INSPECTING CENTRAL OFFICE GROUNDING AND ELECTRICAL PROTECTION

Contents

GENERAL

Purpose

This practice provides procedures for inspecting the grounding and electrical protection of central offices.

Reason for Reissuing

This practice is reissued to update the form in Exhibit 1.

OVERVIEW

Introduction

The grounding and electrical protection inspections:

- Are primarily intended for any offices with SPC switching systems.

(continued)

Introduction, continued

- Determine if the minimum standards are met to ensure:
  - Proper equipment function.
  - Adequate protection to personnel and equipment.
- Are normally performed months before new switching system cutover. This allows time to correct deficiencies.

  NOTE: Another inspection should be made after cutover to verify corrections and identify any new problems.
- Identify and correct any problems.
- Are recommended as part of the central office acceptance plan for the installations or rearrangements that affect:
  - CO grounding.
  - Associated wiring.

Requirements of the Responsible Parties

The inspections do not relieve responsible parties from meeting future grounding and protection requirements. The responsible parties will:

- Continue to inspect for any new grounding and protection problems.
- Bring problems to the attention of the appropriate persons for correction.

Ground Lead Numbers

Ground lead numbers noted in this practice refer to the lead numbers in Telops Practice 795-805-071, Central Office Grounding Systems, Engineering Applications.

References

The following Telops practices contain information related to CO grounding and protection inspections:

NUMBER	TITLE
205-805-501	Central Office Grounding Systems, Inspections and Tests.
795-805-072	AC Service Grounding, Engineering Application,
795-805-073	Telephone Central Office Grounding of Transmission Equipment.
887-030-085	Engineering Considerations, Radio Station Protection.

Who Performs the Inspection

Prior to conversion, the project conversion coordinator is responsible for having the inspection performed by all departments responsible for the installation of the grounding leads.

PERFORMING THE INSPECTION

What to Know Before Undertaking the Inspection

The person making the inspection must be very familiar with the fundamentals of:

- Power (AC and DC).
- Grounding.
- Protection.

Preparing for the Inspection

In preparing for an inspection, review safety guidelines and have available:

- The practices listed in "References."
- A copy of the Form S6429, "Inspection, Central Office Grounding and Protection*' checklist contained in Exhibit 1 on Page 7 of this practice.
- Hand tools (e.g., screwdrivers, crescent wrench, assorted allen wrenches) to:
  - Inspect the interiors of AC cabinets, an AC receptacle, ringing machines, carrier power supplies, and DC power rectifiers.
  - Check connections on such things as ground bars.
- A straight edge, such as a ruler.
- A black ink pen for filling in the checklist so the list can be reproduced clearly.

Inspect ion Procedure

Use the following procedure when making the inspection.

STEP	INSPECTING GROUNDING AND PROTECTION
1	Become familiar with the layout of the central office building structure and locat ions of: • Switching systems. • Transmission systems. • DC power plants. • Outside plant cabling. • AC power. • Cable vault or tip splices. • Cable protectors. • Ground electrode field. • Ground bars. This helps you visualize the power, grounding, and protection systems required to meet minimum GTE requirements.

(continued)

PERFORMING THE INSPECTION, continued

Inspection Procedure, continued

STEP	INSPECTING GROUNDING AND PROTECTION

2 On Page 1 of Form S6429 (see Exhibit 1, Page 7), enter the:

- Date of inspection.
- Exchange name.
- Name of the switching system (when a new system is involved).
- Names of persons actively participating in the inspection.

NOTE: When more than one floor of a building exists, use a separate Form S6429 for each floor. identify the appropriate floor after the exchange name and system.

3 Use a straight edge and pen to diagram the layouts for each ground bar (master ground bars, floor ground bars, cable vault ground bars). Refer to Form S6429, Back of Page 11, (see Exhibit 1, Page 28) for an example.

a. Place these diagrams on the reverse side of the first few pages of the "Inspection, Central Office Grounding and Electrical Protection" checklist. Refer to Form S6429, Back of Pages 5, 6, 7, 8, 9, 10, and 11 (see Exhibit 1, Pages 16, 18, 20, 22, 24, 26, and 28).

b. Show whether the ground bar lugs are one- or two-hole by indicating the lug as a rectangle with one or two circles darkened inside to show the number of holes.

c. Show lead sizes and label each with where it connects to and/or by the lead numbers provided in Telops Practice 795-805-071.

4 Complete the checklist on Pages 2 to 6 of Form S6429 (see Exhibit 1, Pages 9 to 18) according to the following instructions:

COLUMN TITLE	ENTRY
Wire Size-Type	* Actual wire gauge for each of the leads. • Letters NA when the specific lead is not applicable to this office application. • Word MISSING when the lead is required but was omitted.
Wire Type	• BARE for uninsulated. • SOL for solid conductors. • TINNED for tinned conductors. • STR-PVC for stranded conductors with polyvinyl chloride insulation.

(continued) __

Inspection Procedure, continued

STEP	INSPECTING GROUNDING AND PROTECTION

4 cont.

COLUMN TITLE	ENTRY
Connect ions	ldentify improper connections, such as: • Loose. • One-hole lugs on ground bars. • GTE non-standard lugs.
Conduit	Identify any leads in conduits. Identify leads in metal conduit whether or not the lead is properly bonded to the metal conduit or if metal clamps exist.
Proposed Correction Date	Correction dates are to be entered by the responsible parties.
Date Corrected	Actual correction date.
Remarks	Enter any necessary remarks.
Additional Remarks	Note other grounding and protection discrepancies.

5 Enter details for each AC main service on Form S6429, Pages 6 through 11 (see Exhibit 1, Pages 17 through 28). Include:

- RMS voltage phases to neutral/phase to phase.
- Number of phases.
- Whether the main is wye or delta configuration.
- If the main has a multigrounded neutral (yes or no).
- Service conductor size and service ampere rating.
- Conductor material.
- Number of conductors comprising a single phase.
- AC surge protector manufacturer and model number for commercial disconnect.
- Optional AC surge protector.
- Details on the load side of the emergency generator transfer switch.

6 Answer the questionnaire items on Pages 7 to 11 of Form S6429 (see Exhibit 1, Pages 19 through 28).

(continued)

Inspection Procedure, continued

STEP	INSPECTING GROUNDING AND PROTECTION
7	To clearly identify items of the checklist needing attention, make an asterisk in the left margin preceding each.
8	After completing Form S6429, review the diagrams, checklist items, and questionnaire to verify that everything has been checked and understood.
9	Be sure the DC power plant is carefully checked to ensure that it complies with Telops practices. Take another look around the building to be sure none of the applicable items was overlooked.
10	Review the results to identify any situations not meeting the GTE minimum requirements.
11	Direct the appropriate group to take corrective action.

Emergency Power

Wiring of emergency power receptacle must be inspected and tested to assure the receptacle will work properly at the time of power outages. The inspector must:

- Make sure the sequence of the three phase systems or single phase wiring is correct at the emergency power receptacle.
- Make sure the phase sequence and receptacle wiring is in agreement with the emergency generator currently available.
- Make sure that spare fuses exist for the power panel and surge arresters.
- Test emergency lights inside the switch.

Exhibit 1
Form 90001528 - Inspection, Central Office Grounding and Electrical Protection
(Page 1 of 11, Front)

FORM 90001528
Page 1 of 11
GTEP 795-805-074

INSPECTION

CENTRAL OFFICE GROUNDING & ELECTRICAL PROTECTION

SUBJECT: 1 K1 **Date of Inspection:** _____

Exchange: _____ **Switching System:** _____

Details for using this form covered In Telops Practice 795-805-074.

This checklist covers the more Important grounding and electrical protection Items.

Names of persons making Inspection: _____

_____

_____

_____

_____

_____

DISTRIBUTION OF INSPECTION REPORT:

Original · G. 0. · Area Engineering
Copy · Service · Switching Service
Copy · Central Office · Site Location
Copy · Network Conrtruction . Systems

Exhibit 1, continued
Form 90001528 - Inspection, Central Office Grounding and Electrical Protection
(Page 1 of 11, Back)

GTE

FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Checklist

Page 2 of 11

Lead No.	Description	Wire Size-Type	Connections	Conduit	Proposed Correction Date	Date Corrected	Remarks
1	Bldg. - Ground ring (with rods)						
1A	Bldg. - Ground ring concrete encased						
2	Bldg. - Well(s) or deep anodes						
3	Bldg. - Lead 1 to each bldg. column						
4	Bldg. - Main AC enclosure neutral to ground ring electrode						
5	Bldg. - Minimum of 2 Lead 5 opposite sides Lead 1 to Master Ground Bar (MGB)						
6	Bldg. - From Lead 1 to metallic fence						
7	Bldg. - From each Lead 2 to MGB						
8	Bldg. - Main AC enclosure neutral to water main						
9	Bldg. - Water main to interior bypass						
10	Bldg. - Water main to MGB						
13	Bldg. - Main AC enclosure neutral to MGB						
14	Bldg. - Each MGB/Floor Ground Bar (FGB) to adjacent bldg. column						
14A	Bldg. - Lead 14B to MGB/FGB						
14B	Bldg. - Ring to computer floor metal to Lead 14A						

Additional Remarks

Exhibit 1, continued
Form 90001528 - Inspection, Central Office Grounding and Electrical Protection
(Page 2 of 11, Back)

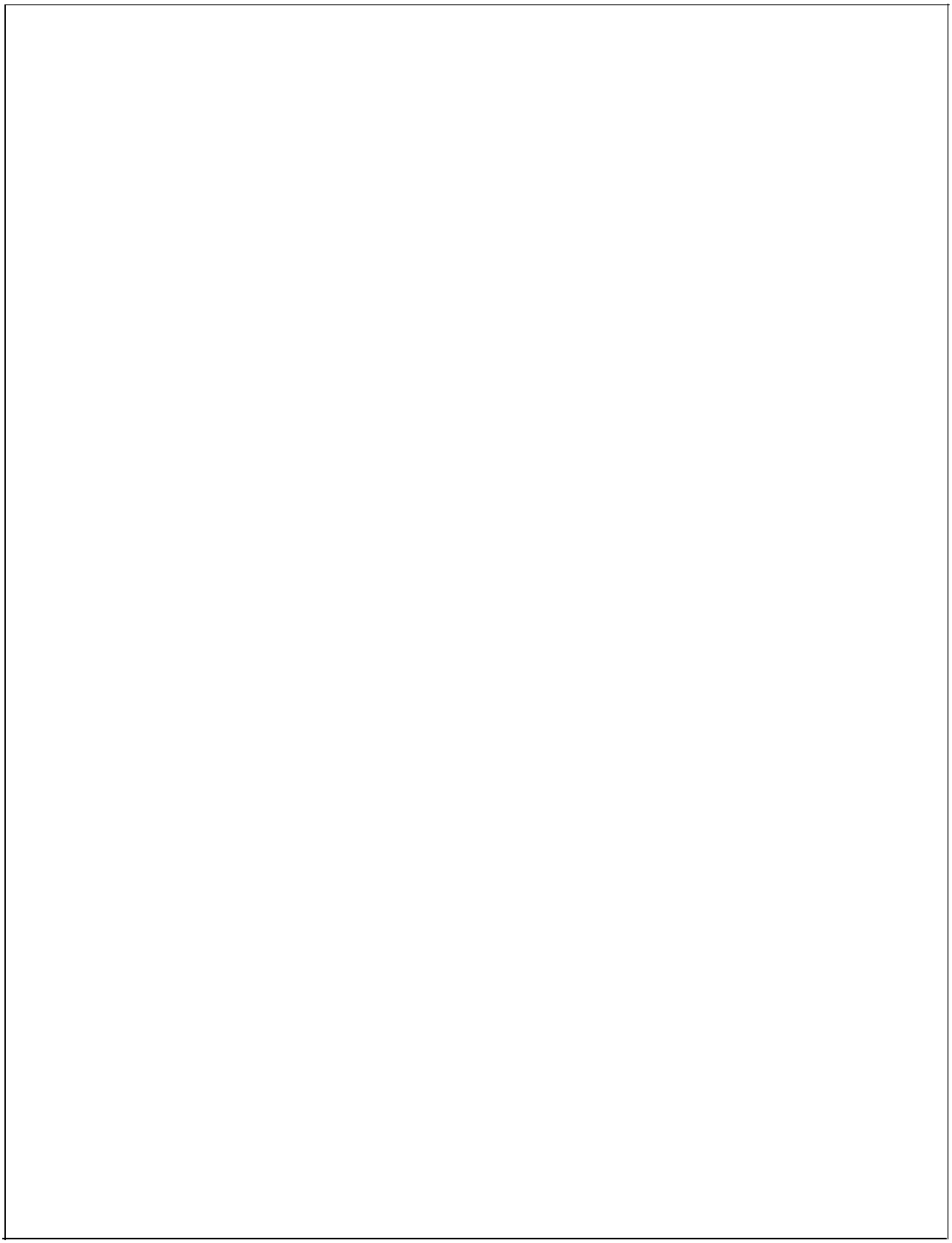
GTE

FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Checklist

Lead No.	Description	Wire Size-Type	Connections	Conduit	Proposed Correction Date	Date Corrected	Remarks
15	Bldg. - MGB/FGB to FGB for horizontal equalizer on same floor						
16	Bldg. - MGB to Cable Vault Ground Bar (CVGB) or Lead 17/17A						
17	Outside Plant (OSP) - CVGB or Lead 18 to cable shields						
17A	OSP - CVGB or Lead 18 to external fiber optic metal						
18	Bldg. - Bottom floor MGB/FGB to FGB on each floor						
19	Bldg. - Lead 18 to FGB (if needed)						
20	Bldg. - MGB/FGB each floor branch AC enclosure green wire						
20A	Bldg. - Bldg. - MGB/FGB to disconnect neutral separate derived						
21	Bldg. - MGB/FGB to radio halo ground ring						
22	Bldg. - Roof tower ground and mechanical equipment to lightning system						
23	Central Office Equipment (COE) Installation - MGB/FGB same floor to Entrance Cable Protection Ground Bar (ECPGB) Metallic Distribution Frame (MDF)						
23A	COE Installation - MGB/FGB same floor to carrier HF protector						
24	COE Installation - ECPGB (MDF) or Lead 23A to bottom protector module						
24A	COE Installation - Lower protector module to next higher module						
25	Bldg. - From Lead 1 to nearest lightning rod						

Additional Remarks



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FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Checklist

Page 4

Lead No.	Description	Wire Size-Type	Connections	Conduit	Proposed Correction Date	Date Corrected	Remarks
26	Bldg. - Lightning rod system to all nearby objects						
27	Bldg. - From Lead 1 to extension tower ground ring						
28	Bldg. - From Lead 1 to external radio bldg. ground ring						
29	COE Installation - Branch AC enclosure green wire to battery charger enclosure						
30	Bldg./COE installation - Branch AC enclosure green wire to lights/outlets						
31	COE Installation - MGB/FGB same floor to Leads 32-36						
32	COE Installation - From Lead 31 to battery charger frame and Lead 29						
33	COE Installation - From Lead 31 to battery racks						
34	COE Installation - From Lead 31 to Power Control Unit (PCU) frame						
35	COE Installation - From Lead 31 to Distribution Switching Unit (DSU) frame						
36	COE Installation - From Lead 31 to PDU frame						
37	COE Installation - MGB/FGB same floor to battery return terminal						
37A	COE Installation - MGB/FGB same floor to carrier supply return						
38	COE Installation - FGB same floor to Power Distribution Frame (PDU) return bus						
38A	COE Installation - FGB same floor to carrier supply PDU return						

Additional Remarks

GTE

FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Checklist

Lead No.	Description	Wire Side-Type	Connections	Conduit	Proposed Correction Date	Date Corrected	Remarks
39	COE Installation - DC bus duct enclosure to next enclosure section						
40	COE Installation - DC bus duct enclosure to MGB/FGB same floor						
41	COE Installation - MGB/FGB same floor to electronic system Lead 42/58						
41A	COE Installation - MGB/FGB same floor to carrier Lead 58A						
42	COE Installation - Lead 41 to each electronic system lineup						
43	COE Installation - Each adjacent electronic system frame						
44	COE Installation - Bypass electronic system missing frame						
45	Bldg. - Isolated AC green wire main to branch						
46	COE Installation - Lead 45 to electronic system outlet green wire						
47	COE Installation - MGB/FGB to electromechanical (EM) system Lead 48						
48	COE Installation - Lead 47 to EM system frame lineups						
49	COE Installation - EM frames to EM shelves						
50	COE Installation - Carrier Primary Distribution Unit Frame (PDUF) return bus to Lead 51						
51	COE Installation - Lead 50 to each transmission frame isolated DC						
52	COE Installation - Each integrated transmission frame to DC return						
53A	COE Installation - MGB to PDUF Transmission						

Additional Remarks

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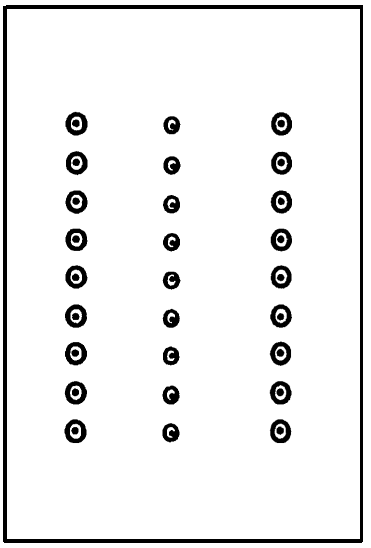

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FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Checklist

Lead No.	Description	Wire Size-Type	Connections	Conduit	Proposed Correction Date	Date Corrected	Remarks
54	COE Installation - MGB/FGB to electronic system storage cabinets						
55	COE Installation - MGB/FGB to wave guide/coax entrance						
56	COE Installation - MGB/FGB to AC radio transmission cabinet						
57	COE Installation - MGB/FGB to center electronic system superstructure						
57A	COE Installation - MGB/FGB to center carrier superstructure						
58	COE Installation - Lead 41 to Lead 59A electronic system aisle						
58A	COE Installation - Lead 41 to Lead 59A carrier aisle						
59	COE Installation - Lead 58 to each electronic system frame						
59A	COE Installation - Lead 58A to each carrier frame						
60	COE Installation - MGB/FGB to conductive floor tile						
61	COE Installation - MGB/FGB to Lead 62						
62	COE Installation - Lead 61 to aisle lineup						
63	COE Installation - Lead 62 to terminal block						
64	COE Installation - MGB/FGB to facility test module						

AC Main Service	_____ Volts _____ Phase	Check one ☐ WYE ☐ DELTA	Yes or No _____ MGN	Cond. Size	Check one ☐ Copper ☐ Cop-Clad ☐ Alum	Quan. per each phase
	Main Service Disconnect Surge Protection					
	Manufacturer				Model	
	Exposed Optional Generator Transfer Panel Surge Protection					
	Manufacturer				Model	
Additional Remarks						

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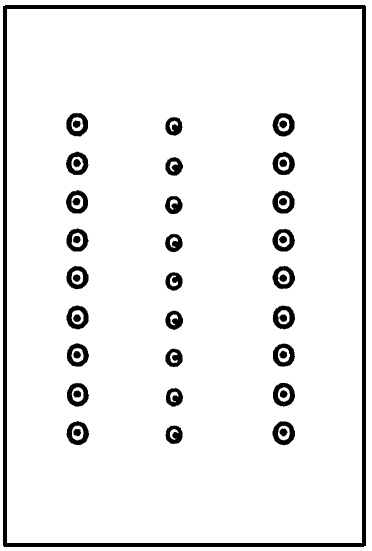

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FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Questionnaire

Reference	Item to Check	Y, N or N/A	Proposed Correction Date	Date Corrected	Remarks
205-805-501	Make ground field measurements (per 205-805-501 when possible) and list test values in remarks.				
795-805-071	Multiple floor exchange with VE for equipment within 142 and less than 200 foot ground conductor length; VEs separate 200 feet or less with MGBs & FGBs within 6 feet of conductor length to VEs; horizontal equalizers for multiple VEs on lowest floor, every alternate floor thereafter, and top floor; and electromechanical equipment treated the same.				
795-805-071	Do all grounds terminate on the same floor?				
205-805-501 795-805-071	Are ground conductors continuous without sharp 90 degree bends? Do they meet other restrictions?				
795-805-071	Are all ground bar connectors approved two hole lugs?				
795-805-071	Are ground leads allowed in metallic conduit, bonded at each end, and no lead encircled by metal?				
205-805-501 795-805-071	Have ground test report by local forces and necessary MGB, FGB, and CVGB tags been handled?				
	Additional Remarks				

FORM 90001528
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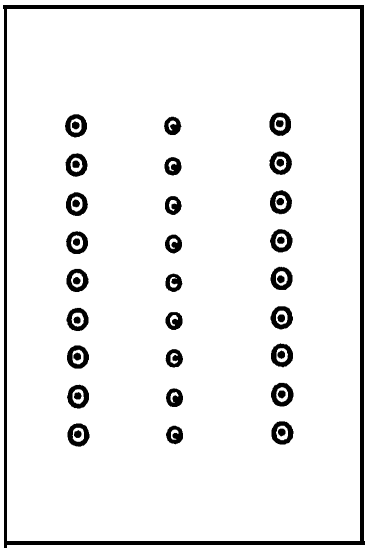

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FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Questionnaire

Reference	Item to Check	Y, N or N/A	Proposed Correction Date	Date Corrected	Remarks
205-805-501 795-805-071	Are all ground connections clean, tight, and free of physical damage?				
795-805-072	Are standard AC main entrance arresters provided and within 4 feet of disconnect panel? Do they test OK?				
795-805-072	AC Main disconnect is bonded to panel tub. No panel tub bond to the AC neutral in distribution and branch panels or no ground on load neutral.				
795-805-072	Are AC grounding electrode conductors sized in accordance with NEC 250-94 and Lead 13 not sole AC grounding? Are service phase and neutral conductors equal size?				
795-805-071 795-805-072	Are AC grounding conductors (Green Wire) provided to lights and outlets in switching system and battery rectifiers?				
795-805-072	Do AC step down transformers have secondary neutral bonded to AC service main neutrals?				
795-805-072	Is type GP ground sensor installed on 480V service of 1000A or more?				
795-805-072	Are Quick-gard (ground fault) circuit breakers installed on AC outlet circuits installed in telephone equipment frame areas?				
	Additional Remarks				

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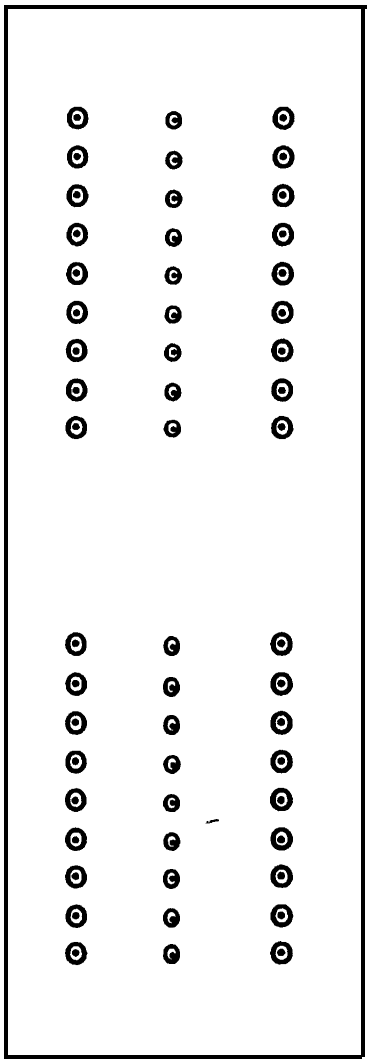
GTEP 795-805-074



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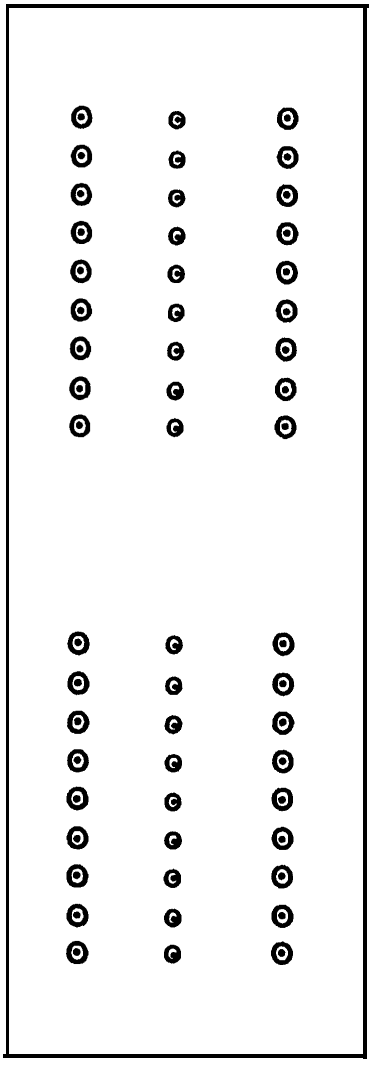
FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Questionnaire

Reference	Item to Check	Y, N or N/A	Proposed Correction Date	Date Corrected	Remarks
795-805-072	Has AC generator white wire neutral been removed from general frame and phase sequence verified?				
795-805-071 795-805-072	Are orange outlets properly installed with nonmetallic boxes and nonmetallic covers in electronic switching frames with nonmetallic conduit before touching switching frames and through frames?				
795-805-071	Are chassis grounds removed or eliminated in electronic switching frames, frame isolation provided in digital systems, and verified?				
795-805-071	Is every 17 feet of protector verticals separately grounded to FGB and protector bonded to each other and to the ECPGB?				
795-805-071	Has # 1 grounding cable been run from FGB to HF cable termination cabinet or rack mounted HF strip, strip isolated and no lead sheathed stubs?				
795-805-071	Has Lead # 37, per Exhibit 1 of Telops Practice 795-805-071, been connected as close to battery as possible and Lead 38 used properly?				
795-805-071	Are charger, PDU, PCU cabinets grounded to floor ground bar?				
795-805-071	DC power ground is not connected to DC power cabinets, not to electronic switching frames, and not to storage cabinets.				
	Additional Remarks				

FORM 90001528
GTEP 795-805-074



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FORM 90001528
GTEP 795 805-074

C.O. Grounding and Electrical Protection Questionnaire

Reference	Item to Check	Y, N or N/A	Proposed Correction Date	Date Corrected	Remarks
795-805-071	Are separate DC power ducts or primary feeders provided to electronic switching equipment within 20 loop feet of battery or DC plant bus?				
795-805-071	Have DC bus duct section joints been bonded?				
795 Series GTE Standard Engineering Practices, Bulletins	Does DC power plant conform with various GTEP standards by rectifiers connecting to battery and battery to DBU or PDU and rectifier remote sensing used?				
- 7 1	Has electronic switching system grounding been provided?				
795-805-071 795-805-073	Are termination bays in all new equipment locations using isolated grounding and have existing racks been treated per Telops Practice 795-805-073?				
795-805-072	Are power correctly wired arresters provided to aircraft warnings light branch circuit? Are arresters provided for exposed circuits or generators?				
795-805-072	Is AC conduit and raceway installed in accordance with national electrical code?				
795-805-071	Entrance cable bonding ribbon does not extend beyond cable vault even when CVGB is not used or MGB is not in cable vault.				

Additional Remarks

FOAM 90001528
GTEP 795-805-074

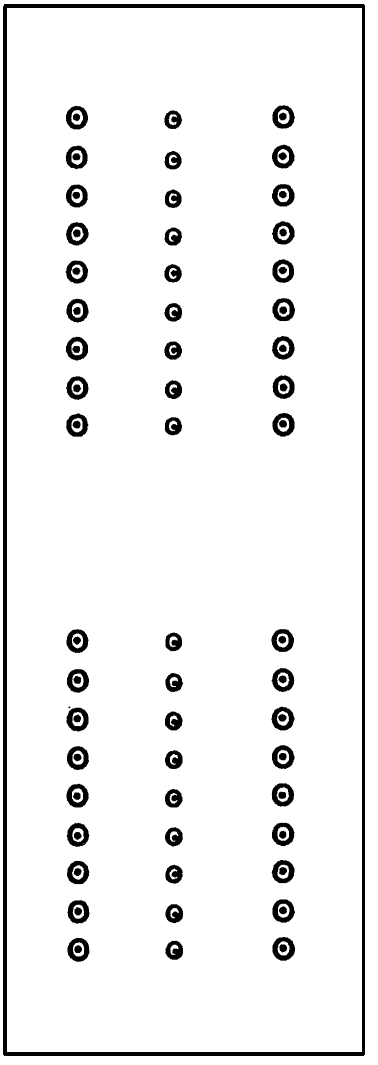

Exhibit 1, continued
Form 90001528 - Inspection, Central Office Grounding and Electrical Protection
(Page 11 of 11, Front)

GTE

FORM 90001528
GTEP 795-805-074

C.O. Grounding and Electrical Protection Questionnaire

Reference	Item to Check	Y, N or N/A	Proposed Correction Date	Date Corrected	Remarks
887-030-085	Are outer conductors of antenna lead bonded to the tower at top and bottom?				
795-805-071 887-030-085	Is wave guide bonded to the tower ring at tower base shoes and to ground at entrance to the central office?				
887-030-085	Are grounding conductors clamped to tower without welding or drilling?				
795-805-071 887-030-085	Are radio cabinets bonded to the grounding system?				
887-030-085	Is the radio room ground halo bonded to the building grounding system?				
795-805-071	Has roof tower ground ring been provided and bonded to building corner steel columns?				
887-030-085	Are ground rings provided for each independent tower?				
	Additional Remarks				

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