report in accordance with the intended final cell numbering. ID-1285 Form Issue dated 5-67 or later contains a Serial Number column on the rear of the form. This is not shown in Figure 1. Should the cells not be placed as intended, the "Cell No." on the rear of the form and

the "Electrolyte Level" information on the front of the form will have to be corrected accordingly.

5.22 For cells without serial numbers, tag or mark cell numbers on the top of each cell with a "china marking pencil" or any other suitable method. Retain this temporary identification until the cells are placed in their final sequence and the symbols and notes can be associated with the permanent cell numbers. When feasible, select and place the cells, retaining the temporary cell numbering and thereby obviate the need for transposing the numbers.

5.3 In the first column on the form complete the cell numbers to correspond with the final cell numbering. Use as many sheets as necessary for each battery.

5.4 As soon as possible after the battery is delivered to the job location, under "Electrolyte Level" and "As Received" column, indicate with appropriate symbols (explained on the back of ID-1285) the electrolyte level of each acceptable cell as received.

5.5 On cells requiring corrective action, record the symbols in the "Correction" column, representing the measures necessary to cover the plates, or to bring electrolyte to minimum level as explained in Paragraphs 4.22, 7.25 to 7.27.

NOTE: On the final form the symbols under the "Correction" column will represent a collective total of the amounts added or removed until the cells are turned over to the telephone company.

5.6 Indicate in space for "Remarks" the quantity of cells or batteries of original shipment that are unacceptable, and reason, such as cracked container or cover, or unacceptable due to excessive plate exposure. In the space for "Remarks" record the position and length of any external scratches or crazing within the plastic or containers that are considered acceptable.

6. RECEIVING BATTERY SHIPMENTS

6.1 Rack mounted cells are received in paperboard cartons or wooden shipping crates or boxes which in turn are shipped on pallets (platforms) in groups of 4 to 9 and may weigh as much as 2000 pounds. Depending on the facilities for lifting, the common carrier or local truckman may choose to handle palletized units to the job location.

6.2 Since door openings and stair wells usually make it impractical to accept delivery of palletized units the bands should be broken and the cells, in their individual shipping containers, may then be brought into the building. Further, the delivery of palletized units in the building should be discouraged as some difficulty may be experienced in removing the cells with the battery hoist.

6.3 Do not allow the local truckman to remove the cells from their individual cartons. Cell top, sides, and bottoms are very easily damaged when moved unprotected.

6.4 Uncrating and unpacking floor mounted cells is covered in Section 17D.

7. D.S. INSPECTION

WARNING: Do not attempt to repair any cell unless specifically instructed to do so. Do not allow petroleum products or heat to come in contact with plastic cell parts.

7.1 Cell Damage and Defects

7.11 Inspect each cell and accessory promptly after receipt. It is imperative that cells be examined for

shipping damages as soon as they arrive on the job. Noting damages promptly with the common carrier (preferably while he is still in the building) will greatly aid the subsequent filing of claims.

7.12 If cells are still palletized, remove steel bands carefully as the sudden release of tension must be avoided to prevent personnel and equipment damage. The uncrating and handling of KS-5562 floor mounted cells is covered in Section 17D.

7.121 Use R-3662 Safety Steel Strap Cutter to remove steel bands. As an alternate, grasp a midportion of the band with two pair of long nose pliers (adjacent plier jaws touching) and by separating the pliers with a shearing action the band will be torn. Retain hold on the pliers until the ends of the band can be contained.

7.13 Open shipping crates, cartons, etc. taking care so as not to injure the cell. Do not cut cartons with the skinning knife as many cells have been damaged in this manner. Once the cartons are opened, exercise care to avoid damaging the jars. Plastic jars are particularly susceptible to damage by scuffing and scratching. Prevent jars from coming in contact with metal battery stand supports, grit on the floor or shelf, etc.

7.14 Check for evidence of stains and discoloration in the packing material which would suggest either spillage or cracked jars. Check for any other defect or physical damage to the cell parts and accessories.

7.15 In addition, check each cell in detail for the following items:

7.151 Breaks in jar-to-cover seal.

7.152 Loose active-paste-material lodged between element and jar wall. See Paragraph 9.16 for definition of "element". See Figure 2.

7.153 On Exide cells, plate support rods (top of cell) bent or broken. See Figure 2.

7.154 Scratched plastic jar and cover. It may be necessary to wait until the cell is being hoisted onto the rack to gauge scratches on the bottom. Examine each plastic jar bottom, sides and cover to determine that there are no holes, chips, gouges or scratches 1/64" deep or deeper. An R-3618 Scratch Depth Gauge may be used for checking gouges and scratches. Lightly draw the protruding edge of the gauge along the opening and if light cannot be seen between the heel of the gauge and the surface of the cell, the unit is defective and should be reported.

NOTE 1: If any of the above items are evident but not accompanied with the following items it can be assumed these irregularities are factory defects (packing material undamaged) and

they should be reported on a Route "G" J.I.M. to the Supplies Inspection Organization.

NOTE 2: If the following items are evident they would indicate damage in transit. For E.F. & I. (W.E.E.) orders, report damages to Field Service on a Route "C" J.I.M. For T.C.E. orders, report damages to the Distributing House on a Route "H" J.I.M. This is covered in the SDI.

7.155 On Exide cells, ears on lead plates turned (bent) up where resting on the jar support ledge. See Figure 2.

7.156 Cracked jar or cover when made of either plastic or rubber. Mold marks should not be confused with cracks.

7.16 When reporting damaged cells or defective cells on a J.I.M., take care to include all of the following information: (1) Complete job address and phone number (2) Manufacturer (3) Supplier's Order Number, if available (4) Complete job order number with suffix letters (5) KS and quantity of all List numbers, and total number of cells if different, such as; "KS-5361, twenty L 151 & two L 150 - total 64 cells" (6) Battery involved, such as; "130V A" or "48V C" (7) Date cells were manufactured and manufacturing location code. This information, when available, is found on the cell post, on an intercell connector or on the cell cover.

7.17 When returning a cell to the factory due to defective parts, completely fill out ID-177 Surplus Material Tag directing particular attention to detailing the nature of the defect. In addition, circle each defect in the jar or cover with a china marking pencil.

7.18 While waiting for a decision on reports of damages, defects or operating company complaints, it is necessary to apply a form of charge to the cells within specified time limits to prevent them from totally deteriorating. The method is covered in Section 18A, Paragraph 6.

7.2 Plate Exposure and Electrolyte Level

7.21 A drop in the electrolyte level to the top of the plates is usually due to loss of gas and evaporation and is a normal condition.

7.22 Cells received with the electrolyte level below the top of the plates are assumed to have lost electrolyte by spillage.

7.23 As soon as possible after receipt, check electrolyte height in each cell to determine that the plates are covered.

7.24 Cells having more than 1/2-inch of the plates exposed (not covered by electrolyte) for more than twenty minutes are not acceptable.

7.241 When returning a cell due to excessive plate exposure fill with water to the minimum level. Indicate

on an attached tag the specific reason the cell is not acceptable and the amount of water added.

7.25 If more than 1/2" of the plates are exposed for less than 20 minutes, as might result from improper handling by the local truckman or tipping by the installer, etc., the cell may be "saved" by an immediate transfer of electrolyte from a number of the battery cells with the highest electrolyte level. The details of this adjustment shall be recorded on ID-1285 under "Electrolyte Level, As Received and Corrected" columns. Note explanation in space for "Remarks". See Figure 1.

7.26 With any type of cell, being able to pick up electrolyte with the hydrometer is proof that the plates are covered. Check electrolyte heights in transparent jar cells, by observation. View electrolyte height in rubber jar cells by removing shipping plug vent, filling funnel or height indicator as necessary. Some nontransparent containers have an anti-explosion baffle partially covering the plates. See cautions in regard to open flame and sparks. With the top of the plates in view, and when no electrolyte can be seen, it must be assumed that more than 1/2" of the plates are exposed. See Paragraph 7.24.

7.27 If the plates are exposed 1/2 inch or less, and just enough water to cover the plates. Record the amount added on ID-1285 under "Electrolyte Level-Correction". See Figure 1. Cells that have not had the plates exposed should not have water added at this inspection time.

7.28 After checking and correcting as necessary, the electrolyte level of each cell, replace the shipping plugs to reduce hazard of an explosion, control evaporation and facilitate handling.

8. CLEANING AND NEUTRALIZING

8.1 Clean and neutralize all cells thoroughly as soon as practicable after they arrive on the job.

8.11 During shipment some electrolyte will always escape from the cell and collect on the cell cover and jar. Cells must vent in transit to release pent-up gasses. It will be necessary to clean cells of spilled electrolyte and to neutralize the remaining acid from the cleaned cells in order to determine if there exists any small cracks or breaks, leaking or broken seals, etc., as may be evidenced by the reappearance of electrolyte. Cleaning at this time also facilitates handling the cells later when placing them on racks and in cabinets.

8.12 Mix a strong soda solution. See Paragraph 9.29. Replace shipping plugs or otherwise block or cover all openings effectively to prevent soda solution from entering the cell. Soda inside a cell will ruin it.

8.13 Wet a cloth or towel in the soda solution and squeeze out sufficiently to prevent dripping. Wipe thoroughly to neutralize cell top and sides.

8.14 Pay particular attention to acid accumulations in the area of the cell posts and post-to-cover seal. Usually it is not necessary to remove NO-OX-ID "A" compound from the cell posts but any electrolyte on the outside of the NO-OX-ID "A" compound must be neutralized.

8.15 If there is evidence of electrolyte creepage around or on the cell posts (e.g. blackening of the positive post or other evidence of corrosion) remove NO-OX-ID "A" compound from those posts affected by thoroughly wiping with a dry cloth or towel. Disposable towels are preferred and may be obtained from Chicopee Mills Inc., 47 Worth Street, New York City 13, N. Y. Towels are packed 100 per box. Brush thoroughly with a wire brush to remove all oxide or corrosion. Neutralize posts with a strong soda solution.

8.16 After neutralization has been completed, rinse to remove salts and residue with a cloth or towel wet with plain water. Daub wet cloth or towel on NO-OX-ID covered posts and thoroughly wipe cleaned posts, jars and covers. A white residue on the cell after it dries indicates a need to re-rinse.

8.17 Recoat all cleaned posts with a thin film of NO-OX-ID "A" compound.

8.171 Take care to use clean NO-OX-ID "A" compound. NO-OX-ID "A" compound contaminated with acid has been suspected of contaminating otherwise clean posts. If the compound is suspected, use a fresh quantity and take care not to transfer acid back into the compound.

8.18 After inspection, cleaning and neutralizing cells in paperboard containers, temporarily tie up the sides and replace the top to provide protection until they can be installed.

9. DEFINITIONS AND DESCRIPTIONS

9.01 Storage Cell: An assembly of negative plates, positive plates and separators in a single container. The plates are charged and when contained in the electrolyte solution the terminals are electrically alive. It operates as an electrolytic cell for supplying electric energy through chemical action. After discharge it may be restored to a charged condition by an electric current flowing in a direction opposite to the flow of current when the cell discharges.

9.02 Storage Battery: Two or more cells in a connected group is defined as a storage battery. If a single cell is used independently as the total accumulated voltage it may be called a battery.

9.03 Voltage: Storage cell voltage is due primarily to the difference in potential existing between two conducting substances immersed in the same electrolyte. The potential for lead (negative) and lead peroxide (positive) supported by lead antimony grids, in electrolyte at 1.210 specific gravity and 77F is 2.05 volts, the nominal open circuit voltage.

9.04 Trickle Charge Rate: The current necessary to keep the battery in a fully charged condition when the battery is not delivering current to a load.

9.05 Specific Gravity: The ratio between the density of the electrolyte, and the density of water which is taken as 1.000. Specific gravity becomes lower, approaching 1.000, as the battery is discharged and rises as the battery is charged.

9.06 Ampere-Hour: The unit of capacity for storage cells. The "ampere-hour capacity" value represents a prediction of the cells ability, through chemical action, to furnish to a load at a useful voltage, a given value of current in amperes for a particular length of time. As an example the 8 hour discharge rate shown on the cell multiplied by 8 hours equals the ampere-hour capacity.

9.07 Finishing Rate: formerly Nominal Charging Rate: the current value recommended by the battery supplier as a current which can be absorbed by the cell throughout the charge without overheating or harmful gassing.

9.08 Plate Exposure: When more than 1/2" of the top of the plates have been exposed (not covered by electrolyte) for more than twenty (20) minutes the condition of "plate exposure" exists.

9.09 Floating: Maintaining a continuous voltage across a battery at a value which will supply all external demands for current and in addition will supply a trickle current into all cells to counteract internal losses. Since approximately 2.13 volts per cell is the lowest value that will insure an adequate trickle charge, batteries are usually floated at 2.17 volts per cell to insure an adequate charge for the weakest cell.

9.10 Automatic Float: An arrangement whereby a voltage regulator holds the voltage at all times very close to the float value. Battery life is long because the cells are kept fully charged with a minimum current. Maximum reserve capacity is always available and very close voltage regulation is obtained for the connected circuits.

9.11 Positive Plate: A positive plate consists of a grid filled with positive active material. A charged positive plate is dark brown in color. The terminal to which positive plates are attached is usually designated POS., + or is referred to as the plus terminal. Grid materials are made of either lead-antimony or of lead-calcium.

9.12 Negative Plate: A negative plate consists of a grid filled with negative active material. A charged negative plate is light gray in color. The terminal to which negative plates are attached is usually designated NEG., - or is referred to as the minus terminal. Grid materials are made of either lead-antimony or of lead-calcium.

TABLE A ELECTROLYTE LEVEL
(PAR., 9.22)

	Maximum Level	Minimum Level
KS-5553 & KS-15544 in transparent containers, KS-5361, L116 to L151A and KS-5538	High line (top)	Low line (top)
KS-5553, KS-15544 & KS-5562 in non-transparent containers & without float covers.	Second color visible	Top of float just shows
KS-5553 & KS-5562 with float covers.	High line (bottom)	Low line (top)
KS-5361	High line (top)	Low line (top)

NOTE: Maximum and minimum levels of cells with transparent covers over floats are attained when the leading edge of the float target reaches the above maximum and minimum lines marked on covers. On some small cells where plant design does not permit observing level lines on parts of the cells, use top of separators and bottom of cover as limits.

9.13 Separator: A separator is placed between each positive and negative plate to prevent physical contact between the two. It is composed of various material affording low resistance to the circulation of electrolyte by its porosity and, in turn, providing low internal resistance to electrical current flow.

9.14 Retainers: Loosely woven fiberglass mat in contact with the face of the positive plate.

9.15 Group: A group is an assembly of a set of plates of same polarity for one cell.

9.16 Element: An element consists of the positive and negative groups of plates with separators and retainers for one cell.

9.17 Unit: Any number of cells factory interconnected and arranged in a common container and two or more distinctively separate compartments.

9.18 Electrolyte: Electrolyte is the solution in which the plates of a storage cell are immersed. This solution consists of purified sulphuric acid and approved water. The specific gravity of the solution at any time is dependent upon the type of cell, the electrolyte temperature and the amount of cell charge. Observed specific gravity readings are corrected to established base temperature of 70°F or 77°F for reference purposed. (See Section 18E for definitions of reference temperatures of 70°F and 77°F). Water which is lost from the electrolyte through evaporation or other reasons is replaced to keep the proportion of water to acid practically constant. If this is not done the hydrometer readings would reflect the variation of the electrolyte density due to water loss and cannot be relied upon as an accurate indication of the condition of charge.

9.19 Thermometer: Thermometers to measure electrolyte temperature are graduated in degrees Fahrenheit and also have a scale indicating the correction to be made on the observed hydrometer reading to correct it to the establishing base or reference temperature.

9.20 Hydrometer: A hydrometer is an instrument for measuring the specific gravity of the electrolyte. The syringe

type consists of a sealed glass tube properly weighted and provided with an inner scale graduated in terms of specific gravity. This is enclosed in a syringe, consisting of a glass cylinder with rubber bulb at one end and a tip at the other, arranged so that electrolyte can be drawn out of the cell to float the hydrometer.

9.21 Level Indicator: Level Indicators are provided for cells when the level cannot be observed through nontransparent containers such as rubber jars. The indicator floats on the electrolyte and through a hole in the cover of the cell. The stem has identifying marks or colors which indicate the electrolyte level in ranges.

9.22 Maximum and Minimum Levels: "Maximum Level" and "Minimum Level" vary with the particular cell involved as defined in Table A.

9.23 Battery Rack: Any battery support other than the floor such as battery stands, relay racks, cabinets, etc.

9.24 Containers: Containers or jars are made of hard rubber and transparent molded plastic.

9.25 Case: The term "case" is applied to the wooden case or box in which some cells are packed and left during life.

9.26 Pans: Previously called Trays. Pans are made of plastic or lead and when specified are placed under cells or the entire battery. Pans are used under high voltage battery cells and in rented quarters to catch electrolyte in case a cell should break or leak.

9.27 String: A string is all the cells permanently connected in series without taps and each cell in a string is subject to the same current conditions; that is, has the same charge or discharge current. An exception is a 70 cell Carrier battery which is wired with taps. The taps are to equalize group loads spaced over the entire battery which does not affect charge or discharge current values throughout the string. A battery consists of one or more strings.

9.28 Large and Small Cells: Large cells are those whose 8-hour rated capacity is over 100 ampere-hours and small cells are those of 100 ampere-hour rating and less.

9.29 Strong Soda Solution: A "strong solution" is 2 pounds of table soda (bicarbonate), one pound of washing soda, or 1/2-pound of Bell System pyrophosphate cleaner to one gallon of water. It is used where there is a strong concentration of electrolyte as in the case of spillage or dripping. Cleaning cloths may be used to mop up electrolyte after neutralization. A gallon of strong soda solution will neutralize from 1/2- to 1-pint of electrolyte.

9.30 Weak Soda Solution: A "weak soda solution" is approximately 4 ounces of table soda (bicarbonate) or 2 ounces of Bell System pyrophosphate cleaner per gallon of water. It is used to neutralize traces of electrolyte as on surfaces subject to electrolyte fumes.

9.31 Explosion Control Devices: Explosion control devices are of two designs. One consists of a gas collector hood at the top of the plates but below the level of the electrolyte. A vent tube fits into the hood. The shape of the hood causes the gas rising from the plates to collect and vent through the vent tube. Gas accumulation is limited to the space within the tube. The second control device consists of a porous ceramic vent fitted to the cell cover which permits gas to escape but prevents an open flame or spark from entering the cell.

9.32 Crazing: Lines, similar in appearance only, to cracks which may develop in plastic containers.

9.33 Rack Mounted Cells: All cells of a design size intended for mounting on a "Battery Rack".

9.34 Floor Mounted Cells: Previously defined as "Rubber Tank Type Cells". An enclosed type floor mounted storage cell such as KS-5562.

9.35 Open Tanks: A floor mounted, open type lead-lined wood tank. An older design of cell now Manufacture Discontinued and replaced by "Floor Mounted Cells".

10. INSTALLING EQUIPMENT

10.1 Tools

Code	Description	In Kit
R-2628	Brush, Wire	3
R-1748	Clamp, C. 3"	3, 4, 42, 49, 102
R-3662	Cutter, Steel Strap, Safety	3
R-3939	Gantry	
R-3618	Gauge, Depth, Scratch	

10.1 Tools (Cont'd)

Code	Description	In Kit
R-3055	Goggles, Safety All Plastic	4, 32, 32A, 36, 42, 43, 48, 55, 102, 145, 162
R-2667	Hoist, Battery Includes R-3437 Battery Lifting Strap	
R-3448	Hoist, Battery, 3 Tier Including R-3437 Battery Lifting Strap	
R-1496	Hoist, One Ton	
R-1370	Level, Bench, 12"	3, 32, 32A, 102
R-4058	Lift Assembly, Battery	
R-2694	Lift, Battery, One Ton	
R-2695	Truck, Hand Lift	

10.2 Supplies

Code	Description
Obtain Locally	Ammonia
R-3043	Apron, Acid Proof
RM-626122	Canvas, Flameproofed
KS-14666	Cloth, Cleaning
Obtain Locally	Clothing Protection (See Note 1)
R-3266	Compound NO-OX-ID "A"
R-3034	Gloves, Acid Resistant (See Note 1)
Obtain Locally	Overshoes, Rubber (See Note 1)
RM-646317	Paints, Enamel, Gray, Acid Resistant
612.173	Pencil, Black China Marking
Obtain Locally	Rubber Sheet Soft 1/16" to 3/16" thick, Amount depends on condition of floors
Obtain Locally	Sawdust
Obtain Locally	Soda, Bicarbonate (commercial), Washing Soda (commercial) (See Note 2)
KS-7860	Spirits, Petroleum
Obtain Locally	Sponge
Obtain Locally	Talc or Soapstone Powder
Obtain Locally	Water, Distilled or water used by the telephone company and known by them to have the battery supplier's approval
RM-641450	Wax, Cable Impregnating

NOTE 1: When handling storage batteries or electrolyte, accidental exposures to acid is sometimes experienced, however, under normal conditions direct contact with electrolyte will not be encountered while installing enclosed type storage batteries. Since acid will injure clothing ordinarily

→ worn, the local supervisor may purchase "Worklon" coveralls style 9127 for battery and wet counter cell operations, if in his option exposure to electrolyte justifies the purchase of protective clothing. These coveralls are made of Dacron and are priced higher than ordinary cotton for similar operations. They may be obtained from Worklon, Inc., 63 New York Ave., Huntington, L.I., N.Y. 11744.

NOTE 2: Bell System soda cleaner, if available, is an excellent acid neutralizer but the pyrophosphate cleaner which replaces it in building service supplies is a less effective neutralizer and should be used only when the others are not available. Bubbles are given off when soda is neutralizing acid. No bubbles appear when pyrophosphate is neutralizing acid.

→ Arrowed lines indicate new or changed information.

[Vertical lines at side of paragraphs indicate requirements.

Manager, Product Engineering

Reason for Reissue:

To include TI - 17A in Paragraph 3.3.
To change "Worklon" coverall style number from D-999 to 9127.