

**TYPE-ACCEPTANCE PROGRAM FOR
TELEPHONES USED WITH THE
CONVENTIONAL CENTRAL OFFICE INTERFACE**

TSG STANDARD 3

March 1990

PREFACE

The Telephone Security Group (TSG) prepared this standard. The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the TSCM (technical surveillance countermeasures) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

PART 1

INTRODUCTION

1.1 PURPOSE

TSG Standard 3 specifies the design and construction criteria, the application procedures, the manufacturer's testing requirements, and the documentation necessary for TSG type-acceptance of telephones compatible with the *conventional central office interface*.

1.2 APPLICATION

TSG Standard 3 may be referenced or included in US Government-sponsored procurement specifications to define TSG *type-accepted telephones*. This standard may be made available to telephone manufacturers who are responding to US Government requirements for TSG *type-accepted telephones*.

1.3 DEFINITIONS

Words and terms that are defined in the glossary for Standard 3 are printed in italics. The definitions in this glossary are for use with this standard only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usage given is intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using TSG Standard 3 that these terms not be given any more or any less meaning than is specified here.

1.4 TSG TYPE-ACCEPTANCE PROGRAM

1.4.1 The TSG maintains a program for the specification, evaluation, and type-acceptance of telephones that incorporate the design and construction characteristics necessary for them to be considered free from intrinsic vulnerabilities. The *type-accepted telephone* concept is a viable and important approach for verifiable telephone security that has long been employed by the US Government. It is the intent of this program that when a telephone model has been TSG type-accepted, every telephone marketed as this TSG type-accepted model will, by virtue of its design and construction, incorporate all the essential properties that protect against its passing *on-hook* audio.

1.4.2 This TSG standard specifies the design and construction criteria for TSG *type-accepted telephones* that are compatible with the traditional nonproprietary central office interface. A fundamental requirement of the basic TSG *type-accepted telephone* defined by this standard is that all external wirelines entering the telephone are *disconnected* from all internal circuitry (except the *annunciator*) when the telephone is in the *idle state*. Many proprietary *computerized telephone system (CTS) electronic telephones*, even when they are in the *idle state*, need power continuously from the CTS and/or to exchange information with it on a regular basis. These telephones, therefore, cannot support the requirement for total physical *disconnect* from the external wirelines. TSG Standard 4 addresses these telephones.

- 1.4.3 In order that maximum flexibility is provided to produce the most economical, fully effective security program for every individual application, TSG has developed a system of multiple categories of *type-accepted telephones*. A set of specific type-acceptance criteria is used to determine qualification for each type-acceptance class. The specifications provided in this standard assign the qualification criteria for each of several security classes that are applied to *type-accepted conventional central office interface telephones*. All *conventional central office interface* type-acceptance classes are designated by the letter X and followed by a number that indicates the specific security level; Class X 1 has the highest security. Increasing numerical values indicate decreasing security level.
- 1.4.4 Essential elements of the TSG telephone type-acceptance program are:
- 1.4.4.1 Design and construction specifications that describe the conditions under which telephones are considered to be:
- 1.4.4.1.1 Physically incapable (by reason of design and construction) of producing *microphonic* audio on any wires leaving the instrument while it is in the *idle state*.
- 1.4.4.1.2 Capable of being individually subjected to routine on-site physical and electrical inspections that will adequately and expeditiously determine if the protective measures remain effective and if any intrusive audio surveillance modifications have been installed.

- 1.4.4.2 The standardized evaluation and qualification conditions that are used to determine each type-acceptance class.
- 1.4.4.3 The Requirements for documentation and sureties to be provided to a member agency of the TSG. These must properly demonstrate and guarantee that a particular model telephone does conform to all required criteria. Any telephone model whose design and construction is shown by adequate documentation, backed by the necessary surety, to conform to the required criteria will be type-accepted by the TSG and approved for installation and use without any requirement for additional *isolation* or *disconnect* measures.
- 1.4.4.4 Type-acceptance application process.
- 1.4.4.5 Limited requirements on product stability. These are applied, for the most part, only to those components of the *type-accepted telephone* that is used to implement mandatory security features. The manufacturer is largely free to change all nonrelated areas without affecting its type-acceptance status.
- 1.4.4.6 Labeling requirements for *type-accepted telephones*.
- 1.4.4.7 Guidelines for use by participating agencies of the United States Government to enable them to identify and select telephones suitable for use in sensitive discussion areas.
- 1.4.5 It is expected that many commercial instruments now being marketed will qualify for type-acceptance at the minimum security level with little or no need for special modifications at additional cost. Most telephone installations by the member agencies of TSG, however, will require more than the minimum level of security. Compliance with specific criteria concerning security methodology can produce eligibility for the higher security classifications.
- 1.4.6 While it is not expected that many telephones now being commercially produced will inherently meet the criteria for the higher classifications, the great majority of models currently on the market can probably be economically modified (in production quantities) to do so. The production of economical *type-accepted telephones* in the higher security classes is expected to result in the closing of a large portion of the government telephone market to all products that do not have this status. It is anticipated that a significant number of manufacturers will recognize that it is to their commercial advantage to produce modified versions of their various telephone models that will qualify for high- classification type-acceptance.
- 1.4.7 The TSG type-acceptance program is mutually beneficial to the government and to the telephone industry. The TSG design and construction criteria for type-acceptance are provided both to government agencies and to qualified members of the industry. The identification of the *type-accepted telephone* models allows government agencies (who are concerned about *on-hook telephone security*) to exclude from consideration for procurement all telephones not acceptable; the TSG type- acceptance requirements may be included as part of the telephone procurement specifications. Manufacturers who wish to compete in this market can readily determine if their products are acceptable and, if not, what modifications are necessary to make them acceptable. Also, the type-acceptance procedure clearly defines what portions of the telephone can be subsequently altered by the manufacturer without affecting its

type-accepted status. Changes of this sort can be made at the discretion of the manufacturer without involvement of the government.

- 1.4.8 The numerical type-acceptance classes rate the telephones on the basis of *idle-state* security only. The security of many installations, however, also depends on the characteristics of the telephones when they are in the *in-use state*. Manufacturers may wish to indicate special *in-use state* qualities of their products to communicate special suitability for those situations. A system of optional alphabetical suffixes may be appended to the type-acceptance class number to indicate the following:
 - 1.4.8.1 **Suffix A.** The *handset* requires a push-to-talk operation for the *transmitter element* and either a push-to-listen operation or an isolation amplifier for the *receiver element*. Only handset operation is available with this unit; any other functions that employ *microphonic* activity (such as *headset*, *hands-free answering* units, *speakerphones*, or *speaker-microphones*) are not possible. Except for the *handset transmitter element*, the telephone contains no *microphones*.
 - 1.4.8.2 **Suffix B.** Only *handset* operation is available with this unit; any other functions that employ *microphonic* activity (such as *headset*, *hands-free answering* units, *speakerphones*, or *speaker-microphones*) are not possible. Except for the *handset transmitter element*, the telephone contains no *microphones*.
 - 1.4.8.3 **Suffix C.** Either *handset* or *headset* operation is available with this unit; any other functions that employ *microphonic* activity (such as *hands-free answering* units, *speakerphones*, or *speaker-microphones*) are not possible. Except for the *handset* or *headset transmitter element*, the telephone contains no *microphones*.

PART 2 PROCEDURE FOR OBTAINING AND MAINTAINING TSG TYPE-ACCEPTANCE

2.1 Type-acceptance procedures cannot be applied effectively to any telephone without the full cooperation of the manufacturer. The type-acceptance concept involves the manufacturer on a continuing basis, to include but not be limited to the following:

- 2.1.1 Design of the original telephone.
- 2.1.2 Design of modifications if necessary to comply with the type-acceptance requirements.
- 2.1.3 Testing the candidate telephone to establish that it does perform in accordance with the type-acceptance criteria.
- 2.1.4 Documentation of all claims relating to the type-acceptance requirements.
- 2.1.5 Technical information to support the development of field inspection procedures.
- 2.1.6 Continued production of the type-accepted version in support of systems purchased by the government or by a government contractor.

2.2 When a manufacturer applies for and receives type-acceptance, it is for the specific configuration described in the application documentation. TSG assigns a type-acceptance number to this configuration. This number cannot be used on any alternative configuration that involves a change in any portion of the telephone that has been designated a *critical subassembly* for the type-acceptance class in question. The type-acceptance may be revoked at any time it becomes apparent that the telephone is not providing adequate *idle-state* audio security.

2.3 **INITIAL CONTACT**

- 2.3.1 A manufacturer responding to a specific procurement requirement (whether a direct request or a public announcement) of an agency of the US Government submits the application for type-acceptance to that agency.
- 2.3.2 A manufacturer wishing to obtain type-acceptance to gain entry into the portion of the government market affected by the type-acceptance program can apply to any TSG participating agency

2.4 **PROCEDURE**

- 2.4.1 Ascertain the type-acceptance class(es) required, if appropriate.
- 2.4.2 Evaluate the proposed products to determine the degree of compliance with the criteria for the class intended.
- 2.4.3 Develop and implement any modifications necessary to meet the requisite criteria. Documentation of the proposed modifications may be submitted to the agency in question for preliminary evaluation before actual implementation.

[Preliminary approval of the approach, based on the documentation submitted, means only that no

obvious deficiencies are in evidence. Actual type-acceptance requires that the modified telephone be fully tested in accordance with the requirements for the type-acceptance class in question. There is no assurance that an approach that has received preliminary approval will pass these tests.]

2.4.4 Perform all required tests on an actual modified telephone that is exactly like the production unit.

2.4.5 Submit the following documentation to the agency performing the type-acceptance evaluation. Documents identified as containing proprietary information will be used to evaluate and confirm the necessary conditions only. All proprietary information will be treated with strict confidentiality.

[The format used here to list the required documentation is for convenience in presentation and to facilitate application. The manufacturer is encouraged to use existing manuals, drawings, brochures, or other publications that may be available. It is not necessary to extract and repeat specific information in order to meet the documentation requirements in each of the categories listed below. It will be sufficient to state where the information can be found in the publications provided.]

2.4.5.1 Letter of application, signed by an authorized company official, containing the following:

2.4.5.1.1 Identification of product--manufacturer, product line, and models involved. Include whatever additional descriptive information is necessary to eliminate all possibility of ambiguity or confusion with any other product.

2.4.5.1.2 The class number for which application is being made.

2.4.5.1.3 Certification that the product meets the criteria for that class, and that it may be opened for visual and electrical inspection (to verify that it conforms to all type-acceptance criteria) at any time without invalidating the normal product warranties.

2.4.5.1.4 Point of contact for inquiries--name, title, address, telephone number.

2.4.5.2 *Summary of product offering*, including manufacturer's sales and/or technical literature for the product.

2.4.5.3 *Summary of test results*, explaining basis for asserting that the proposed telephone meets the appropriate type-acceptance criteria.

2.4.5.4 *Functional description*, containing the following:

2.4.5.4.1 Operation of telephone.

2.4.5.4.2 Appearance.

2.4.5.4.3 Installation requirements.

2.4.5.4.4 Operations manual.

2.4.5.4.5 Identification of all systems with which the telephone is compatible.

2.4.5.4.6 Features, options, and *auxiliary units* available with the version being evaluated. Options available on the standard commercial model may, at the manufacturer's discretion, be excluded from the version being submitted for type-acceptance.

2.4.5.5 *Electrical description*, containing the following:

- 2.4.5.5.1 -- Complete theory of operation, including descriptions of the lineswitch and the interface connection.
- 2.4.5.5.2 -- Block diagrams, including complete descriptions of signals between functional blocks.
- 2.4.5.5.3 -- Schematic diagrams and circuit descriptions.
- 2.4.5.5.4 -- Component listing.
- 2.4.5.5.5 -- Installation/maintenance manual.

- 2.4.5.6 . *Detailed security evaluation*--must include all features, options, and *auxiliary units* included in paragraph 2.4.5.4.6. All applicable criteria are applied to the basic telephone and to the composite formed when the *auxiliary units* are attached and operational.
- 2.4.5.6.1 -- Provide component layout diagrams, including location and function of test points.
- 2.4.5.6.2 -- Provide circuit descriptions and diagrams of all audio circuits, *focal subassemblies*, and *critical subassemblies*.
- 2.4.5.6.3 -- Identify all components (manufacturer and model number) added to implement positive security measures.
- 2.4.5.6.4 -- Document all software/firmware involved in the implementation of the positive security measures.
- 2.4.5.6.5 -- Cite each applicable type-acceptance criterion by its paragraph number in part 3 of this standard (the paragraph numbers themselves indicate if the criterion being addressed is in the annex specific to the class for which application is being made). Show how the proposed telephone complies with the criterion.

- 2.4.5.7 . *Laboratory test report*, containing the following:
 - 2.4.5.7.1 -- Abstract.
 - 2.4.5.7.2 -- Objectives of tests.
 - 2.4.5.7.3 -- List of test equipment used.
 - 2.4.5.7.4 -- Test equipment configuration used for each test.
 - 2.4.5.7.5 -- Test data and conclusions.

- 2.4.5.8 . *Support documentation for field tests and inspections*--to be distributed to field inspection teams for use during on-site testing. The information provided for this purpose should be nonproprietary.
 - 2.4.5.8.1 -- Component layout diagrams, including location and function of testpoints.
 - 2.4.5.8.2 -- Instructions for assembly and disassembly of the telephone.
 - 2.4.5.8.3 -- Photographs showing the appearance of all circuit boards and assemblies.

- 2.4.5.9 . *Supplementary information* requested by the government in order to complete the evaluation of the application.

2.5 **MARKETING OF TYPE-ACCEPTED TELEPHONES**

- 2.5.1 Telephones being marketed to agencies or departments of the US Government as TSG *type-accepted telephones* must be permanently marked to show the TSG type-acceptance number and either a serial number or the month and year of manufacture.
- 2.5.2 Regardless of the agency to which the initial application was made, once a TSG type-acceptance number is assigned to a telephone, it will be recognized as a type-accepted item by all the member agencies of the TSG without need for further evaluation.

PART 3

DESIGN AND CONSTRUCTION SPECIFICATIONS

Preliminary Note

The general approach and those requirements that are applicable to all type-acceptance classes are presented. Specific requirements for individual type-acceptance classes are provided in separate dedicated annexes for each class

3.1 OPERATIONAL LIMITATIONS

- 3.1.1 The telephone must not be capable of cordless operation. Wireline connections between the telephone and the switched *network* are required for the telephone to function. All communications and information interchange between the telephone, its component parts, and *auxiliary units*, and with the *telephone network*, must be on metallic wirelines.
- 3.1.2 There must not be any *hands-free answering* capability. A *manual action* on the part of the user is necessary to initiate, answer, join, or maintain a call. The telephone can be in the *in-use state* only if:
- 3.1.2.1 . The *handset* is physically removed from the *handset mounting*, or
 - 3.1.2.2 . A manual *speakerphone* or *headset switch* is activated, or
 - 3.1.2.3 . An *auxiliary unit* is manually activated.
- 3.1.3 Some telephones may require additional action by the user (such as pressing a line select key) to be in the *in-use state*; this is entirely acceptable.
- 3.1.4 The telephone is immediately restored to and remains in the *idle state* if:
- 3.1.4.1 . the hold feature has not been activated, and
 - 3.1.4.2 . all *auxiliary units* are manually deactivated, and
 - 3.1.4.3 . the *headset* and *speakerphone* switches are turned off, and
 - 3.1.4.4 . the *handset* is positioned in the *handset mounting*.
- 3.1.5 When a call is terminated, or placed on hold, all required *idle-state* security measures automatically and immediately become effective.
- 3.1.6 Positive security measures cannot include any software-dependent or firmware-dependent functions.
- 3.1.7 *Type-accepted telephones* may contain line-hold circuitry only if the activation of the line-hold feature requires that the *handset* be placed in the *handset mounting* and that all other manual operations normally associated with the telephone being in the *idle state* have been accomplished.

3.2

TELEPHONE SECURITY AND INSPECTION SUPPORT MEASURES

3.2.1 Electrical Requirements

3.2.1.1 TSG has determined that in most cases the full objective of the telephone type-acceptance program can only be achieved if metallic- contact *disconnect* devices are used to perform the *disconnect* and shorting functions that are specified below and in the annexes.

3.2.1.1.1 All metallic-contact devices used for audio security must be rated for at least 10,000 operations under the conditions that exist in the telephone.

3.2.1.1.2 When metallic-contact devices are required to short across sensitive elements, the opening and closing of the contacts must occur with no voltages applied across them.

3.2.1.2 Examples of ways in which metallic-contact *disconnects* can be implemented are:

3.2.1.2.1 · *Directly actuated*--mechanically operated switches, magnetic proximity switches, position sensitive mercury switches, etc. These could be located in the *handset*, or in the *handset mounting*, so that they operate directly by the placement or removal of the *handset*.

3.2.1.2.2 · *Indirectly activated*--metallic-contact mechanical relays that could be controlled by whatever form of *hookswitch* is used in the conventional (before modification for type-acceptance) version of the telephone.

3.2.1.3 It is recognized that the modern telephone industry often regards these devices as obsolete technology. Their requirement here, however, does not derive merely from their functional performance but also from physical and electrical characteristics that make the performance readily confirmable by electrical and physical inspection. It is emphasized; therefore, that whenever the type-acceptance criteria specifically designate metallic-contact *disconnect* devices, functionally equivalent operational alternatives employing more modern technologies will not be acceptable.

3.2.1.4 When positive security measures that perform *disconnect* and shorting operations are applied, normal operation of the telephone necessitates that provision be made to suspend these measures when the telephone is in the *in-use state*.

3.2.1.4.1 With the exception of the *annunciator*, the suspension of the positive security measures required for the intended type-acceptance class, however, must never occur without a *manual action* by the user that is unequivocally associated with placing the telephone in the *in-use state* (e.g., lifting the *handset* or activating a *speakerphone* switch).

3.2.1.4.2 The security measures are completely controlled at the telephone. All security measures must restore to full effect when the user performs any normal telephone operation intended to terminate the *in-use state*.

3.2.1.4.3 Regardless of which state the telephone is in (*in-use*, *idle*, programming, etc.), no

change (temporary or permanent) in any of the security features required for its type-acceptance class (except those for the annunciator) can result from any acoustic or electromagnetic signals, from action by the servicing switch, or from signals on any of the *station mounting cord* wires or power supply wires. The security features are independent of the voltages (or absence thereof) on any of these wires.

- 3.2.1.5 No electrical paths or circuitry used to convey *in-use state* control signals from the manually actuated component (e.g., *hookswitch*, *headset* switch, *speakerphone* switch) to the devices that implement the positive security measures (e.g., relays) may include or share components or devices that are used for any other purpose. Items such as switches, transformers, relays, integrated circuits, or multicomponent packages that cannot be readily opened for maintenance on the individual components must be entirely dedicated to the control of the protective device.
- 3.2.1.6 Telephones are treated as being comprised of components, devices, and subassemblies that may be categorized as being either *idle-state-inactive*, *idle-state-active*, *idle-state-disconnecting*, or *idle-state-shorting*.
 - 3.2.1.6.1 *Idle-state-inactive* components and subassemblies are those that only need to be functionally operational when the telephone is *in use*. These components/subassemblies may be disconnected from all external wires when the telephone is in the *idle state* without interfering with any *idle-state* functions.
 - 3.2.1.6.2 *Idle-state-active* components and subassemblies are used to perform functional operations while the telephone is in the *idle state*. They require an *idle-state* source of electrical power. Examples of electric power sources commonly used by telephone manufacturers are the AC ringing signal on the tip-ring pair, DC trickle current from the tip-ring pair, internal batteries, and external power sources not connected to the tip-ring wires. If a telephone contains *idle-state-active* components/subassemblies that are supported in the *idle state* by an external power source, it cannot be completely disconnected electrically from all external wiring without causing some loss of function. Therefore, restrictions on *idle-state* power sources occur as a result of the fundamental TSG type-acceptance requirements. These restrictions are explained below and in the annexes.
 - 3.2.1.6.3 *Idle-state-disconnecting* devices and subassemblies establish temporary electrical connections between two conductors when the telephone is *in use*. When the telephone is in the *idle state*, the connections are removed, and there is no electrical path between these conductors.
 - 3.2.1.6.4 *Idle-state-shorting* devices and subassemblies place temporary electrical connections between two conductors so they are shorted together when the telephone is in the *idle state*. When the telephone is *in use*, the shorting connections are removed.
- 3.2.1.7 All devices and subassemblies that perform functions required for the TSG type-acceptance of a telephone are designated *critical subassemblies* for that telephone.
 - 3.2.1.7.1 The *annunciator* is the only *idle-state-active component/subassembly* that is permitted to contain *transducers*, or audio functions.

- 3.2.1.7.2 If the *annunciator* conforms to the following requirements, it may remain connected to external wires when the telephone is in the *idle state*:
- 3.2.1.7.2.1 It is an identifiable two-terminal device or subassembly.
- 3.2.1.7.2.2 There are no electrical or magnetic connections to any *idle-state-inactive* components or subassemblies.
- 3.2.1.7.2.3 Across the two terminals, the open-circuit *microphonic* response to a 2 Pa sound pressure level (2 Pa equals 100 dB above 20 μ Pa; 20 μ Pa is the conventional value for the threshold of hearing) must be less than 1 μ V_{rms} for the frequency range 100 Hz to 15 kHz.
- 3.2.1.7.3 If the *annunciator* subassembly does not comply with the above criteria, the following protective measures must be applied to the *annunciator transducer* unit at all times that it is not actually producing an *audible signal*.
- 3.2.1.7.3.1 All terminals or wires for the *transducer* unit must be shorted by metallic contacts.
- 3.2.1.7.3.2 All terminals or wires for the *transducer* unit must be disconnected from all other components in the telephone by metallic-contact devices.
- 3.2.1.8 The various type-acceptance classes contain different requirements for *idle-state-inactive components* and subassemblies. Some classes specify *focal subassemblies*. In order for a telephone to qualify for a particular type-acceptance class, it must short and disconnect the *focal subassemblies* designated for that class.
- The following positive security measures must be applied at the boundary of every *focal subassembly*.
- 3.2.1.8.1 Signals may only couple across the boundary when the telephone is in *use*.
- 3.2.1.8.2 The only coupling medium (intentional or fortuitous) that is allowed to cross the boundary of a *focal subassembly* is electrical conduction on metallic conductors.
- 3.2.1.8.3 The *conductors* crossing the *focal subassembly* boundary must be shorted by metallic-contact *idle-state-shorting* devices and broken by metallic-contact *idle-state-disconnect* devices.
- 3.2.1.9 Except as specified below, *focal subassemblies* cannot include any components other than *transducers* or *microphonic* elements and the components used to implement the positive security measures.
- 3.2.1.9.1 Wires and printed circuit conductors may be included if they connect directly to a *transducer* and are operationally necessary. Wires in the *cord* connecting an external member (e.g.,

handset headset, auxiliary unit) to the main body of the telephone must meet this criterion to be included in a *focal subassembly*.

3.2.1.9.2 Components connected directly across the terminals of the *transducers* may be included if the *transducers* in question are located in a member external to the main body of the telephone and the positive security measures are located within the main body itself.

3.2.1.9.3 Some *transducers* are contained in sealed packages which also contain other components. Electret *microphone-based transmitter elements* are typically constructed in this way. For purposes of assigning the *Socal subassembly*, sealed packages that do not permit direct access to the actual *transducer* may be treated as if the entire package were the *transducer*.

3.2.1.10 The type-acceptance classes also differ in the limitations assigned to *idle-state-active* components and subassemblies that *do not* contain *transducers* or audio functions. Whenever an *idle-state-active* component or subassembly (other than the *annunciator*) is used, it must have been tested and shown to comply with the following requirement.

For all *idle-state-active* components or subassemblies the open circuit microphonic response to a 2 Pa (100 dB above 20 pa) sound pressure level must be less than 1 uVrms for the frequency range 100 Hz to 15 kHz.

3.2.1.11 When the telephone is in the *idle state*, all *idle-state-inactive* components/subassemblies are disconnected from (and are incapable of receiving, processing, or in any way acting upon) all electrical power, signals, or instructions that originate outside of the *telephone-auxiliary unit* composite.

3.2.1.11.1 All *idle-state-inactive components/subassemblies* must be isolated from all wires, coupling devices, and transmission media that are not wholly contained within the *telephone-auxiliary unit* composite. This isolation must be accomplished with metallic-contact *idle-state* disconnecting devices or subassemblies.

3.2.1.11.2 Normal-open metallic-contact *idle-state* disconnect devices and/ or subassemblies must be incorporated such that, when the telephone is in the *idle state*, they completely sever all electrical connections between every *idle state-inactive* component/subassembly and:

3.2.1.11.2.1 All external wiring.

3.2.1.11.2.2 All *idle-state-active* components and subassemblies.

3.2.1.12 *Idle-state-disconnect* and *idle-state-shorting* devices and subassemblies must be tested and shown to be *non-microphonic*.

The open-circuit *pressure response level* must be measured across every pair-wise combination of connections to the component or subassembly. Within the range 100 Hz to 15 kHz, the *microphonic* response must be less than 1uVrms for a sound pressure level of 2 Pa (100 dB above 20 uPa).

- 3.2.1.13 The following technical criteria apply to the selection of *idle-state-disconnect* and *idle-state-shorting* devices and subassemblies used to meet the security requirements of these standards.
- 3.2.1.13.1 The initial contact breakdown voltage rating for *disconnect* devices must be at least 1.5 kV. The resistance across the open contacts must exceed 100 MQ.
- 3.2.1.13.2 The capacitance across the open contacts of the *disconnect* devices must be lower than 7 pF.
- 3.2.1.13.3 The closed resistance across the closed contacts of shorting devices must be less than 150 mQ, and the contact surfaces must be either mercury, 5-percent gold alloy, or gold clad.
- 3.2.1.14 The following requirements apply to the selection of *idle-state-inactive* components and subassemblies.
- Only electret type *microphones* may be used. Carbon *microphones*, dynamic *microphones*, and piezoelectric types are expressly excluded.
- 3.2.1.15 A visual indication is to be provided whenever any of the *idle-state* protective measures are not in effect. If the protective measures are disabled because the *handset* was removed from the *handset mounting*, no further visual indication is necessary.
- If there are ways by which the user can cause the telephone be in the in-use state without lifting the handset, such as with a speakerphone, the telephone must be fitted with a lamp indicator that will unambiguously show when the protective measures have been disabled. This lamp must respond to all activities that disable the protective measures while the handset is in the handset mounting. There is no need for it to respond to the lifting of the handset, but there is also no objection to its doing so.
- 3.2.1.16 A *type-accepted telephone* may not draw more than 0.1 uA DC current from its *station mounting cord* when it is in the *idle state*. It is anticipated that once placed into service, the telephone will be subjected to intermittent situations in which high-level AC and/or DC voltages occur on *station mounting cord* wires. The telephone is required to be able to withstand voltages as high as 1.5 kV without temporary or permanent change in its *idle-state* properties, or damage to any components.
- When the telephone is in the *idle state*, the maximum DC current it may draw, in either polarity is 0.1 uA. This limit applies to any voltage source less than or equal to 1.5 kV applied to its *station mounting cord* wires.
- 3.2.1.17 *Transducers* that have an open-circuit *microphonic pressure response level* (regardless of whether they are functionally transmit or receive elements) of more than 30 mV/Pa (60 mV_{rms} response for 100 dB above 20 IIPa SPL) in the frequency range 200 Hz to 8 kHz must be protected with *disconnect* and shorting devices.
- When the telephone is in the *idle state*, all the electrical leads and/or terminals of any

transducer that has an open-circuit *microphonic pressure response level* of more than 30 mV/Pa in the frequency range 200 Hz to 8 kHz must be shorted together and disconnected from all other conductors. Metallic contacts must be used.

3.2.2 **Mechanical Requirements**

- 3.2.2.1 The construction of the telephone set must provide (at any time before, during, or after installation) a means for the physical inspection of all security measures to ensure they are functioning properly. All security functions must be verifiable by physical inspection and/or electrical measurement.
- 3.2.2.2 The telephone must be capable of repeated disassembly without physical damage or deterioration occurring.
- 3.2.2.3 The telephone must afford the means for easy safe electrical access to perform measurements at the following without risk of damage:
 - 3.2.2.3.1 Every metallic contact used as a protective measure.
 - 3.2.2.3.2 Every terminal of every *transducer*.

Note: If the *transducer* is enclosed in a sealed package, the access may be to the terminals or wires of that package.
 - 3.2.2.3.3 All wires leaving the telephone.
 - 3.2.2.3.4 All places where power is available when the telephone is in the *idle state*.
- 3.2.2.4 If a type-acceptance class requires test points (e.g., to permit the electrical verification of security protective conditions), these test points must be placed so they can be safely accessed while the telephone is operational. The location of the test points must be such that they can be accessed without danger of touching any other component or wiring. Under no circumstances shall the security-related test points be accessible without the telephone case being opened.
- 3.2.2.5 All *transducers* not specifically allowed must be physically removed from the telephone set: not merely disconnected. Depending on class suffix, this may include, but is not limited to, *speakers* for voice announcements, *speakerphones*, and built-in *microphones*.
- 3.2.2.6 The construction of the telephone must preclude any possibility that internal components or wiring can obstruct the operation of any switch or device used to provide or control the physical protective measures.
- 3.2.2.7 Any use of multiple *hookswitch* plungers will be fully redundant. Depressing any one alone will fully operate all the *idle-state* protective measures.

3.3 **MANUFACTURING RESTRICTIONS**

Once a telephone is type-accepted, design or construction changes are permitted unless they affect

some aspect of the criteria required for its type-acceptance class. Any design or construction change in the designated *focal subassemblies* or *critical subassemblies* automatically cancels the type-acceptance status.

3.4 ELECTRICAL TEST REQUIREMENTS

3.4.1 Sound Pressure Response Tests

The *pressure response level* measurements are to determine if there are any *microphonically* produced signals that are in excess of permitted levels. Acoustic energy is projected at the telephone at a specified sound pressure level; ground-referenced and differential voltage measurements are performed on every conductor that leaves the telephone.

3.4.1.1 Test Procedures

3.4.1.1.1 Test Conditions

3.4.1.1.1.1 The sound pressure level for these tests is 2 Pa (100 dB above 20 uPa).

3.4.1.1.1.2 If the telephone uses local power, it must be tested both with the power applied and with the power disconnected.

3.4.1.1.1.3 Online tests are performed in the *idle state*. The telephone is provided an electrically quiet connection to a simulated 50-volt central office. Both polarities are tested. All connections are accomplished in the manner normal for the telephone being tested.

3.4.1.1.1.4 Offline tests are performed with the telephone completely disconnected from all real or simulated central offices. In both online and offline tests, all contacts used for positive security measures are in their normal condition (normal-open are open, normal-closed are closed).

3.4.1.1.1.5 Incremental voltage tests are performed with the telephone connected to the online test configuration but with the applied voltage varied smoothly between -50 and 50 volts taking five ~ two seconds to complete the transition.

3.4.1.1.2 Acoustic Signals

A frequency range is specified for each required test. The tests are performed with single-frequency tones and may be conducted continuously over the test frequency range or at intervals not to exceed one-half octave below 400 Hz and one-third octave above 400 Hz. The test signal sound pressure levels at the telephone are not lower than 2 Pa for all tests. The test frequencies may be modulated to facilitate recognition during recovery but the rms value must not be lower than 2 Pa for at least 50 percent of the measurement period.

3.4.1.1.3 Signal Recovery

3.4.1.1.3.1 A set of conductors to be evaluated is designated for each category of *pressure response level* test; ground is always included in this set. Voltage measurements are performed for all the pair-wise combinations of these conductors. For each such conductor pair (e.g.,

wire-to-ground or wire-to-wire), measure the differential voltage produced as the result of *microphonic* response to the test signal. The measurements may use either matching impedances or any impedance not lower than 100 kQ. The choice is at the option of the tester.

For offline voltage measurements on a conductor pair, the test equipment may be matched to the internal terminating impedance that is presented by the *idle-state telephone* across that pair.

- 3.4.1.1.3.2 The voltages measured on the tip-ring, tip-ground, and ring-ground pairs during the online tests will be loaded by the simulated central office. The impedance of this loading must be stated with the test data.

For online voltage measurements on a tip-ring, tip-ground, or ring-ground pair, the test equipment impedance may be matched to either:

- 3.4.1.1.3.2.1 The internal terminating impedance that is presented by the *idle-state telephone* across that pair, or
- 3.4.1.1.3.2.2 The internal terminating impedance that is presented by the simulated central office across that pair.

3.4.1.1.4

Acceptance Criteria

Voltage measurements are only valid if they are performed on wires or wire pairs for which the aggregate loading of all external connections, including the test instrumentation and any other article external to the telephone, produces a net impedance not less than the allowed amount. The test instrumentation must be capable of detecting and accurately measuring voltages one-tenth the specified maximum value.

A maximum allowed microphonic response voltage is specified for each of the required tests.

3.4.1.2 **Functional Microphonic Sound Pressure Response Limit**

- 3.1.4.2.1 Online, offline, and incremental voltage tests are required. The *pressure response level* tests are conducted for the telephone equipped and configured exactly as described in the type-acceptance application. All measurements are performed with the telephone in the *idle state*.

- 3.4.1.2.2 The telephone is examined for *microphonics* as if it were an actual elemental *microphone*; only the overall behavior of the entire *telephone- auxiliary unit* composite is considered for these tests.

- 3.4.1.2.3 *Microphonic* response voltage measurements are performed for all the conductors (wires) that leave the *telephone-auxiliary unit* composite. The *handset, headset, or auxiliary unit cords* are not considered to be "conductors that leave the *telephone-auxiliary unit* composite" and therefore need not be tested.

- 3.4.1.2.4 The maximum allowed *microphonic* response voltage applies over the frequency range 100 Hz to 15 kHz.

Acceptance Criterion

- 3.4.1.2.5 No *microphonic* voltages are permitted that exceed $1\mu\text{V}_{\text{rms}}$ when measured across an impedance that is not less than the lower value of:
 - 3.4.1.2.5.1 The proper matching impedance, or
 - 3.4.1.2.5.2 100 k Ω .

3.4.1.3 Fortuitous Microphonic Sound Pressure Response Limit

- 3.4.1.3.1 Online, offline, and incremental voltage tests are required. These *pressure response level* measurements are to determine if there are any incidental *microphonic* components in the telephone that are capable of causing *microphonically* produced signals to be present on the external wires.
- 3.4.1.3.2 *Microphonic* response voltage measurements are performed for all the conductors (wires) that leave the *telephone-auxiliary unit* composite. The *handset*, *headset*, or *auxiliary unit cords* are not considered to be "conductors that leave the *telephone-auxiliary unit* composite" and therefore need not be tested.
- 3.4.1.3.3 The *pressure response level* tests are conducted for the telephone equipped and configured as follows:
 - 3.4.1.3.3.1 All components whose proper functions require that they be acoustic *transducers* are removed from inside the telephone.
 - 3.4.1.3.3.2 The *handset cord* is disconnected.
 - 3.4.1.3.3.3 The telephone is in the *idle state*.

Acceptance Criterion

- 3.4.1.3.4 No microphonic voltages are permitted that exceed $1\mu\text{V}_{\text{rms}}$ when measured across an impedance that is no less than the lower value of:
 - 3.4.1.3.4.1 The proper matching impedance, or
 - 3.4.1.3.4.2 100 k Ω .
- 3.4.1.4 Idle-State-Disconnect/Shorting Devices or Subassemblies: Microphonic Sound Pressure Response Level Limit
 - 3.4.1.4.1 The sound *pressure response level* tests are conducted on the *idle-state-disconnect* and *idle-state-shorting* devices/subassemblies with these units not installed in the telephone.

3.4.1.4.2 *Microphonic* response voltage measurements are performed for all the terminals of the device being evaluated and for all the conductors (wires) that are used to connect it to other components.

3.4.1.4.3 The maximum allowed *microphonic* response voltage applies over the frequency range 100 Hz to 15 kHz.

Acceptance Criterion

3.4.1.4.4 No microphonic voltages are permitted that exceed $1\mu\text{V}_{\text{rms}}$ when measured across impedance that is no less than the lower value of:

3.4.1.4.4.1 The proper matching impedance, or

3.4.1.4.4.2 100 k Ω .

3.4.1.5 Transducers: Microphonic Sound Pressure Response Level Limit

3.4.1.5.1 The *pressure response level* tests are conducted on all *transducers*, (*speakers*, and *receiver elements* as well as *microphones*) and on all other components in the telephone identified as being *microphonic*.

3.4.1.5.2 The *transducers* are tested not installed in the telephone.

3.4.1.5.3 *Microphonic* response voltage measurements are performed for all the terminals of the device being evaluated and for all the conductors (wires) that are used to connect it to other components.

3.4.1.5.4 The maximum allowed *microphonic* response voltage applies over the frequency range 200 Hz to 8 kHz.

Acceptance Criterion

3.4.1.5.5 The *transducer* must be disconnected and shorted if voltages are produced that exceed 60 mV_{rms} when measured across an impedance that is not less than the lower value of:

3.4.1.5.5.1 The proper matching impedance, or

3.4.1.5.5.2 100 k Ω .

3.4.2 Contact Capacitance Tests

This test need not be performed if the manufacturer of the component in question has specified for it, a minimum performance that meets or exceeds the acceptance criterion.

3.4.2.1 All normal-open metallic-contact pairs used for positive security measures must be measured (installed or not installed, at the manufacturer's option) to confirm compliance with the

criterion for maximum capacitance. The test instrumentation must be capable of detecting and accurately measuring capacitances one-tenth the specified maximum value.

Acceptance Criterion

3.4.2.2 The capacitance across the normal-open contacts must be lower than 7 pF.

3.4.3 Contact Resistance Tests

These tests need not be performed if the manufacturer of the component in question has specified for it, a minimum performance that meets or C the acceptance criteria.

3.4.3.1 All normal-closed metallic-contact pairs used for positive secretly measures must be measured (installed or not installed, at the manufacturer's option) to confirm compliance with the criteria for maximum closed resistance. The test instrumentation must be capable of detecting and accurately measuring resistances one-tenth the specified maximum value.

3.4.3.2 All normal-open metallic-contact pairs used for positive security measures must be measured (installed in the telephone) to confirm compliance with the criteria for minimum open resistance. The test instrumentation must be capable of detecting and accurately measuring resistances 10 times the specified minimum value.

Acceptance Criteria

3.4.3.3 The closed resistance of normal-closed contacts must be lower than 150 mQ.

3.4.3.4 The open resistance across normal-open contacts must exceed 100 MQ.

3.4.4 Voltage Breakdown Tests

These tests need not be performed if the manufacturer of the component in question has specified for it, a minimum performance that meets or exceeds the acceptance criterion.

3.4.4.1 All normal-open metallic-contact pairs used for positive security measures must be measured (installed or not installed in the telephone at the manufacturer's option) to confirm that their resistance remains in excess of 100 MQ when 1.5 kV is placed across them. The test instrumentation must be capable of detecting and accurately measuring resistances 10 times the specified minimum value.

3.4.4.2 All components at risk from voltages applied at the *station mounting cord* wires must be measured (installed or not installed at the manufacturers option) to confirm that they do not draw more than 0.1 IIA when 1.5 kV is placed across them. The test instrumentation must be capable of measuring currents one-tenth the specified level.

Acceptance Criterion

3.4.4.3 The initial breakdown point for normal-open contact devices and for components that are

subject to *station mounting cord* voltages must be not lower than 1.5 kV.

**PART 3
(ANNEX 1)**

**SUPPLEMENTARY DESIGN AND CONSTRUCTION
SPECIFICATIONS TYPE-ACCEPTANCE CLASS X1**

Preliminary Note

This annex to part 3 of TSG Standard 3 describes the specific supplementary requirements for TSG type-acceptance Class X1. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in part 3.

- 3(1).1 No external connections are permitted except to the *station mounting cord*.
- 3(1).2 The number of contacts permitted in the *station mounting cord* jack is restricted and depends on the type of service for which the telephone is intended.
- 3(1).2.1 . **Two-wire Service Without Provision for System Control.** Two contacts are permitted. These are dedicated to the central office tip-ring pair.
- 3(1).2.2 . **Two-wire Service With Provision for System Control.** Four contacts are permitted. One contact pair is dedicated to the central office tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open *hookswitch* contacts, which are completely isolated from all other components in the telephone. When the telephone is in the *in-use state*, the *hookswitch* will provide a closure between the wire pair used for system control. When the telephone is in the *idle state*, the *hookswitch* maintains an open across that wire pair.
- 3(1).2.3 . **Four-wire Service Without Provision for System Control.** Four contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and the other to the central office receive tip-ring pair.
- 3(1).2.4 . **Four-wire Service With Provision for System Control.** Six contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and one to the central office receive tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open *hookswitch* contacts, which are completely isolated from all other components in the telephone. When the telephone is in the *in-use state*, the *hookswitch* provides a closure between the wire pair used for system control. When the telephone is in the *idle state*, the *hookswitch* maintains an open across that wire pair.
- 3(1).3 If the telephone provides neither four-wire service nor an isolated set of *hookswitch* contacts to terminate a second *station mounting cord* wire pair, only one pair of wires, the tip-ring pair, is permitted to connect to the telephone.
- 3(1).4 Last number redial (LNR) memory is permitted if it does not require external electric power when the telephone is in the *idle state*.
- 3(1).5 LNR memory is permitted if it is supported by a capacitor that charges only when the telephone is *in use* and is provided with a positive means of discharge when it is *idle* so that it is completely discharged in less than 20 minutes.

- 3(1).6 Except as specifically allowed, *idle-state* electrical power, including internal batteries, is not permitted.
- 3(1).7 The only *idle-state-active* components or subassemblies permitted are the *annunciator* and the LNR. The LNR may only remain active for 20 minutes after the *idle state* is established.
- 3(1).8 A line-hold circuit is permitted if it is connected on the line side of the normal-open metallic contacts that terminate the tip-ring pair, and if its operation requires that the *handset* be placed in the *handset mounting*. The line-hold circuit must be completely isolated from all other *idle-state-inactive* components and subassemblies when the *handset* is in the *handset mounting*.
- 3(1).9 Local auxiliary power may be used to support *idle state-inactive* subassemblies if *idle-state-shorting* and *idle-state-disconnect* operations (using metallic-contact devices) are performed on the power leads at their point of entry into the telephone.
- 3(1).10 The *focal subassemblies* designated for type-acceptance are:
- 3(1).10.1 . The *transmitter element*.
 - 3(1).10.2 . The *receiver element*.
 - 3(1).10.3 . All *transducers* and *microphonic* components.
- 3(1).11 The *critical subassemblies* designated for type-acceptance Class X1 are:
- 3(1).11.1 . The *focal subassemblies*.
 - 3(1).11.2 . The *idle-state-active* components and subassemblies.
 - 3(1).11.3 . The *idle-state-disconnect* devices and subassemblies.
 - 3(1).11.4 . The *idle-state-shorting* devices and subassemblies.
 - 3(1).11.5 . The *station mounting cord* jack.
 - 3(1).11.6 . The *transducers* and *microphonic* components.
 - 3(1).11.7 . The *auxiliary* power connections.
 - 3(1).11.8 . The *line-hold* circuit (if included).
- 3(1).12 Test points that permit the electrical verification of all security protective conditions are included. At a minimum, these test points must provide electrical access to the following:
- 3(1).12.1 . Every metallic contact used as a protective measure.
 - 3(1).12.2 . All terminals on the *annunciator transducer* or *ringer* package.

3(1).12.3

· All wires leaving the telephone.

**PART 3
(ANNEX 2)**

**SUPPLEMENTARY DESIGN AND CONSTRUCTION
SPECIFICATIONS TYPE-ACCEPTANCE CLASS X2**

Preliminary Note

This annex to part 3 of TSG Standard 3 describes the specific supplementary requirements for TSG type-acceptance Class X2. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in part 3.

- 3(2).1 No external connections are permitted except to the *station mounting cord* or to local *auxiliary* power sources as specified below.
- 3(2).2 The number of contacts permitted in the *station mounting cord* jack is restricted and depends on the type of service for which the telephone is intended.
- 3(2).2.1 . **Two Wire Service Without Provision for System Control.** Two contacts are permitted. These are dedicated to the central office tip-ring pair.
- 3(2).2.2 . **Two-wire Service With Provision for System Control.** Four contacts are permitted. One contact pair is dedicated to the central office tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the *in-use state*, the *hookswitch* will provide a closure between the wire pair used for system control. When the telephone is in the *idle state*, the *hookswitch* maintains an open across that wire pair.
- 3(2).2.3 . **Four-wire Service Without Provision for System Control.** Four contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and the other to the central office receive tip-ring pair.
- 3(2).2.4 . **Four-wire Service With Provision for System Control.** Six contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and one to the central office receive tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the *in-use state*, the *hookswitch* provides a closure between the wire pair used for system control. When the telephone is in the *idle state*, the *hookswitch* maintains an open across that wire pair.
- 3(2).3 If the telephone provides neither four-wire service nor an isolated set of *hookswitch* contacts to terminate a second *station mounting cord* wire pair, only one pair of wires, the tip-ring pair, is permitted to connect to the telephone.
- 3(2).4 Last number redial (LNR) memory is permitted if it does not require external electric power when the telephone is in the *idle state*.
- 3(2).5 LNR memory is permitted if it is supported by a capacitor that charges only when the telephone is *in use* and is provided with a positive means of discharge when it is *idle* so that it is completely

discharged in less than 20 minutes.

- 3(2).6 LNR and repertory dial are permitted if powered by a replaceable internal battery instead of a capacitor. The battery must be the minimum physical size necessary to provide 12-month service. The battery leads must feed directly to a current-limiting resistor that prevents current in excess of 0.1 ~LA from being drawn from the battery.
- 3(2).7 Except as specifically allowed, *idle-state* electrical power, including internal batteries, is not permitted.
- 3(2).8 The only *idle-state-active* components or subassemblies permitted are the *annunciator*, the LNR, and the repertory dialer.
- 3(2).9 A line-hold circuit is permitted if it is connected on the line side of the normal-open metallic contacts that terminate the tip-ring pair, and if its operation requires that the *handset* be placed in the *handset mounting*. The line-hold circuit must be completely isolated from all other *idle-state-inactive* components and subassemblies when the *handset* is in the *handset mounting*.
- 3(2).10 Local *auxiliary* power may be used to support *idle state-inactive* subassemblies if *idle-state-shorting and -disconnect* operations, using metallic-contact devices, are performed on the power leads at their point of entry into the telephone.
- 3(2).11 There are no *special focal subassemblies* in this type-acceptance class that require individual shorting and *disconnect* operations in addition to those already specified in the main portion of part 3 to this standard.
- 3(2).12 The *receiver element* must be shorted by an acceptable *idle-state-shorting* device or subassembly when the telephone is not in use.
- 3(2).13 The *critical subassemblies* designated for type-acceptance Class X1 are:
- 3(2).13.1 . The *idle-state-active* components and subassemblies.
 - 3(2).13.2 . The *idle-state-disconnect* devices and subassemblies.
 - 3(2).13.3 . The *idle-state-shorting* devices and subassemblies.
 - 3(2).13.4 . The *station mounting cord* jack.
 - 3(2).13.5 . The *transducers* and *microphonic* components.
 - 3(2).13.6 . The *internal battery* connections.
 - 3(2).13.7 . The *auxiliary* power connections.
 - 3(2).13.8 . The *line-hold* circuit (if included).
- 3(2).14 Test points that permit the electrical verification of all security protective conditions are included. At

a minimum, these test points must provide electrical access to the following:

- 3(2).14.1 · Every metallic contact used as a protective measure.
- 3(2).14.2 · All terminals on the *annunciator transducer* or *ringer* package.
- 3(2).14.3 · All wires leaving the telephone.

**PART 3
(ANNEX 3)**

**SUPPLEMENTARY DESIGN AND CONSTRUCTION
SPECIFICATIONS TYPE-ACCEPTANCE CLASS X3**

Preliminary Note

This annex to part 3 of TSG Standard 3 describes the specific supplementary requirements for TSG type-acceptance Class X3. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in part 3.

- 3(3).1 No external connections are permitted except to the *station mounting cord* or to local *auxiliary* power sources as specified below.
- 3(3).2 The number of contacts permitted in the *station mounting cord* jack is restricted and depends on the type of service for which the telephone is intended.
- 3(3).2.1 . **Two-wire Service Without Provision for System Control.** Two contacts are permitted. These are dedicated to the central office tip-ring pair.
- 3(3).2.2 . **Two-wire Service With Provision for System Control.** Four contacts are permitted. One contact pair is dedicated to the central office tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open *hookswitch* contacts, which are completely isolated from all other components in the telephone. When the telephone is in the *in-use state*, the *hookswitch* will provide a closure between the wire pair used for system control. When the telephone is in the *idle state*, the *hookswitch* maintains an open across that wire pair.
- 3(3).2.3 . **Four-wire Service Without Provision for System Control.** Four contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and the other to the central office receive tip-ring pair.
- 3(3).2.4 . **Four-wire Service With Provision for System Control.** Six contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and one to the central office receive tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open *hookswitch* contacts, which are completely isolated from all other components in the telephone. When the telephone is in the *in-use state*, the *hookswitch* provides a closure between the wire pair used for system control. When the telephone is in the *idle state*, the *hookswitch* maintains an open across that wire pair. 3(3).3 If the telephone provides neither four-wire service nor an isolated set of *hookswitch* contacts to terminate a second *station mounting cord* wire pair, only one pair of wires, the tip-ring pair, is permitted to connect to the telephone.
- 3(3).4 Last number redial (LNR), repertory dial, and other *idle-state-active* components and subassemblies are permitted if they do not contain *transducers* or audio circuits.
- 3(3).5 Power for *idle-state-active* components and subassemblies may be provided from a capacitor that charges only when the telephone is *in use* and is provided with a positive means of discharge when it is *idle* so that it is completely discharged in less than 20 minutes.

- 3(3).6 Power for *idle-state-active* components and subassemblies may be provided from a replaceable internal battery instead of a capacitor. The battery must be the minimum physical size necessary to provide 12-month service. The battery leads must feed directly to a current-limiting resistor that prevents current in excess of 1uA from being drawn from the battery.
- 3(3).7 Local *auxiliary* power may be used to support idle-state-inactive subassemblies if *idle-state-shorting* and *-disconnect* operations (using metallic-contact devices) are performed on the power leads at their point of entry into the telephone.
- 3(3).8 Power for *idle-state-active* and *idle-state-inactive* components and subassemblies may be provided from an external auxiliary DC source (AC power must be converted to DC externally to the telephone). The DC source must be externally current-limited to 1 IIA or less when the telephone is in the *idle state*. The telephone must filter the power at the point of entry to attenuate by not less than 60 dB all frequencies above 100 Hz. The point of entry for this DC power must be separated from the point of entry for the *station mounting cord*.
- 3(3).9 A line-hold circuit is permitted if it is connected on the line side of the normal-open metallic contacts that terminate the tip-ring pair, and if its operation requires that the *handset* be placed in the *handset mounting*. The line-hold circuit must be completely isolated from all other *idle- state-inactive* components and subassemblies when the *handset is* in the *handset mounting*.
- 3(3).10 There are no *special focal subassemblies* in this type-acceptance class that require individual shorting and *disconnect* operations in addition to those already specified in the main portion of part 3 to this standard.
- 3(3).11 The *receiver element* must be shorted by an acceptable *idle-state-* shorting device or subassembly when the telephone is not *in use*.
- 3(3).12 The *critical subassemblies* designated for type-acceptance Class X3 are:
- 3(3).12.1 · The *idle-state-active* components and subassemblies.
 - 3(3).12.2 · The *idle-state-disconnect* devices and subassemblies.
 - 3(3).12.3 · The *idle-state-shorting* devices and subassemblies.
 - 3(3).12.4 · The *station mounting cord* jack.
 - 3(3).12.5 · The *transducers* and *microphonic* components.
 - 3(3).12.6 · The internal battery connections.
 - 3(3).12.7 · The *auxiliary* power connections.
 - 3(3).12.8 · The *line-hold* circuit (if included).

GLOSSARY

Preliminary Note

The definitions in this glossary are for use with the TSG standards only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using the TSG standards, that these terms not be given any more or any less meaning than is specified here.

ANNUNCIATOR

A device for producing an *audible signal* to announce an incoming call.

AUDIBLE SIGNAL

A sound that is specifically emitted by the telephone to be audible anywhere in its immediate vicinity.

AUXILIARY UNIT

A device connected to the telephone by means other than the *station mounting cord* or the handset cord.

BUILT-IN MICROPHONE

A microphone located in the body of the telephone rather than in the *handset*.

CONVENTIONAL CENTRAL OFFICE INTERFACE

The interconnection standard that is used by telephones (or other terminal equipment) designed and constructed in compliance with *Part 68, FCC Rules and Regulations*, for connection to the North American public switched telephone network.

CORD

A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors: used to provide the electrical connections between two separate, distinct units or component parts.

CRITICAL SUBASSEMBLY

Any subassembly that is not a *focal subassembly* but which contains components essential to the operation of positive security functions.

CTS (COMPUTERIZED TELEPHONE SYSTEM)

A generic term used to describe any telephone system that uses centralized stored program computer technology to provide switched telephone networking features and services. CTSs are referred to commercially by such terms as computerized private branch exchange (CPBX), private branch exchange (PBX), private automatic branch exchange (PABX), electronic private automatic branch exchange (EPABX), computerized branch exchange (CBX), computerized key telephone systems (CKTS), hybrid key systems, business communications systems, and office communications systems.

DISCONNECT

A device that [1] inserts a break at some point in the normal hard-wire conduction path that exists between a *telephone* and its *telecommunications medium*, and [2] only when the telephone is in the *in-use state*, establishes a temporary metallic connection across that break.

FOCAL SUBASSEMBLY

Any subassembly that contains *transducers* or other potentially *microphonic* components.

HANDS-FREE ANSWERING

A feature available on some telephones and telephone systems that, when certain types of incoming calls occur, either automatically places the telephone in the *in-use state* or allows the user, without any *manual action*, to initiate the *in-use state* by means of a voice-activated switch.

HANDSET

A combined telephone earpiece (containing a *receiver element*) and mouthpiece (containing a *transmitter element*) mounted on a handle.

HANDSET CORD

A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors: used to provide the electrical connections between the *handset* and the main body of the telephone.

HANDSET MOUNTING

The receptacle, bracket, cradle, or other support specifically provided on the main body of the telephone to hold the *handset* when it is not *in use*; the *handset mounting* is fitted with a means to detect whether or not the *handset* is in place in (or on) the *handset mounting*.

HEADSET

A combined telephone earpiece (containing a *receiver element*) and mouthpiece (containing a *transmitter element*) assembly to be worn on the user's head.

HOKSWITCH

The device employed to determine if the *handset* is or is not in place in (or on) the *handset mounting* is termed the *hookswitch* regardless of how it operates. In some cases the *hookswitch* will not involve any sort of mechanical switch and/or break any incoming current loop.

HOUSE CABLING

The wiring and associated frames that provide the electrical connections between the computer-controlled telephone system and the individual blocks or jacks for each telephone's *station mounting cord*.

IDLE STATE (VOICE TERMINAL)

A *voice terminal* is in the *idle state* whenever it is not in the *in-use state* (see below).

IN-USE STATE (VOICE TERMINAL)

A *voice terminal* is in the *in-use state* if it is communicating to its network system that a user is either initiating or actively engaged in communications via a temporary switched connection set up by that *network system*.

ISOLATOR (ISOLATION)

A device that [1] inserts a break at some point in the normal hard-wire conduction path that exists between a *telephone* and its *telecommunications medium*, and [2] only when the telephone is in the *in-use state*, provides a temporary communications channel across that break without establishing an end-to-end metallic connection.

KEY TELEPHONE SYSTEM

A system of telephones and connections to the *public switched telephone network (PSTN)* or to a *private branch exchange (PBX)* that provides the telephones with selective access to the *PSTN* or *PBX* connections by means of pick-up keys located at or near the telephone's.

MANUAL ACTION

An action that requires that the user touch, move, lift, or otherwise manipulate by hand, some control or pan of the telephone. An operation that is actuated by the user's voice does not qualify as a *manual action*.

MICROPHONE

Any component among whose intended functions include performing as a *transducer* to produce an electrical analogue output from an audio-frequency sound pressure waveform input.

MICROPHONIC

Any component, regardless of its intended functions, that exhibits *transducer* behavior to produce an electrical analogue output from an audio-frequency sound pressure waveform input is termed *microphonic*.

NETWORK SYSTEM

An assembly of member terminals, control facilities, and intercommunication facilities that can establish and maintain a communications link between any two of the member terminals.

OFF-HOOK (TELEPHONE)

A telephone in the *in-use state*.

ON-HOOK (TELEPHONE)

A telephone in the *idle state*.

ON-HOOK TELEPHONE AUDIO SECURITY

The use of positive measures to protect *on-hook telephones* against passing room audio is known as *on-hook telephone audio security*.

PRESSURE RESPONSE LEVEL

The *pressure response level* of a *microphone* is the ratio of voltage output to sound pressure level input.

PUSH-TO-OPERATE HANDSET

There are three forms of *push-to-operate handsets*.

[1] A *telephone handset* equipped with separate push-to-activate momentary contact switches, one for the *transmitter element* and one for the *receiver element*. Either switch when not activated shorts the leads to its respective transducer and completely disconnects- the transducer from the *station mounting cord* wires.

[2] A *telephone handset* equipped with a single push-to-activate momentary contact switch. When the switch is not activated, the leads for both the *transmitter element* and the *receiver element* are shorted and are disconnected from the *station mounting cord* wires.

[3] A *telephone handset* equipped with both a single push-to-activate momentary contact switch and with an isolation amplifier that allows audio signals to travel from the *station mounting cord* to the *receiver element* but not from the *receiver element* to the *station mounting cord*. When the switch is not activated, the leads for the *transmitter element* are shorted together and are disconnected from the *station mounting cord* wires.

RECEIVER ELEMENT

The *speaker* located in the *handset* or *headset* earpiece. This *transducer* converts audio-frequency electrical signals to acoustic signals that are audible when the earpiece is held against the user's ear.

RINGER

An *annunciator* that cannot be used for voice calls, announcements, or paging. A *ringer* can only produce

specific *audible signals*.

SPEAKER

Any component among whose intended functions include performing as a *transducer* to produce a sound pressure analogue output from an input audio-frequency electrical waveform.

SPEAKER-MICROPHONE

Any component whose intended functions include performing both as a *microphone* and as a *speaker*.

SPEAKERPHONE

A feature that permits a telephone to be used without lifting the *handset*. A *speakerphone* may be physically incorporated into the telephone set or it may consist of one or more auxiliary units. A usable *speakerphone* contains a *microphone* or, *microphone-amplifier* combination, which is sensitive enough to pick up normal conversational speech levels at a distance of several feet and a *speaker*, or *speaker-amplifier* combination, which will transduce normal telephone signal levels to sound pressure levels that can be heard at a distance of several feet.

STATION MOUNTING CORD

A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors: used to provide the electrical connections between the main body of the telephone and the blocks or jacks that terminate the *house cabling*.

TELECOMMUNICATIONS MEDIUM

A means of transporting electrical information from one communications terminal to another.

TELEPHONE

A *voice terminal* that, regardless of whatever other functions it performs, is a member terminal of a *telephone network* and accomplishes all the incoming and outgoing signaling and voice interfacing necessary for operation in that network.

TELEPHONE NETWORK

A *network system* that, regardless of whatever other functions it performs, provides temporary speech communications links between member *voice terminals*. The essential characteristics of a *telephone network* are [1] that it recognize when a member terminal is initiating a call (goes *off-hook*), [2] that it identify the terminal being called (number dialed), [3] that it annunciate the incoming call (rings the called terminal), and [4] that it maintain a voice grade communications channel between the calling and called terminals only for the duration of the call.

TRANSDUCER

A component of the telephone that either converts electrical signals to acoustic signals or acoustic signals to electrical signals: includes *microphones*, *ringers*, *speakers*, and *speaker-microphones*.

TRANSMITTER ELEMENT

The *microphone* located in the *handset* or *headset* mouthpiece. This *transducer* converts acoustic signals spoken directly into the mouthpiece to analogue audio-frequency electrical signals for transmission to the main body of the telephone.

TSG-APPROVED TELEPHONE

TSG-approved status is awarded to telephones that have been technically evaluated by the government's Telephone Security Group and determined to meet all applicable *on-hook telephone audio security* criteria. A *TSG-approved telephone* provides all necessary security features as intrinsic properties of the telephone itself.

TYPE-ACCEPTED TELEPHONE

A *TSG-approved telephone* model that the TSG has evaluated in response to a formal application by its manufacturer, and has been approved and awarded a TSG type-acceptance number. The TSG telephone type-acceptance program is the primary vehicle for evaluating commercial telephones for TSG approval. TSG has issued type-acceptance standards that specify the *on-hook security* design, construction, and performance characteristics required for various genres of telephones and type-acceptance classes.

VOICE TERMINAL

A generic term used to describe any device that, regardless of whatever other functions it performs, provides an intentional transmit and/or receive interface between a human talker/listener and an electric or electronic communications system. All *voice terminals* contain *transducers*; a *microphone* is necessary if there is a transmit function and a *speaker* if there is a receive function. Telephones, *speakerphones*, and intercom sets are common examples of *voice terminals*.