CEMF CELLS

ALKALINE TYPE

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1. GENERAL

1.1 Scope

1.11 This section covers the installation of Alkaline Type Counter Electro Motive Force cells and includes cautions, inspection and check, mixing and filling procedure and placing and making circuit connections.

1.2 Description

1.22 An alkaline type counter cell consists of a container supporting two sets of plates and a conducting electrolyte solution. It operates as a resistor to reduce the voltage between the central office battery and the connected equipment. See Figures 1 and 2.

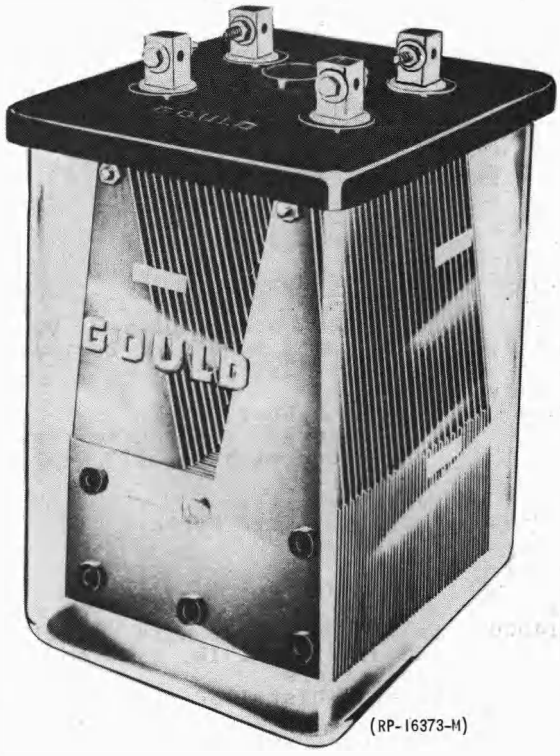

FIG. 1 TYPICAL LARGE SIZE PLASTIC CEMF CELL (PAR. 1.22)

2. INSTALLING EQUIPMENT

2.1 Tools

Code	Description
ITE-4040	Adjusting Set, DC

NOTE: The telephone company usually has a 3 volt scale DC Model 280 voltmeter which may be borrowed. If not available use the ITE-4040.

Obtain Locally	Brush, Suedeshoe
R-2628	Brush, Wire
Obtain Locally	Can Opener
R-1482	File, Flat
R-3055	Goggles, Safety, All Plastic
R-1060	Knife, Putty
R-2120	Pliers, Long Nose
R-3154	Sheeting, Protective
R-2512	Wrench, Adjustable, 8" - Open End
R-1255	Wrench, O.E., 31/32" - 1-1/16"
R-1770	Wrench, O.E., 1/2" - 9/16"

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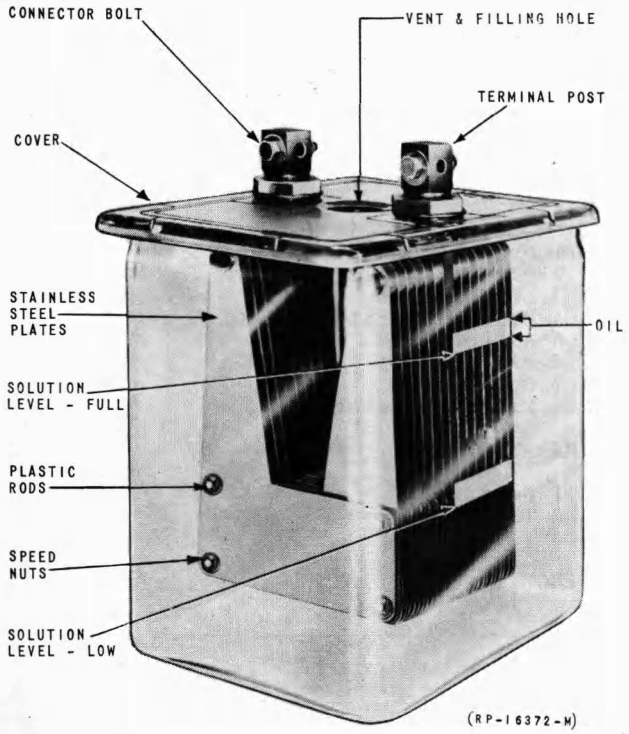

FIG. 2 TYPICAL SMALL SIZE PLASTIC CEMF CELL WITH PARTS IDENTIFIED (PARS. 1.22, 5.81)

2.2 Supplies

R-3043	Apron, Rubber
Obtain Locally	Boric Acid Solution
KS-14666	Cloth, Cleaning
R-3126	Compound, Silicone
Obtain Locally	Container, Glass, Glazed, Porcelain, Hard Rubber or Earthenware
Obtain Locally	Funnel, Glass
R-3034	Gloves, Rubber
-	Oil, Mineral, for Counter Cells (Provided with KS-5170 CEMF Cells)
R-3163	Paper, Abrasive
RM-636333	Rod, 1/2" Hard Rubber
Obtain Locally	Sandpaper 4/0
KS-14422 or KS-14500	Sodium Hydroxide
	Sodium Hydroxide with nickel depolarizer 1 lb. or 6 oz. containers
-	Water: (Distilled or tap, well, etc., Approved for Storage Battery Use)

3. PRECAUTIONS

NOTE: The mixing of CEMF cell solution should not present a hazard to personnel or equipment if the following precautions and safety measures are observed.

3.1 Personnel Protection

3.11 The person mixing the solution should protect himself by using an R-3043 rubber apron, R-3055 safety goggles (not safety glasses) and a pair of R-3034 rubber gloves. Always stir at arms length keeping the face to one side of the mixing container, i.e., not over the container.

3.12 If the sodium hydroxide, dry or in solution, should come in contact with the skin immediately run a large amount of water over the area and neutralize with a boric acid solution. If allowed to enter the eyes rinse with water for fifteen minutes and afterwards secure prompt medical attention.

3.2 Equipment Protection

3.21 In preparing for mixing the solution protect the floor as necessary and protect any adjacent equipment close enough to be affected by the spray.

3.22 When handling the jars exercise care to prevent cracking, chipping or scratching. Use protective material at all times to prevent any part of the jar from coming in contact with hard materials such as bare floors, steel racks, metal parts of lifting or moving devices or tools.

4. INSPECTION AND OBTAINING REPLACEMENTS

4.1 As soon as possible after the cells have arrived on the job carefully open each packing container and examine the contents for damage. A preliminary check at this time allows for claim papers to be filed promptly, when required, in accordance with the Job Clerical Handbook and replacements to be obtained as soon as possible. Inspect further for manufacturing defects and determine from the job specifications that the correct quantity and proper type were shipped.

4.2 When replacements and manufacturer's corrections are required originate a JIM. The JIM should include KS and list numbers, office name, address, job order number and D.S. order number. If signer's address is other than that given for the office it should also be included.

4.3 A description of flowlines and the ability to recognize them as compared to actual cracks is necessary in order to judge an acceptable cell from a defective one.

4.31 In the process of manufacturing cell tops the molding material runs into the mold and separates at each plug (hole in the cover piece) it rejoins on the far side of the plug and in so doing leaves a fine line in the surface of the cover, which is known as a flowline. This is not a defect and should not be confused with an actual crack.

4.4 Replace cells temporarily in their shipping containers to protect them until they can be installed.

5. MIXING

5.1 Preparation for Mixing

5.11 Sodium hydroxide is mixed with water to make a caustic soda solution and forms the cell electrolyte. The mixing is usually done at or near the final location of the cell.

5.12 Prepare the general area where the mixing will be performed by providing necessary protection. See Paragraph titled "Equipment Protection".

5.13 Obtain and wipe clean an RM-636333 hard rubber rod for stirring. Have sufficient water for mixing available and boric acid solution for neutralizing as required. Open the necessary quantity of sodium hydroxide, and discard the nickel depolarizer except when renewing solution in old Exide cells with nickel plates.

NOTE: Sodium hydroxide per KS-14422 is the same as that per KS-14500, except that nickel depolarizer is furnished with the latter. Either is satisfactory for use in cells with stainless steel plates, and either may be furnished for use with them, depending on supply conditions.

If it becomes necessary to use tools or utensils previously used with storage battery electrolyte they should first be thoroughly rinsed with water. Put on the rubber gloves, rubber apron and safety goggles.

5.14 Especially with the larger size jars when space permits stirring and placing of the elements, consider locating the jars in final position on the stand before adding the liquid. Where space limits prohibit filling, mixing or placing elements make up a platform or use the R-2667 battery hoist as a temporary support and as an aid to final placement. The R-5460 three position stool may be used to support jars to be placed on the lower shelf.

5.2 Plastic Cells

5.21 Do not mix the solution in cell jars made of plastic. The heat generated may be sufficient to cause damage to the jar.

5.22 Mix in a glass, glazed, hard rubber or earthenware container and transfer to the plastic jar. Never mix in an aluminum container nor allow aluminum to come in contact with sodium hydroxide or the electrolyte solution.

5.23 When a sufficiently large mixing container cannot be readily obtained the required sodium hydroxide may be mixed in less water than indicated for the cell (See Table A) but not less than 1/3 of that shown as excessive heat will be generated with a stronger concentration. It is not necessary to keep an account of the amount of water used since the final solution will contain the quantity of sodium hydroxide shown in Table A plus sufficient water to bring the solution up to the high level line with the element in place.

5.24 Place into the plastic jar 1/3 to 1/2 of the required amount of approved water to which the concentrated solution is added later.

5.3 Glass Cells

5.31 Mixing is performed within the jar when glass CEMF cell jars are provided. Fill the glass jar to approximately 1 1/2" below the high level line with approved water.

5.4 Mixing Operation

5.41 Pour the sodium hydroxide pellets into the water just above the water level to prevent splashing. IMMEDIATELY stir with the hard rubber rod until the pellets have completely dissolved.

5.411 Never pour water into dry sodium hydroxide.

5.42 When mixing in a separate container for plastic jars pour the solution into the jar in which water was previously added.

TABLE A

COUNTER EMF CELL CAPACITY AND SOLUTION DATA (PARS. 5.23, 5.81)

Old Desig's	KS-5170 List	F.L.C. Amps	Par. 1.33 Solution A.H.	Water Gals.	Sod. Hydro. NaOH Lbs.	Sod. Hydro. NaOH Ozs.	Oil Pints	Depolarizer Grams
NAK2	100	5	1700	0.35	-	6	0.3	0.25
NAK4	101	15	3000	0.75	-	12	0.6	0.50
NAK8	102	30	5100	1.25	1	-	0.9	0.875
NAK30	103	60	7200	1.75	1	12	1.2	1.375
NAE26A	106	100	20000	4.5	4	-	2.3	3.5
NAE50	110	200	20000	4.5	4	-	2.0	3.5
NAF58	120	300	43000	12.5	10	-	4.2	8.75
NAK2A	130	5	3000	0.75	-	12	0.6	0.50
NAK4A	131	15	8000	1.75	1	12	1.2	1.375
NAE6A	140	30	21000	4.50	4	-	2.0	3.5
NAF10A	150	75	54000	13.00	10	-	4.2	8.75
NAF14A	151	100	53000	13.00	10	-	4.2	8.75
	202 to 212 405 to 412 and 504	These are list 100 cells mounted in various ways in groups						

5.5 Assembly

5.51 Verify the assembly bolts on the element and cover are tight and all packing material and foreign matter removed from between the plates. Carefully lower the element into the electrolyte and observe that the cover rests evenly and squarely on the top edge of the jar. Additional ventilation is usually provided by spacing between the cover and jar, therefore, no sealing compound is used.

5.6 Placing

5.61 Place cell in its final position taking care so as not to bump or strike it against hard objects.

5.7 Spacing

5.71 Space cells as listed in Table B below with the center-to-center or terminal post-to-terminal post dimensions shown.

TABLE B

CELL SPACING (PAR. 5.71)

Cell	Min. C-to-C Inches	Min. Post-to-Post Inches
Cells mounted with plates perpendicular to stand length		
KS-5170, List 101, 130	5-1/4	4-3/8
List 102	7-5/8	6-3/4
List 103, 131	10-5/8	9-3/4
List 106	13	8 or 16-1/4
List 110, 140	13	8
Cells mounted with plates parallel to stand length		
KS-5170, List 101-103,130,131	8-5/8	3-1/4
List 106, 110, 140	11-1/8	5
List 120 (intermittent)	15	6-1/2
List 120 (continuous)	15-5/8	7-1/8
List 150, 151	15	6-1/2
NOTE: Loading for more than eight (8) hours at a time is considered "continuous" and for less time is considered "intermittent".		

5.72 The clearance between KS-5170 List 120 cells and adjacent storage battery cells shall be at least 3" when loading is continuous and 1" when loading is intermittent.

5.8 Final Adjustment

5.81 Fill to the high level line with approved water. Pour in the CEMF cell oil listed in Table A approximately equivalent to the thickness of the oil line marked on the cell. See Figure 2.

5.82 CEMF cells do not require charging.

6. OPERATION

6.1 General

6.11 When required in the circuit the CEMF cell reduces the voltage between the battery and the telephone office equipment. As the load current passes from one set of plates to the other, through electrolysis the water is converted to oxygen and hydrogen gas. When relatively large amounts of current pass through the cell sufficient explosive gas is liberated to cause an explosion should an open flame or spark come close to the vent. The rate of gassing is proportional to the current flow.

6.2 Temperature

6.21 The temperature of the cell may be assumed less than the maximum of 140°F if the hand can be held on the side of the jar. The minimum temperature is determined by the room ambient temperature and shall not be less than 15°F.

6.3 Voltage

6.31 The voltage drop across any individual cell in operation with room temperature above 50°F shall not be greater than 2.6 volts and for the average of a group, 2.5 volts per cell.

6.32 Voltages, particularly with new electrolyte and extremely light loads, may be so low as to affect office alarms in which case an artificial load may be necessary until the office load increases sufficiently.

7. CIRCUIT CONNECTIONS

7.1 Any connection made directly to the cell post shall have both of the contact surfaces clean and both coated with a thin film of R-3126 silicone compound.

7.11 If oxidation or corrosion is evident on either of these surfaces remove with an R-2628 wire brush or with R-3163 abrasive paper. If high spots exist remove with an R-1482 flat file. Silver Plated and lead coated surfaces should be cleaned, when necessary by wiping with a dry cloth. Should this be unsatisfactory brush lightly with a suede shoe brush so

as not to destroy the protective surface. When connecting solderless lugs, (previously connected to wire ends and treated with a protective coating as described in Section 7D), remove this coating only from the contacting surface. Clean thoroughly and apply the silicone. Use silicone compound to coat the body of the connecting bolt and both surfaces to be joined.

→ Arrowed lines indicate new or changed information.

[Vertical lines at side of paragraphs indicate requirements.

7.12 Assemble and tighten securely.

7.13 Fill the unused bolt hole in the cell post with silicone and then coat the remainder of the post with a thin film of silicone.] ←

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Reason for Reissue:
To add requirement line to Paragraph 7.13.

Replaces Section 15 dated 12-15-60.