

ELECTRICAL PROTECTION

INVESTIGATION OF COMPLAINTS

CONTENTS	PAGE
1. INTRODUCTION	1
2. INVESTIGATING PRINCIPLES	4
GENERAL	4
FIELD NOTEBOOK	4
PHOTOGRAPHS	5
REMOVAL OF EQUIPMENT	5
EQUIPMENT NOT SUPPLIED BY BELL SYSTEM	5
ASSISTANCE FROM BELL LABORATORIES	5
QUESTIONING THE CLAIMANT	6
3. TELEPHONE PLANT TO BE INVESTIGATED	6
INVESTIGATION OF CUSTOMER PREMISES EQUIPMENT	6
INVESTIGATION OF OUTSIDE PLANT	8
INVESTIGATION OF CENTRAL OFFICE EQUIPMENT	8
INVESTIGATION REPORT FORMS	9

1. INTRODUCTION

1.01 This section provides information useful to the protection engineer as a guide when investigating electrical shock, acoustical disturbance, and fire complaints. These complaints may be originated by a customer or an employee.

1.02 When this section is reissued, the reason for reissue will be given in this paragraph.

1.03 Figures 1, 2, and 3 typically illustrate the flow of information and the protection engineer's organizational position of responsibilities when investigating a complaint. The District Residence/Business Installation and Repair Manager coordinates customer complaints. Employee complaints are coordinated by the employee's line organization. The Claims Agent is normally responsible for investigating the *majority* of customer complaints; the company safety coordinator is in charge of investigating most employee complaints. These groups are assisted by operating company experts such as the protection engineer. When necessary, the operating company experts are further assisted by Bell Laboratories. As can be seen, the protection engineer reports directly to the Claims Department and/or Safety Department during investigations unless otherwise directed.

1.04 This practice covers *only* the investigating responsibilities of the protection engineer. It should be closely followed to protect the telephone company from possible litigation. This section should be used along with Section 010-702-001, Investigating and Reporting Safety Related Complaints Involving Customer Premises Equipment. (The above practice is broader in its coverage than just the responsibilities of the protection engineer.) When investigating acoustical disturbance complaints, the engineer should refer to Section 010-170-003 (to be issued), Occupational Exposure to Noise, concerning acoustical protection available in the Bell System.

1.05 Investigation and documentation must be completed to gather all the facts even if one or more of the investigations is incomplete. Cases often come to trial several years after the event when many things affecting the case have been changed precluding additional investigation.

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

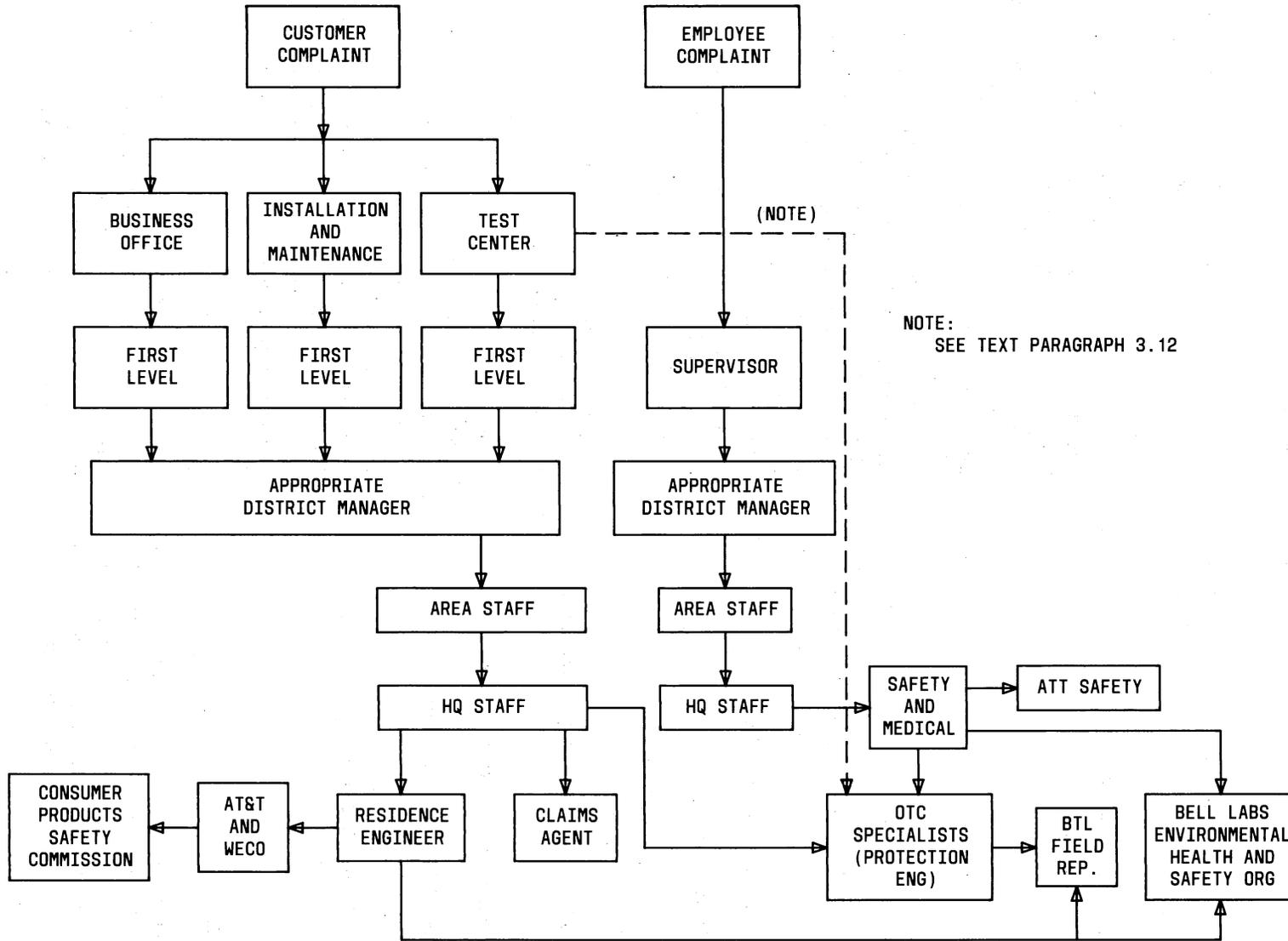


Fig. 1—Typical Complaint Notification Routine

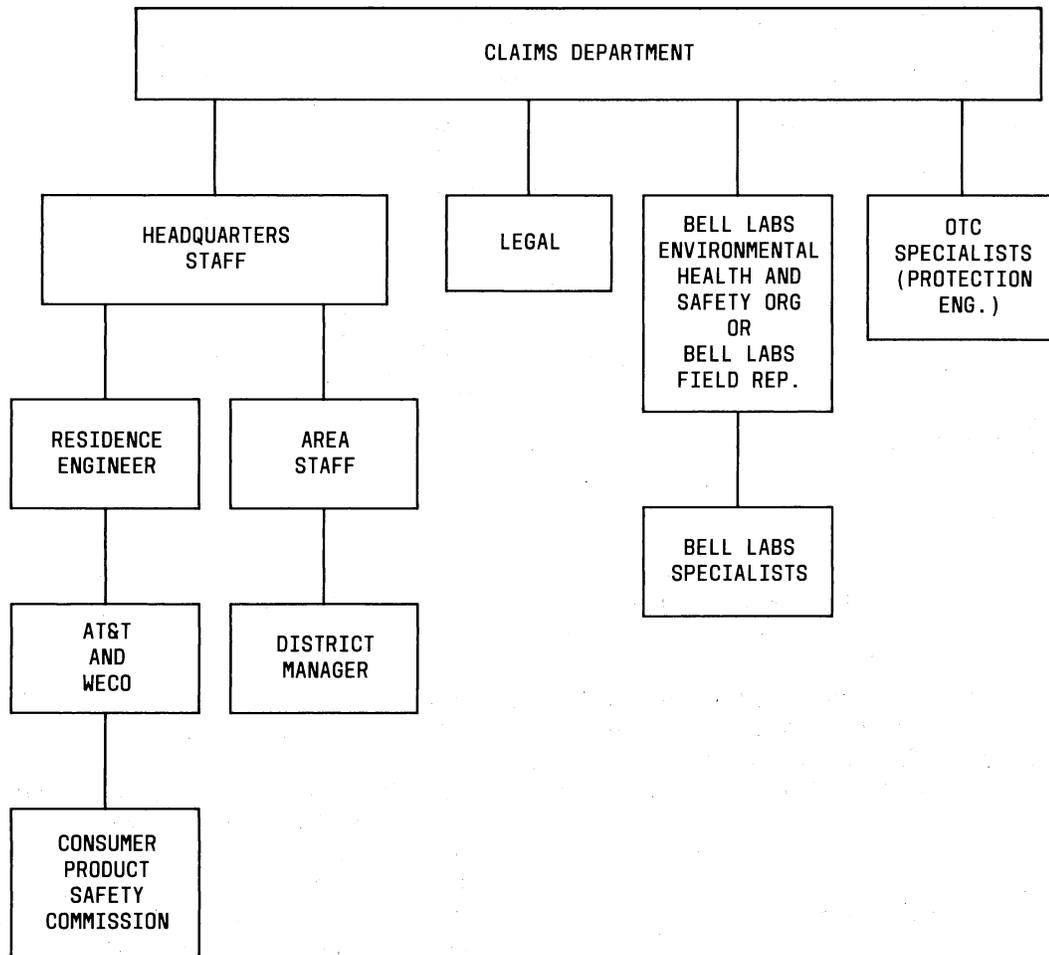


Fig. 2—Typical Customer Complaint Investigation Responsibility

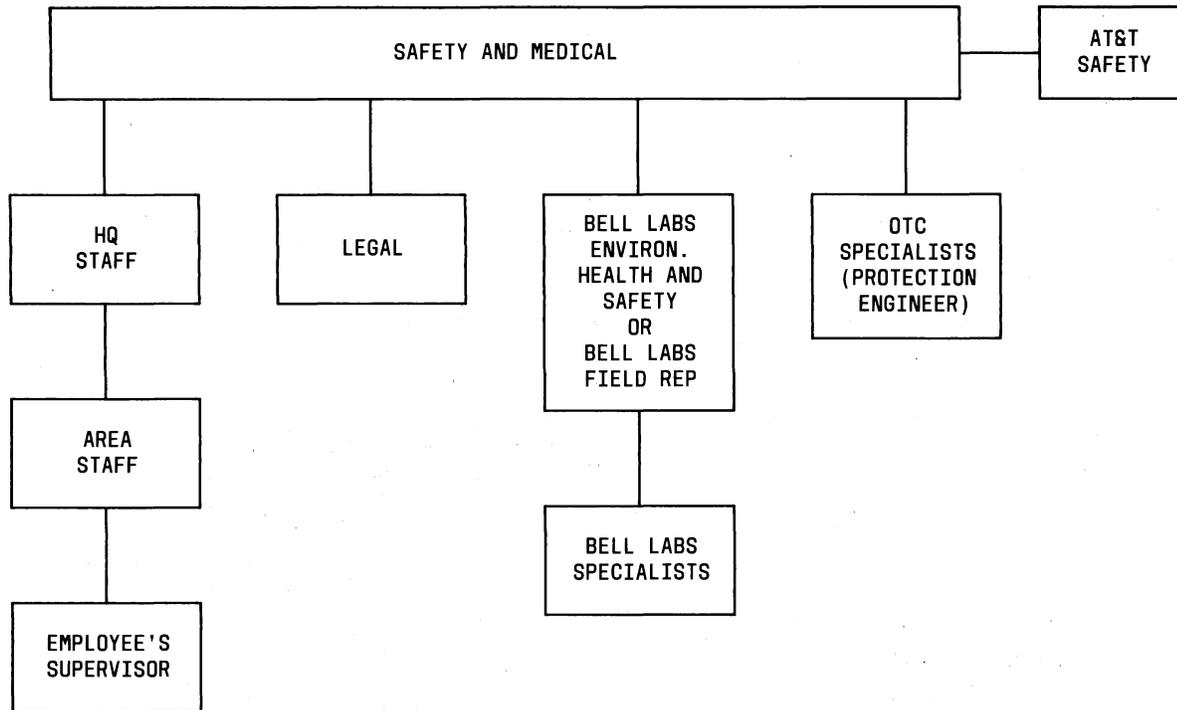


Fig. 3—Typical Employee Complaint Investigation Responsibility

1.06 Part 2 covers the general principles to be followed while conducting an investigation. Part 3 describes the different parts of the telephone plant that should be examined when investigating a complaint.

2. INVESTIGATING PRINCIPLES

GENERAL

2.01 Prompt on-site investigations of complaints are extremely important in determining if Bell System equipment or installation methods are at fault. The protection engineer should begin his investigation as soon as possible after the complaint is received. The Claims Agent or representative from the Health and Safety Organization should contact claimant and accompany protection engineer when visits are made to the customer's premises. The earliest possible start in the investigation insures the most accurate picture of the circumstances causing the complaint. This is very important in

the event of legal action against the telephone company.

2.02 The customer or employee originating the complaint should have only one point of contact with the telephone company concerning this matter. This point of contact should *not* be the protection engineer. All questions concerning liabilities, and unusual conditions should tactfully and courteously be referred to the organization responsible for the investigation (Claims Agent or Safety Organization). This organization should be consulted prior to any customer contacts or visits to the scene of the alleged incident. This helps to avoid unnecessary visits and duplication of requests for information.

FIELD NOTEBOOK

2.03 The protection engineer should keep a field notebook documenting all aspects of his investigation. The notebook should be kept in such a manner that someone could reconstruct the

investigation using only his notes. It should contain the time, date and location of the occurrence. Before visiting the site, record information such as names, addresses and telephone numbers of people allegedly injured, or whose property was damaged. Names, addresses and telephone numbers of all witnesses should also be recorded. This information can usually be obtained from the organization in charge of the investigation. Sketches, floor plans, and other details should be included. Assigned telephone company facilities should also be recorded (eg, cable pair, loop pole, etc).

PHOTOGRAPHS

2.04 Photographs should be taken of apparatus and equipment involved, especially if damaged, using color film whenever possible. Any suspicious elements that may have caused damages should be photographed. All pictures should be labeled as to date, time, place and photographer's name.

REMOVAL OF EQUIPMENT

2.05 Before the equipment is removed from installation, it should be carefully inspected visually, and detailed notes made of its condition and appearance. The nature of the installation should also be briefly described. In the case of a plug-in device such as a headset, record in the field notebook whether or not the device was plugged into the jack at the time of the inspection. After the equipment has been inspected, it should be tagged and carefully removed for examination or laboratory evaluation. Information on the tag should be adequate enough to link the apparatus to the incident. It should include the date of removal, signature of employee removing apparatus, equipment serial number (if any) and date of manufacture. Use an engraver whenever possible to make positive identification.

2.06 Care must be taken not to alter the condition of the equipment when removing from installation. The remains, even if consisting only of fragments, should be retrieved with extreme care. If the specimen is to be put in storage temporarily, it should be stored (with engraved or tagged identification) in such a manner that its condition will not be altered. The person who removes the equipment is responsible for the equipment until submitted to the organization responsible for the investigation. The field notebook should display all dates in which equipment changes

hands. It is essential that the equipment be accounted for at all times after removal until possible litigation procedures.

EQUIPMENT NOT SUPPLIED BY THE BELL SYSTEM

2.07 Verify that all station sets and all items of associated equipment are Bell System property before removing, testing and/or performing maintenance. In most cases this can be done by checking the handset or other items of associated equipment for "Bell System Property Not for Sale" markings. If terminal equipment is not supplied by the Bell System, use the same procedures to investigate as for Bell provided terminal equipment, except the investigation should be limited to the facilities Bell provides. For example, wall jack or connecting block, station protector with carbons or gas tubes, Bell supplied inside wire, etc. Dismantle or remove only that equipment that is (1) Bell System property or (2) Bell System manufactured. If the equipment is neither of the above, refer the customer to the equipment manufacturer or supplier. If customer owned Bell System equipment is involved, remove equipment if customer agrees, and replace with equivalent equipment. The protection engineer should continue his investigation from the plug-in module through the outside plant facilities into the central office (discussed in Part 3).

ASSISTANCE FROM BELL LABORATORIES

2.08 Occasionally, the telephone company will require the assistance of Bell Laboratories. For employee complaints, this decision is usually made by the Safety and Medical Organization. For customer complaints, the decision is usually made by the Claims Agent. Requests for assistance from BTL should be made through the local Bell Laboratories Field Representative or Bell Laboratories Environmental Health and Safety Organization.

2.09 The BTL field representative will inform the investigation team where to send equipment or when to expect a BTL specialist. Paragraphs 2.05 and 2.06 must be followed if equipment is to be removed and/or packaged. The site of the investigation should be altered as little as possible if a BTL specialist plans an on-site visit. However, recognizable safety hazards should be eliminated as soon as possible after the incident.

2.10 The BTL specialist will be an expert in one or more of the three fields covered by this

SECTION 876-101-120

practice (electrical shock, acoustical disturbance, or fire). The specialist will furnish any special equipment needed and will generally be able to participate, advise, or testify in legal proceedings. In the unlikely event that sound level measurements must be taken in an acoustical disturbance case, a BTL specialist **must** take these measurements. Operating company engineers do not usually have access to the couplers and other equipment needed to couple the sound level microphone to the receiver of the station set in question. These couplers are designed according to American National Standards Institute (ANSI) standards and are not readily available.

QUESTIONING THE CLAIMANT

2.11 The following questions should be used as a guideline when questioning the claimant. The questions are typical of those that may be asked. Questioning should be done preferably by the Claims Agent or Safety Organization representative, with guidance and assistance from the protection engineer, to determine the significant engineering facts. Questions should be selected according to the specific incident being investigated (electrical shock, acoustical disturbance, or fire).

- (a) What was the claimant doing before the accident? Were claimant's hands or clothing wet?
- (b) Was claimant talking, answering or dialing at the time?
- (c) To whom was claimant talking (name, address, telephone number)? Who initiated call?
- (d) Try to determine the position of the claimant's body (particularly the extremities) at the time of the incident. Was claimant standing or sitting? Did claimant have either hand or elbow on a conductor? What was claimant standing on? Was claimant in simultaneous contact with telephone cord and some other conductor such as stove, sink or refrigerator? Was claimant in contact with an appliance cord?
- (e) Have claimant describe the incident. Did claimant see a flash? Feel a shock or burn? Where? Hear a loud noise? Try to have claimant described the exact sensation. If an electrical burn is claimed, report its exact location.

Note: Do **NOT** suggest any of these sensations to claimant; ie, do not ask claimant if he saw a flash, rather try and have him describe the sensation in his own words.

- (f) Did claimant drop the set? (This may explain a crack in the set.)
- (g) Has claimant had previous difficulty with the set? When was it last used before incident? Was it used after the incident? If yes, what was its condition?
- (h) Did the claimant have any difficulty with other electrical equipment at the time? Did any fuses or circuit breakers operate?
- (i) What were the weather conditions?
- (j) Has claimant been to a physician (name and address)?

Witnesses should be questioned along the same line as claimant.

3. TELEPHONE PLANT TO BE INVESTIGATED

3.01 Whenever personal injury or property damage is alleged to have resulted from electrical shock, acoustical disturbance or fire damage, an immediate inspection of telephone facilities must be made. These facilities must include the station equipment along with the outside plant and central office equipment which supports the station equipment.

INVESTIGATION OF CUSTOMER PREMISES EQUIPMENT

3.02 Extreme caution should be used when investigating equipment that has been reported to have malfunctioned. Begin the investigation with the building entrance facility. The tip and ring leads should be tested with a voltmeter to determine if any foreign potential exists. If foreign potential does exist, the employee should **not** touch the leads or protector installation. If no foreign potential exists, measure and record the potential between tip and ring, tip and ground, and ring and ground. Photograph the protector and grounding terminals before making changes. Check and confirm proper installation per Sections 876-300-100 and 460-100-400. Sketch the details of the grounding system. Include the protector type (gas tube or carbon block); length and gauge of ground wire; length and gauge of bonds between telephone,

power, water system, mobile home chassis, etc. Note whether all protector wells contain protector units and if protector is equipped with cover. Record the type of power ground and outdoor meter and whether service cabinet is indoors or outdoors. If investigation involves a phone booth, determine if the protector, power ground, and metal phone booth are bonded together. Examine the protector fuse (if equipped) to determine if it has operated. Verify that all utilities (telephone, power, and metallic water system) are properly bonded together and grounded, with all clamps secure (see Section 460-100-400 etc). If telephone plant is grounded by a buried rod, disconnect all bonds and measure and record the grounding resistance (see Section 876-700-100).

3.03 Make a continuity check from outside plant leads to ground before disassembling the protector. Record the results of this test (open or grounded). Remove the outside plant leads and recheck with the voltage tester. If no foreign potential exists remove and tag old protector and cover. Install a new protector as quickly as possible and reconnect grounds. Protector blocks should be dismantled by the protection engineer only if Bell Laboratories is **not** participating in the investigation. Station protectors will sometimes be tested at the Laboratories to determine sparkover voltages. Disassembly and reassembly of carbon block or gas tubes will result in sparkover voltage shift. If Bell Laboratories is not participating in the investigation, protector blocks should be dismantled and inspected for pitting and white smudges which indicate arcing. Record observations. Note and record if there is **no** evidence of arcing. If gas tube protectors are used, record any change in appearance. Gas tubes may be sent to BTL for testing to determine if operation is normal.

3.04 It is essential for station equipment to be inspected before the surrounding environment (room, installation, etc) is changed. Photograph the set and surrounding area before disturbing equipment or installation (paragraph 2.04). A sketch of the floor plan should be entered into the field notebook. Details should include: type of rug and floor (wood, cement, etc), and the station set location with respect to house wiring and electrical sockets, metallic fixtures, and grounded objects. If equipment is **not** Bell System property or Bell System manufactured, refer the customer to the equipment manufacturer. However, for the record, the non-Bell System manufacturer's name

and type of equipment should be recorded in the field notebook.

3.05 Remove station set, cord, and terminal block from customer premises. Return to the telephone company premises or laboratory to dismantle the equipment. (Do not dismantle any equipment if Bell Laboratories will be involved in the investigation.) **Equipment should not be dismantled on the customers premises.** Determine the condition of the set including cord and jack. If investigating an acoustical disturbance case, check the varistor located across the receiver. Look for "cold" solder joints or evidence of high current flow. In all cases, check for burned wires, loose connections, cracks and pitting. Check cord for broken, frayed or burned insulation. Check transmitter for any high voltage arcing. Look for small arc marks on metal surfaces of receiver opposite the receiver cover holes and metal surfaces of transmitter of older type transmitter. Use a jeweler's loupe as a magnifier since these marks may appear as small pin hole marks. The jeweler's loupe should be at least 5-power magnification; up to 20-power magnification may be beneficial. The inside of the transmitter and receiver should be checked for tracks of soot especially near one of the holes. The adjacent transmitter and receiver plastic cover should also be checked for tracks of soot. Any change in the color of metal could mean a passage of high current. If abnormal conditions are found, try to establish a means by which the condition could have caused the incident. If nothing abnormal is found, test to confirm that the phone is in good working order.

3.06 The protection engineer in conjunction with the Claims Agent or Safety Organization representative should concentrate on the following when investigating a fire allegedly caused by Bell System equipment:

- (a) First location of flames or smoke
- (b) Burn patterns
- (c) Location of equipment which could cause a fire; ie, furnace, oil burner, plumber's torch, welding rods, electrical appliances, flame fired appliances, ashtrays, cigarette lighters, candles
- (d) Recent work which could result in a fire

SECTION 876-101-120

- (e) Use of flammable solvents or other liquids such as lighter fluid, spray cans, etc.
- (f) Questionable electrical wiring in the vicinity of the fire.

This information should be obtained from the fire department, eyewitness accounts or actual physical evidence. Consideration might be given to employing the services of those who are experienced in fire investigation if local experience is lacking.

3.07 All station equipment involved in the investigation should be removed, tagged and placed in custody of the organization in charge of the investigation (paragraphs 2.05 and 2.06). This should include the station set, cord, wall jack or connecting block, station protector, etc. Also remove equipment such as dial light transformers if station is so equipped.

3.08 A number of other conditions should be investigated if circumstances deem necessary. If claimant was using the equipment at the time of the incident, the called party should be questioned and his equipment investigated if necessary. If claimant has party line service, all equipment bridged to that line should be investigated. This equipment should be removed only if malfunctioning.

INVESTIGATION OF OUTSIDE PLANT

3.09 The protection engineer should thoroughly inspect the outside plant facilities between the customer premises and the Central Office (CO). This inspection must include drop wire, all open wire, aerial cable, terminals and protectors, and any other equipment along the line. Record the voltage and type of power line configuration that parallels the telephone plant (consult the local power company to determine the voltage of the line). Note the clearance between the power and telephone lines. If abnormal separations are found, estimate and record the distance in the field notebook. Determine if the cable shield is bonded along the line according to Section 876-400-100. Note any evidence of power-fault caused by a direct lightning stroke such as sputtering of metal, heating discoloration or burn marks on pole, etc. Inquire about traffic accidents or unusual weather conditions that could have resulted in broken poles or cross members. The local power company should be consulted for possible power faults or line maintenance at the time of the incident. Determine if a

breakdown test set was in use at the time of the incident. Record location of cable protectors and bond connections to power neutral. Unusual conditions should be photographed and sketched in the field notebook along with the exact location. All damaged equipment should be removed and tagged according to paragraphs 2.05 and 2.06.

INVESTIGATION OF CENTRAL OFFICE EQUIPMENT

3.10 All CO equipment connected directly to malfunctioning outside plant or station equipment must be completely inspected and tested. This inspection includes heat coils, protector units, line relays, etc. All service **MUST** be restored either during or immediately after the testing and inspection. Determine if any testing of CO equipment was in process at the time of the incident or disturbance. All equipment should first be visually inspected. Unusual conditions should be noted in the field notebook. Equipment that incurred fire or heat damage must be completely photographed. All damaged equipment must be removed and tagged according to paragraphs 2.05 and 2.06.

3.11 There are a number of specific items to check when investigating CO equipment. Check for a foreign voltage to ground on all lines and equipment before performing actual hands-on testing. Also, be certain lines are in an idle condition before proceeding with the inspection. Heat coils and protector blocks should be visually inspected for electrical burns and damage. If the telephone company conducts the investigation, the heat coils, protector units, and protector blocks should be removed and visually inspected for evidence of electrical burns or physical damage. If Bell Laboratories is involved in the investigation, and hard-wired protectors (such as type C50) are involved, remove heat coils and protector blocks. Label components that are connected to tip and ring. For plug-in protector units, **do not** disassemble units. Label which pins are connected to tip and ring.

Danger: Heat coils and protectors must be restored as quickly as possible to minimize the possibility of equipment damage or employee injury.

Examine wiring for broken or missing insulation. Note "cold" solder joints, insecure wire-wrapping, or any other condition that might cause cutoffs, noise or electrical disturbance on frames. Check

line relays, line ferroids, line cut-off relays, etc, for loose connections, burns, crosses and damaged insulation. Inspect all other frames and terminal blocks on which the malfunctioning line terminates. This includes long lines circuit, bunching blocks, bridge lifters, intermediate distributing frame and line distributing frames. All other equipment bridged to the line must also be inspected.

INVESTIGATION REPORT FORMS

3.12 A typical Investigation Report Form shown in Fig. 4 can be reproduced locally. It is recommended that arrangements be made with the Loop Maintenance Center or Test Center to use this or a similar form to report directly to the protection engineer all customer complaints alledging

electrical shock, acoustical disturbance or fire. This procedure could insure early notification to the protection engineer that investigation may be required. If a complaint investigation is initiated, this form should be completed and forwarded to the organization in charge of the investigation.

3.13 Table A can be used as a reminder of the more important items to cover during an investigation. Details are covered in the body of the practice itself. Optional reporting forms of a more comprehensive nature are shown in Fig. 5, Station Inspection; Fig. 6, Outside Plant Inspection and Fig. 7, Central Office Equipment. These forms may be used to facilitate the investigation and may also be forwarded to the organization in charge of the investigation.

TABLE A
INVESTIGATION CHECKLIST

- I. AT BUILDING ENTRANCE FACILITY:
- A. Photograph and sketch.
 - B. Check and record the following:
 - (1) Is there any foreign voltage on protector?
 - (2) Is protector grounded in accordance with Section 876-300-100*?
What electrode?
 - (3) What kind of power distribution system feeds the customer premises?
 - (4) Is power correctly grounded? What electrode?
 - (5) Are protector grounds and power grounds bonded together?
What gauge?
 - (6) Is protector ground bonded to interior metallic water pipe?
What gauge?
 - (7) Is there any evidence of arcing or burns on protector?
Any operated fuses?
 - (8) Do all wells contain protector units?
 - (9) Is there continuity between outside plant leads and ground?
 - C. Remove all damaged equipment.
- II. AT STATION SET
- A. Photograph and sketch floor plan.
 - B. Remove station set, cord, terminal block, etc.
- III. ALONG OUTSIDE PLANT ROUTE
- A. Inspect all outside plant facilities involved with the line.
 - B. Check and record the following:
 - (1) Where are bonds from cable strand to power neutral?
 - (2) What is power line voltage?
 - (3) What type of power system is used? (Δ or Y)
 - (4) What are the clearances between power and telephone lines?
 - (5) Is cable sheath bonded according to Section 876-400-100?
 - (6) Is there evidence of power follow?
 - (7) Was a Breakdown test set being used at the time?
 - (8) Has power company reported any fault or outages in the area?
 - C. Photograph unusual conditions.
 - D. Remove all damaged equipment.

*876-300-100 gives rules for grounding
876-101-130 gives theory of grounding
460-100-400 gives station grounding procedures

TABLE A (Contd)

IV. AT CENTRAL OFFICE

- A. Photograph all equipment involved.
- B. Check and record the following:
 - (1) Is there any foreign potential on any associated equipment or lines?
 - (2) Are there any electrical burns or damage on heat coils, protectors, etc? Are protectors missing?
 - (3) Does wiring have missing or broken insulation?
 - (4) Is there evidence of "cold" solder joints; insecure wire-wrapping, etc., on equipment frames?
- C. Replace damaged equipment and restore service.

V. AT WORK LOCATION OR LABORATORY (if BTL is *not* involved)

- A. Disassemble protectors and station equipment.
- B. Check and record the following:
 - (1) Has fusible disc in protector units melted?
 - (2) Is there evidence of high current in protector unit?
 - (3) Does varistor in handset show sign of high current or cold solder joints?
 - (4) Are there any electrical burns on the inside of the set?
 - (5) Does transmitter or receiver contain small pin holes?
 - (6) Is cord broken, frayed, or burnt?
 - (7) Is there evidence of arcing in the terminal block?
- C. Store equipment under lock and key under control of the investigator who will be involved in litigation.

STATION INSPECTION

Claimant's Name _____ Date of Inspection _____

Address _____

Tel. No. _____

Customer Premises Equipment Type _____

Condition of Equipment _____

Weather conditions at time of incident _____

Connecting Block Type _____

Condition _____

Station Transformer Type _____

Condition _____

Inside Wire Type _____

Condition _____

Evidence of contact with foreign potentials _____

Protector Type _____

Condition _____

Length of Protector ground wire _____

Gauge of protector ground wire _____

Protector ground bonded to power service ground _____

Length of Bond wire _____

Gauge of Bond Wire _____

Power System ground bonded to water system _____

Fig. 5—Typical Station Inspection Report (Sheet 1 of 2)

STATION INSPECTION

Electrical Resistance Measurements

Station Protector grounding terminal to
ground of electrical system _____ OHMS

Station Protector grounding terminal to
Water system _____ OHMS

Station Protector grounding terminal to
remote earth ground _____ OHMS

Electrical System ground to remote
earth ground _____ OHMS

Report any unusual conditions _____

List all apparatus or equipment removed _____

Report prepared by _____

Title _____

Date _____

Tel. No. _____

Fig. 5—Typical Station Inspection Report (Sheet 2 of 2)

OUTSIDE PLANT INSPECTION

Claimant's Name _____ Date of Inspection _____

Company ID No. if Employee _____

Address _____

Tel. No. _____

Standard clearances between drop, cable, open wire terminals, etc. and other wires?

Accidents in the area _____

Evidence of lightning stroke _____

Employees working on line or cable _____

Describe any unusual or non-standard conditions which may have contributed to the occurrence

Describe any equipment removed _____

Report prepared by _____

Title _____

Dept. _____

Date _____

Tel. No. _____

Fig. 6—Typical Outside Plant Inspection Report

CENTRAL OFFICE EQUIPMENT

Claimant's Name _____ Date of Inspection _____

Company ID No. if Employee _____

Address _____

Tel. No. _____

Cable No. _____

Pair No. _____

Type and Condition of line protection _____

Report any equipment maintenance or testing at the time of the incident

Report any unusual or non-standard conditions which may have contributed to the occurrence

Describe any equipment removed _____

Report prepared by _____

Title _____

Dept. _____

Date _____

Tel. No. _____

Fig. 7—Typical Central Office Equipment Inspection Report