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USACE / NAVFAC / AFCEA UFGS-16720N (February 2002)  
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Preparing Activity: NAVFAC Superseding  
UFGS-16720N (September 1999)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated 22 December 2004

Revised throughout - changes not indicated by CHG tags

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#### SECTION 16720N

#### ADMINISTRATIVE TELEPHONE EQUIPMENT, INSIDE PLANT

02/02

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### SECTION 16720N

#### ADMINISTRATIVE TELEPHONE EQUIPMENT, INSIDE PLANT 02/02

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NOTE: This guide specification covers the requirements for administrative telephone equipment for inside plant systems.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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NOTE: This guide specification does not include interior cabling and raceway systems which are covered in Section 16710 STRUCTURED TELECOMMUNICATION CABLES AND PATHWAYS. This guide specification is to be used in the preparation of project specifications.

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NOTE: This section will be used in conjunction with Section 16710 STRUCTURED TELECOMMUNICATION CABLES AND PATHWAYS, Section 16721N TELEPHONE DISTRIBUTION SYSTEM, OUTSIDE PLANT; Section 16402 INTERIOR DISTRIBUTION SYSTEM; any other sections required by the design.

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: Issue (date) of references included in  
project specifications need not be more current than  
provided by the latest guide specification. Use of  
SpecsIntact automated reference checking is  
recommended for projects based on older guide  
specifications.  
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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

#### U.S. DEFENSE INFORMATION SYSTEMS AGENCY (DISA)

DCA DCAC 370-V175-6 Basic System Interface Criteria

#### U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 345-165 (1996) Digital Stored Program Controlled  
Central Office Equipment (Form 522)

#### U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68 Connection of Terminal Equipment to the  
Telephone Network (47 CFR 68)

### 1.2 RELATED REQUIREMENTS

Section 16050N BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

### 1.3 DEFINITION

- a. Year 2000 compliant - means computer controlled facility components that accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations.

### 1.4 SYSTEM DESCRIPTION

Telephone distribution system shall consist of voice switching equipment, inside plant cables, voice instruments, power equipment and batteries, telephone management system, and other auxiliary equipment. System shall be [directly connected] [connected via base dial central office (DCO)] to public switched network in accordance with the rules set forth by FCC Part 68, and other appropriate authorities such as Public Utilities Commission and local telephone company.

#### 1.4.1 Performance Requirements

##### 1.4.1.1 Reliability

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NOTE: Reliability and maintainability are relative terms, and the attainable level will, therefore, depend upon the type, configuration, and degree of redundancy. System availability is a function of reliability and maintainability and is defined as the long-term average fraction of time that a system is satisfactory in service. System availability should be as high as economically feasible and may be calculated as follows:

MTBF

A = -----

MTBF + MTTR

Where: A = Availability

MTBF = Mean-Time-Between-Failure

MTTR = Mean-Time-To-Repair

Designer should give serious thought and consideration in specifying MTBF and MTTR. Additional information are as follows:

Nonrelevant failures: a. Installation damage; b. Accident or mishandling; c. Failures of external test facility or tests; d. Equipment failures caused by an externally applied overstress condition in excess of approved operational test requirements; e. Normal operating adjustments, nonfailures, as prescribed in the approved equipment operating instructions.

Relevant failures which requires maintenance:

a. Three accumulated failures in the common and redundant equipment that do not inhibit full operation; b. Accumulated failures in equipment other than the common and redundant equipment, equal to one per thousand of the equipped lines and one per hundred of the equipped trunk and T1 span equipment quantities that do not cause a complete switch outage; c. Each software malfunction, including inability to perform any one or more of the system monitoring and maintenance diagnostics functions or functional requirements; d. A complete switch failure, no calls being processed; e. Inability to maintain busy hour traffic; f. Simultaneous loss of operations of all maintenance consoles or all attendant consoles, or all printers or all test/diagnostic equipment.

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Electronic Private Automatic Branch Exchange (EPABX) shall have a minimum acceptable system Mean-Time-Between-Failure (MTBF) of [4000] [\_\_\_\_\_] hours.

A failure is defined as the complete loss of the capability of the switch to handle or process calls.

#### 1.4.1.2 Maintainability

EPABX shall have maximum acceptable system Mean-Time-To-Repair (MTTR) of [\_\_\_\_\_] minutes. Repair time is defined as the clock time from the occurrence of the failure to the time when the switch is restored to service either by repair or substitution of the failed component.

#### 1.5 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telephone system installation drawings

SD-03 Product Data

Digital switching system

Cables

Standby battery

Connector blocks

Terminal blocks

Instruments

Features

#### SD-06 Test Reports

Test procedures and reports

Test plans; G

#### SD-07 Certificates

Installer's qualifications; G

Instructor's qualifications; G

Year 2000 (Y2K) Compliance Warranty

#### SD-08 Manufacturer's Instructions

Installation procedures; G

#### SD-10 Operation and Maintenance Data

Telephone distribution system, Data Package 5

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

### 1.6 QUALITY ASSURANCE

#### 1.6.1 Evidence of Experience and Qualifications

##### 1.6.1.1 Installer's Qualifications

Show that the installer who will perform the work has a minimum of [2] [\_\_\_\_\_] years experience successfully installing telephone distribution system of the same type and design as specified herein. Include the names, locations, and point of contact of at least two installations of the same type and design as specified herein where the installer has installed such systems. Indicate type of each system and certify that system has performed satisfactorily in the manner intended for a period of not less than [12] [\_\_\_\_\_] months. Submit data of installer's experience and qualifications.

##### 1.6.1.2 Instructor's Qualifications

Show that the instructor, who will train operation and maintenance



personnel, has a minimum of 24 hours training from a recognized technical organization, and 2 years experience in installation of telephone distribution system of the type specified. Submit data of the instructor's experience and qualifications.

#### 1.6.2 Telephone System Installation Drawings

Submit shop drawing complete with wiring and schematic diagrams, and other details required to demonstrate that system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, equipment relationship to other parts of the work including clearances for operations and maintenance, and terminal assignment of inside wiring.

#### 1.6.3 Test Plans

Submit for approval at least 30 days prior to commencement of formal operational testing a test plans specified in paragraph entitled "Field Quality Control."

#### 1.6.4 Installation Procedures

Where installation procedures, or any part thereof, are required to be in accordance with manufacturer's instructions, submit these instructions to the Contracting Officer prior to installation of the equipment.

#### 1.7 DELIVERY AND STORAGE

Provide protection from weather, humidity and temperature variations, dirt, dust, and other contaminants for equipment placed in storage.

#### 1.8 SITE CONDITIONS

##### 1.8.1 Environmental Requirements

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**NOTE: Designer should consult telephone switching  
equipment manufacturer to verify environmental  
requirements.**  
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Install equipment indoors in a protected environment. Electronic equipment designed for office environment shall be rated for continuous operation under ambient environmental conditions of 10 degrees C to 30 degrees C 50 degrees F to 85 degrees F and 35 to 65 percent relative humidity, noncondensing.

#### 1.9 WARRANTY

##### 1.9.1 Year 2000 (Y2K) Compliance Warranty

For each product, component and system specified in this section as a "computer controlled facility component" provide a statement of Y2K compliance warranty for the specific equipment. The contractor warrants that each hardware, software, and firmware product delivered under this contract and listed below shall be able to accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations to the

extent that other computer controlled components, used in combination with the computer controlled component being acquired, properly exchange data and time data with it. If the contract requires that specific listed products must perform as a system in accordance with the foregoing warranty, then that warranty shall apply to those listed products as a system. The duration of this warranty and the remedies available to the Government for breach of this warranty shall be defined in, and subject to, the terms and limitations of the contractor's standard commercial warranty or warranties contained in this contract, provided that, notwithstanding any provisions to the contrary, in such commercial warranty or warranties, the remedies available to the Government under this warranty shall include repair or replacement of any listed product whose non-compliance is discovered and made known to the contractor in writing within one year (365 days) after acceptance. Nothing in this warranty shall be construed to limit any rights or remedies the Government may otherwise have under this contract, with respect to defects other than Year 2000 performance.

## PART 2 PRODUCTS

### 2.1 Y2K COMPLIANT PRODUCTS

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NOTE: To ensure that buildings' systems continue to function beyond Year 2000, the following paragraph must be included when this section is part of a construction contract. For more information on Y2K, see these web sites on the Internet.

<http://www.doncio.navy.mil/y2k/year2000.htm>, the Year 2000 homepage of the Department of the Navy Chief Information Officer (DONCIO);  
<http://www.itpolicy.gsa.gov/mks/yr2000.legal.htm>, the General Services Administration (GSA) Chief Information Officer (CIO) homepage for Y2K procurement, contracting, and legal issues;  
<http://y2k.lmi.org/gsa/y2kproducts> contains information on vendor product compliance.

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Provide computer controlled facility components, specified in this section, that are Year 2000 compliant (Y2K). Computer controlled facility components refers to software driven technology and embedded microchip technology. This includes, but is not limited to, telecommunications switches, alarms, and other facilities control systems utilizing microcomputer, minicomputer, or programmable logic controllers.

### 2.2 MATERIALS AND EQUIPMENT

Material and equipment shall be the standard products of a manufacturer regularly engaged in manufacture of the products and shall be the manufacturer's latest standard design.

### 2.3 DIGITAL SWITCHING SYSTEM

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NOTE: Designer should omit equipment not required as part of the project. If required, remote switching equipment should be included in the specification if applicable. Remote units will be transparent to its users; such as, it will provide

the same features and functions as the central unit as well as, have the same wiring and capacity requirements. Remote units will be connected to the central unit via direct interface using a 1.544 Mb/s T1 span line. The requirements defined for the central unit will also apply to the remote units. Software requirements or features will be structured in accordance with each particular system being designed. Delete any features not required for any particular system.

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Provide equipment consisting of stored program, processor controlled Electronic Private Automatic Branch Exchange (EPABX) Telephone Switching System utilizing pulse code modulation (PCM) architecture.

#### 2.3.1 Switching Network

Switch shall be a stored program, processor controlled PCM system utilizing solid state construction. Switching network shall be of modular type construction to allow additions to the network or system without interruptions or downtime to the system.

#### 2.3.2 Processor[s]

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NOTE: Designer should decide on the number of processors required based on USER's requirement. Where extremely reliable communications are required with little downtime, dual processor is recommended.

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Switching network and other associated functions of the system shall be under the control of [dual] [a single] central processor[s] utilizing stored program control. Stored system control program shall automatically reprogram and restart the system in the event of power failure. Programs which control functions of the user system shall utilize language which is oriented toward a person-machine interface.

##### 2.3.2.1 Control Programs

Control programs such as trunk routing, digit sending and receiving, and assigning trunk quantities shall be locally or field programmable by means of an interface with a terminal. Programs shall be flexible to the extent that line assignment and class of service type changes can be made in the field by way of this terminal interface.

##### 2.3.2.2 Maintenance Diagnostic Program

Provide system with maintenance diagnostic program for complete system tests. Program shall be in continuous operation and structured so that any fault that is detected is immediately printed out on a maintenance terminal or indicated on a cathode ray tube (CRT). Diagnostic tests that contain no-fault conditions shall be printed out during specified times of day or upon demand. Program shall be integrated into the processor control system so that when faults are registered an automatic transfer of equipment will take place within the system to remedy a fault condition. Automatic transfer of equipment to remedy a fault condition is required only for equipment that would affect a common control portion of the switching

system. Diagnostic and maintenance program shall be accessible by way of field located maintenance terminal.

### 2.3.3 Transmission Requirements

Transmission requirements are expressed in terms of analog measurements.

#### 2.3.3.1 Input Impedance

Nominal input impedance of subscriber circuits and analog trunks of the EPABX shall be 600 ohms. When connecting facility or equipment is other than 600 ohms, Contractor shall provide required impedance matching devices for proper operations.

#### 2.3.3.2 Insertion Loss

Insertion loss: Between 0 dB and 2.0 dB for 2-wire to 4-wire, and 4-wire to 4-wire trunk connections. Between 0 dB and 2.0 dB for trunk-to-line connections, and 0 dB to 6.0 dB for line-to-line terminations or connections.

#### 2.3.3.3 Stability

Components shall have long term loss variation of specified transmission levels of not more than plus or minus 0.5 dB. Long term stability requirement is defined as more than 10 years.

#### 2.3.3.4 Frequency Response

Frequency response loss reading relative to 1004 Hz signal shall not exceed the following:

<u>Frequency</u>	<u>Trunk-to-Trunk</u>	<u>Trunk-to-Line</u>	<u>Line-to-Line</u>
200 Hz	2.0 dB	2.0 dB	2.5 dB
300 Hz - 3 kHz	1.3 dB	1.3 dB	1.5 dB
3.4 kHz	0.5 dB	0.8 dB	0.8 dB

#### 2.3.3.5 Return Loss

Return loss measured at 600 ohms shall not exceed the following:

	<u>Trunk-to-Line</u>	<u>Line-to-Line</u>
Echo Return Loss (ERL)	20 dB	24 dB
Singing Return Loss (SRL)	14 dB	16 dB

#### 2.3.3.6 Longitudinal Balance

For frequencies of 180, 540, 1000, and 2000 Hz, minimum balance shall be 60 dB; at 3400 Hz minimum shall be 50 dB.

#### 2.3.3.7 Steady Noise

Idle channel noise with C-Message weighing at 600 ohms impedance measured on terminated call shall be as follows:

Maximum	23 dBrncO
Average	18 dBrncO or less

#### 2.3.3.8 Impulse Noise

Switching system shall meet an impulse noise limit of not more than five counts exceeding 54 dBncO voice weighed in a 5-minute period on six measurements made during busy hour. Measurement shall be made by establishing connection from impulse counter through the switch into a quite 600-ohm termination.

#### 2.3.3.9 Crosstalk Coupling

In the range of 200 to 3400 Hz the worst case equal level crosstalk level shall not exceed 75 dB below the reference signal.

#### 2.3.3.10 Absolute Delay

Absolute one-way delay through the switching system at 1800 Hz shall not exceed 1000 microseconds.

#### 2.3.3.11 Digital Error Rate

Digital switching system shall produce an error rate into digital connections that shall not exceed 10 to minus 8 bits averaged over a 5-minute period.

### 2.4 HARDWARE REQUIREMENTS

#### 2.4.1 Equipment Mounting Cabinets

Provide modular type cabinets to house the EPABX processor, memory cards, lines, trunks, and miscellaneous items. Height of cabinets shall not exceed 2440 mm 8 feet including cable trays. Equip cabinets with front [and rear] covers which are easily opened or removed.

#### 2.4.2 Cabinet Mounting Shelves

Equip mounting shelves within cabinets with coded card slots to prevent accidental insertion of plug-in cards into improper slots which could result in damage to the system or the plug-in card. Identify each slot to indicate which cards are usable in that particular slot.

#### 2.4.3 Plug-In Cards

Provide identification on each card to indicate specific function. Label each card with model identification and issue number.

#### 2.4.4 Overall Capacity

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NOTE: Designer should insert the appropriate quantities. Determine ultimate required size of system and insert numbers into proper positions. Voice line requirements will be in accordance with Instrument Requirements, keeping separate the number of lines and total number of sets. If ultimate size is understated, system may have to be changed out completely to meet future requirements. Trunk description not used should be deleted.

Designer should identify the type of DCO on military post/base and verify that all trunking will be through that exchange.

Designer should provide interface information, such as local DCO and type, and Autovon switch location.

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Provide system capacity as specified in the following table:

	<u>Equipped</u>	<u>Wired</u>	<u>System Capacity</u>
Voice Lines	[_____]	[_____]	[_____]
Central Office (CO) Trunks	[_____]	[_____]	[_____]
Direct Inward Dial (DID) Trunks	[_____]	[_____]	[_____]
Autovon Trunks	[_____]	[_____]	[_____]
Federal Telephone System (FTS) Trunks	[_____]	[_____]	[_____]
Tie Trunks	[_____]	[_____]	[_____]
[_____]	[_____]	[_____]	[_____]

Provide interconnection of proposed system with existing system when required. The following are definition of each item:

Voice line: System shall provide separate line and number assignment for each of the instruments required.

Equipped: System contains sufficient cards to support the specified lines and trunks in a fully operational basis.

Wired: The only type of equipment required to reach this size is cards on a plug-in basis. System shall contain sufficient processing power, memory, shelf space, card slots, and all other equipment necessary to accommodate this size.

System capacity: System can grow to these sizes by additions in the form of memory, cabinets, and other circuit boards. Excludes systems which require additions of a tandem switch where tie trunks are required.

#### 2.4.5 Traffic

Provide system switching matrix, processors, processor memory, and miscellaneous equipment based upon the following traffic criteria:

##### 2.4.5.1 CCS Quantities

<u>Circuit Type</u>	<u>CCS</u>
Voice Line	8
Attendant Console	34
Trunks	36

##### 2.4.5.2 Traffic Ratio

Determining switch and trunk quantities the following ratios shall be used:

<u>Type of Call</u>	<u>Ratio</u>
Intra-EPABX	35 percent usage

<u>Type of Call</u>	<u>Ratio</u>
Trunk	65 percent usage

#### 2.4.5.3 Grade of Service

Provide trunks, switch quantities, and lines with a P.001 grade of service as indicated on RUS 345-165, Erlang Traffic Table, Lost Calls Cleared.

#### 2.4.6 Numbering Plan

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NOTE: Designer should provide exact numbering plan requirements, if available. Consult the telephone company and other providers of service regarding any current or future plans to change the listed number and/or future numbering plan for Direct Inward Dial from the Direct Distance Dialing and Government networks and for Direct Outward Dial to these networks.

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Provide a flexible numbering plan that will allow for numbers to be changed via terminal interface. Numbering plan for the system shall consist of seven-digit numbers.

##### 2.4.6.1 Dialing Plan

Assign DID stations with seven-digit numbers for public directory lists. Calls within the system shall be accessed by dialing the last three or four digits of the listed station number. Calls to stations outside the system shall be completed by dialing [an access code and then] the published number, such as four digits for base calls, seven digits for off-base local calls, FTS, and Autovon, or ten digits for Direct Distance Dialing (DDD) calls.

##### 2.4.6.2 Translation Functions

System software shall have the capability to prefix at least three digits or delete at least three digits from the originating and terminating trunk.

##### 2.4.6.3 Subscriber Data Base

Contractor shall gather, develop, and load the subscriber data base. Assignment of class of service and associated features and capabilities shall be subject to approval by the Contracting Officer.

#### 2.5 DIRECT DIGITAL INTERFACE

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NOTE: For bulk transmission between two points, use of multiplex or lightwave terminal equipment may be necessary. Some EPABX have inherent capability to transmit and receive multiplexed or optical signals. If an EPABX transmits a multiplexed digital signal to anything other than digital switch which interfaces on a direct digital basis, channel banks will be required. The fiber optic system specified in paragraph entitled "Fiber Optic Transmission and

Multiplex Equipment" is a 45 Mb/s system (672 equivalent voice channels) which may or may not fit a specific application. Other typical fiber optic equipment bit rates are 6 Mb/s, 90 Mb/s, 135 Mb/s, 405 Mb/s, and 560 Mb/s.

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System shall interface directly with tie trunks on T1 carrier without the use of channel banks. System shall be equipped with a synchronous clock for interfacing with other digital switching equipment on a direct digital basis. Clock shall be stable to no more drift than one bit in 10 to the 8th power per day.

## 2.6 CONNECTOR BLOCKS

Connector blocks shall be 66 type equipped with punch down clips.

## 2.7 TERMINAL BLOCKS

Provide wirewrap type for terminating line circuits, trunks, and inside cabling.

## 2.8 POWER SYSTEM

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NOTE: For noncritical systems smaller than 200 lines, power supply should be an integral part of the system power supply and should utilize an isolated circuit. For critical or larger system, power supply should be a separate dc system with a charger. Consult with USER for power reliability requirement, i.e. the need for a redundant charger.

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[EPABX voltage rating: 120 volt plus or minus 10 percent, 60 Hz. Power system shall be contained within the switch cabinets.] Provide a negative 48 Vdc power supply with [\_\_\_\_\_] ampere chargers. Chargers shall be sized to supply the full load requirements of EPABX, ancillary equipment plus [\_\_\_\_\_] amperes. When two chargers are provided each charger shall have the capacity to supply the full load requirement should one charger fail. Transfer of power to one charger shall be automatic and without loss of system functions. Provide distribution power panel. Panel shall be equipped with a low voltage cutoff circuit to disconnect the negative 48Vdc when the voltage falls below minus 44 volts.

## 2.9 STANDBY BATTERY SYSTEM

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NOTE: Type of batteries and characteristics are described in IEEE STD 446. Commonly used type is lead calcium because it does not require periodic equalizing charge if floated between 2.20 and 2.25 volts per cell. Also, presently available is the sealed maintenance-free type which does not require special ventilation due to accumulation of hydrogen gas. However, ventilation of battery room is required by NFPA 70 for safe environment, i.e. concentration of gaseous hydrogen should not exceed 2 percent accumulation per unit volume. Factors



used to determine such condition are the number and type of batteries to be charged; room volume; maximum volume of hydrogen gas emitted during charging; and ventilation rate. In general, approximately 0.000045 cubic meter/hour 0.016 cubic feet per hour of hydrogen gas is produced from each fully charged cell per charging ampere. In a safe environment, explosion-proof wiring, or vapor-proof lighting fixtures is not required per NFPA 70. For large battery room specify eye wash, floor drain and associated maintenance and safety equipment, such as hydrometer, eye goggles, and rubber gloves if wet-cell type batteries is specified. Designer should coordinate these requirements with the mechanical designer.

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Consist of nominal number of [\_\_\_\_\_] [24] battery cells. Battery float voltage: [\_\_\_\_\_] [48] volts. High performance [lead calcium sealed maintenance-free] [lead calcium] type, multicell construction. Discharge rates: [\_\_\_\_\_] amperes minimum for 15 minutes minimum and 8 hours maximum to [\_\_\_\_\_] volt per cell at 25 degrees C 77 degrees F. Float voltage acceptable range shall be [\_\_\_\_\_] [2.2] to [\_\_\_\_\_] [2.3] volts per cell at [\_\_\_\_\_] [1.28] specific gravity. Battery cell shall have safety flame arrestor. Provide inter-cell connectors[, and hydrometer].

#### 2.9.1 Battery Rack

\*\*\*\*\*

NOTE: Designer should check the seismic requirement for location where the battery will be installed. Seismic zone map for the United States is provided in the Uniform Building Code (UBC). For seismic zone areas specify a maximum of two tier for tier racks. Maintaining the batteries is easier when step racks are used. However, more space is required compared to tier racks. Coordinate anchoring with the Structural designer.

\*\*\*\*\*

[Two tier] [step] rack. [Three] [\_\_\_\_\_] frames per rack. Rated for [seismic, zone [2] [\_\_\_\_\_] [non-seismic] location. Length: [\_\_\_\_\_] meters feet.

#### 2.10 TELEPHONE MANAGEMENT SYSTEM (TMS)

\*\*\*\*\*

NOTE: If a comprehensive TMS is not required, the designer should specify a printer only to produce sequential calling data.

\*\*\*\*\*

System shall provide records for later retrieval of the number of the calling line, [access code,] all digits of the called number, date, starting time and duration of all outward calls to the public switched service network, FTS, and Autovon. Capacity to store [\_\_\_\_\_] call record is required. System shall also provide off-line storage. Provide console printer for exclusive use of the TMS.

### 2.10.1 Summary and Detail Reports

The following shall be available from internal report generators:

<u>Station</u>	<u>Department</u>	<u>Division</u>
Single station	Single department	Single division
All station	All department	All division
Selectivity for Date, Trunk Groups and Time of Day	Selectivity for Date, Trunk Groups and Time of Day	Selectivity for Date, Trunk Groups and Time of Day

### 2.10.2 Call Tracing

The TMS shall have specified software requirements that shall allow for the tracing of calls made within the particular EPABX area. All DCO or external call tracing shall be coordinated with responsible personnel at the DCO or local telephone company.

## 2.11 FEATURES

### 2.11.1 System Features

\*\*\*\*\*  
**NOTE: Designer should indicate any special paging requirements such as nurse call.**  
\*\*\*\*\*

EPABX shall include the following as minimum into the basic system:

- a. Alternative routing providing for automatic selection of alternate trunk group if all trunks in the first-choice group are busy.
- b. Common control switching arrangement (CCSA) providing access for private network services.
- c. Class of service treatment providing for [32] [\_\_\_\_] class of service.
- d. Direct inward dialing providing incoming call to directly access a telephone station, bypassing the EPABX operator.
- e. Direct outward dialing providing extension to access trunk groups directly, bypassing the EPABX operator.
- f. Distinctive ringing providing identification of incoming calls as external, intrasystem, or feature by the type of audible signal provided to the station.
- g. Dial pulse (DP)-to-dual tone multifrequency (DTMF) conversion providing system the arrangement to receive dial pulse then convert them to DTMF tones for outpulsing over other trunks.
- h. DTMF-to-DP conversion providing system the arrangement to receive DTMF tones and convert them to dial pulses.
- i. Full availability providing all stations, unless restricted,

availability to all lines, trunks, and features.

- j. Intercept providing routing of unassigned or changed numbers routed to the EPABX operator or recorder.
- k. Paging system providing interface via subscriber circuits. Access to paging system shall be by code dialing.
- l. Least cost routing providing outgoing calls to be automatically routed over the trunk groups that provide the least cost service.
- m. Call conferencing providing attendant the capability to establish up to 6 parties (including trunk circuits) per conference, with up to [\_\_\_\_\_] conferences in progress simultaneously.
- n. "Meet me" conference circuit providing a single-digit access code. Any stations dialing that code at a predetermined time, or upon direction by the attendant, shall be connected in conference.
- o. Station Message Detail Recorder port providing capability for printer interface.

#### 2.11.2 Station Features

System shall include the following as a minimum for station operation:

- a. Call Forwarding-All Calls providing calls to one station to be forwarded to another station.
- b. Call Forwarding-Busy providing calls to a busy station to be routed to an operator or another station.
- c. Call Forwarding-Don't Answer providing calls to a station which are not answered after a programmed ringing interval to be routed to an operator or another station.
- d. Call Hold providing a call in progress to be placed on hold, freeing the station user to initiate a second call or perform a second feature.
- e. Call Pickup-Group providing station users in a station user group to answer any call in that group by dialing a code.
- f. Call Transfer providing a station to transfer a trunk or station to another station, without attendant assistance.
- g. Call Waiting providing a tone to a busy station to let the station know that a call is trying to reach it, permitting the station to place the call in progress on hold, and answer the calling station.
- h. Speed Calling providing the station to call predetermined seven- or ten-digit numbers by dialing two digits.
- i. Executive Override providing station user, upon encountering a busy condition on an internal station, to bridge into the busy connection after transmitting a warning tone.

### 2.11.3 Attendant Console

\*\*\*\*\*  
**NOTE: A 16 button keypad should be specified for  
Autovon precedence operations.**  
\*\*\*\*\*

Console in addition to station-related features and functions, shall have the capability to perform the following functions:

- a. Switched loop operation providing a common-loop circuit for all station and trunk lines in the system to permit the attendant to service any type of call and release from that call and connect to another.
- b. Pushbutton dialing providing a keyset which allows the attendant to complete Autovon precedence calls as well as all types of calls normally associated with the console.
- c. Local call identification providing visual indication of the calling number and class of service of the station originating the call.
- d. Verification providing the console a trunk or line that will allow the attendant, by calling a code or the station number, to verify that the station is busy or in a trouble condition.
- e. Console out-of-service providing the capability of removing the console from operation by a manual pushbutton located on the console or by removing the headset from the plug-in jacks.
- f. Busy override providing the attendant the capability to enter an existing busy station. An override tone shall be provided to the busy station prior to the attendant entering the conversation and the tone shall be repeated every 5 seconds until the attendant leaves the conversation.
- g. Call Hold providing the capability to place any trunk or station on hold while performing other functions.
- h. Call Waiting indicator providing a visual indication of the number of calls waiting to be answered.
- i. Camp-On providing the capability, on an incoming trunk call to the attendant which cannot be extended to a station because it is busy, to place the call in a waiting mode until the busy station goes on-hook. The telephone shall then ring automatically, and upon answering, be connected to the incoming trunk.
- j. Transfer-All-Calls providing the capability to transfer all station and trunk calls to other stations when requested to do so by the station.
- k. Trunk call identification providing a visual indication of the trunk number and trunk type on incoming trunk calls to the console.
- l. Trunk group status indicator providing a visual indication when all trunks in a group are busy.

- m. Two-way splitting providing capability of splitting a connection to talk to either end of connection without the other party hearing.
- n. Answering priority providing capability to manually select the next incoming trunk call, recall or operator call.
- o. Automatic recall providing incoming trunk calls, which have been camped on a busy station or unanswered for a prescribed time period, shall be directed back to the attendant.
- p. Call privacy providing denial to the attendant of the ability to enter an established connection unless specifically called by the user or unless the busy override feature is used.
- q. Simultaneous handset and headset operation.
- r. Console clock providing for a digital clock located on the console panel.

## 2.12 TRAFFIC MEASUREMENT AND MONITORING SUBSYSTEM

System shall be equipped with a traffic measurement and monitoring subsystem to measure, store, manipulate, and print out traffic data for system design and performance analysis.

### 2.12.1 Traffic Measurement and Storage Subsystem

Subsystem shall be controlled by a stored program and perform the traffic measurement and storage function automatically when activated.

### 2.12.2 Traffic Measurement Subsystem

Subsystem shall provide printouts of the measured and stored traffic data at selected intervals of 15, 30, or 60 minutes. Subsystem shall also have the capability to store data and provide an accumulated total for one, 12, or 24 hours.

### 2.12.3 Subsystem

Subsystem when activated, shall provide traffic data on a hard copy printout at the interval requested.

### 2.12.4 Traffic Measurements

Traffic measurement provided by the subsystem shall provide the following data:

- a. Traffic data on trunks collected on a trunk group and individual trunk basis. Trunk data shall include usage, attempts, all trunks busy (ATB), and trunk overflow.
- b. Traffic data lines collected on an individual line and line group basis. Line data shall include usage and attempts.
- c. Dial tone delay measurements measured in dial tone delays that are in excess of one second.
- d. Operator console traffic measured in usage, attempts, and delays

in answer of more than 5 seconds.

#### 2.12.5 Traffic Usage

Traffic usage shall be measured in CCS and other data, such as peg count, overflow, in unit measurements.

#### 2.13 INTERCEPT FACILITIES

Provide EPABX with recorder-announcer to provide intercept facilities and announcements.

##### 2.13.1 Recorder-Announcer

Recorder-announcer shall be of solid state construction and easily installed in cabinets or relay racks. Recorder-announcer shall be equipped with a handset and jacks to facilitate change of announcements and [6] [5] [4] [3] [2] channels. Channels shall be assigned the following functions:

- a. Channel 1: To announce stations that have been disconnected or are no longer in service.
- b. Channel 2: To announce changed station numbers.
- c. Channel 3: To announce improperly called numbers or area codes.
- d. Channel 4, 5, and 6: To announce a Government recorded message.

##### 2.13.2 Recorder-Announcer Messages

Message on the recorder-announcer shall be capable of having at least a 15-second message on each channel. Channels 1, 2, and 3 shall be accessed automatically from the system when a disconnected station, wrong number or invalid number is dialed. Channel 4, 5, and 6 shall be accessed by a directory number or code.

#### 2.14 AUTOVON NETWORK

System shall be able to interface directly with the Autovon Network via dedicated Autovon trunks. System software shall process incoming and outgoing calls via Autovon trunks as specified. Most Autovon interfaces will be a 4-wire precedence network inward dial (PNID) and precedence network outward dial (PNOD), with precedence calls above routine placed with attendant assistance. Certain subscribers shall be class marked to permit direct PNOD. PNID and PNOD to and from Autovon shall employ DTMF with E & M supervisory signalling. Interface impedance shall be 600 ohms plus or minus 10 percent.

##### 2.14.1 Outgoing Direct PNOD Calls

For outgoing direct PNOD calls the trunks shall be scanned first for idle conditions and, when an idle trunk is not found, preemption shall be accomplished in accordance with DCA DCAC 370-V175-6 starting with the lowest precedence trunk available. Preempt tone, in accordance with DCA DCAC 370-V175-6, shall be transmitted to each involved subscriber line automatically by the preempting switch at the time preemption occurs.

#### 2.14.2 Incoming Autovon Calls

Incoming Autovon calls shall attempt completion to the called subscriber. Any busy conditions encountered shall result in return of busy tone to the incoming Autovon trunk.

#### 2.14.3 Incoming Precedence Calls Above Routine

Calls above routine, from the Autovon, shall attempt connection, including preempt, to the called subscriber. When the subscriber or intervening trunks are busy at an equal or higher level of precedence, the calls shall be immediately diverted to the DCA console for assistance. Where a "do not answer" condition is encountered, the precedence call shall be diverted to the DCA for assistance after 30 seconds.

#### 2.15 SYSTEM ALARMS

System shall provide visual indication of high and low voltage alarm and EPABX failure alarms discovered by self-diagnostics. [System shall provide these visual alarms on the EPABX cabinet panels.] [System shall also provide a visual alarm on the attendant console.] [EPABX shall include dry contacts for remote transmission of any system.]

#### 2.16 CABLES

Provide cables in accordance with Section 16710 STRUCTURED TELECOMMUNICATION CABLES AND PATHWAYS, and EIA/TIA standards for cabling configuration requirements.

#### 2.17 STATION JACKS

FCC Part 68, modular eight-wire type.

#### 2.18 STATION LINE CORD

FCC Part 68, modular between station jack and base of instrument, at least 1830 mm 6 feet in length.

#### 2.19 INSTRUMENTS

##### 2.19.1 Single Line

Voice instruments shall be fully modular and equipped with a DTMF dialing pad and a pre-timed feature access button which simulates hook flash.

##### 2.19.2 Electronic

Voice instrument shall be equipped with [\_\_\_\_\_] keys which may be independently programmed as feature or line appearance keys. Instrument shall utilize a maximum of four pairs and shall not require any intermediate hardware between the set and EPABX.

##### 2.19.3 Attendant Console

Each console shall utilize construction technology of the same state-of-art of the EPABX and shall operate up to 305 meters 1000 feet from the EPABX as well as individually or in parallel with adjacent consoles. Provide handset and headset with each attendant console.

#### 2.19.4 Speakerphone

Stand-alone or integrated speakerphones shall provide for on-hook, hands free, two-way conversation for users at least 3050 mm 10 feet away from the instrument.

#### 2.19.5 Instrument Requirements

The following instruments shall be provided:

<u>Quantity</u>	<u>Description</u>
[ ]	Single line - desk
[ ]	Single line - wall
[ ]	Electronic - desk
[ ]	Electronic - wall
[ ]	Attendant Console
[ ]	Wall speakerphone
[ ]	Desk speakerphone

#### 2.20 FIBER OPTIC TRANSMISSION AND MULTIPLEX EQUIPMENT

\*\*\*\*\*  
**NOTE: Delete paragraph and subparagraph if fiber  
optic cable is not used in the project.**  
\*\*\*\*\*

##### 2.20.1 Optic Equipment

Optical span line terminal equipment shall be a T3 rate transmission system with optical span line office terminals equipped to accept up to 28 T1 (1.544 Mb/s) signal lines multiplexing/demultiplexing them for transmission/reception over a pair of optical fibers. Provide transfer switching unit to dual, identical, redundant fibers in the event of damage to the primary optical fibers. Provide a minimum of two optical transmitting and two optical receiving units. Provide an alarm display for indication of malfunctions or failures. Provide automatic transfer to the redundant transceiver in the event of primary transmitter or receiver malfunction. Provide dual, identical, redundant optical transmitters and receivers at each end of each span.

##### 2.20.1.1 Transmitter and Receiver

Provide transmitter and receiver in accordance with Section 16710 STRUCTURED TELECOMMUNICATION CABLES AND PATHWAYS.

##### 2.20.2 Multiplex Equipment

Equipment shall provide an interface between DS-1 and DS-3 signals and conform to the following:

<u>Low Speed Interface (DS-1)</u>	
Channel Capacity	(28) DS-1 Signals
Line Rate	1.544 Mb/s plus or minus 0.5 b/s
Line Code	Half-width Bipolar
Line Impedance	110 ohms, plus or minus 5 percent resistive nominal balanced



### High Speed Interface (DS-3)

Channel Capacity	(1) DS-3 Signal
Line Rate	44.736 Mb/s plus or minus 0.33 b/s
Line Code	B3Zs
Line Impedance	75 ohms, plus or minus 5 percent resistive

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install system components and appurtenances in accordance with manufacturer's instructions and NFPA 70. Provide necessary interconnections, services, and adjustments required for a complete and operable telephone distribution system.

### 3.2 INTERIOR WIRING

\*\*\*\*\*  
**NOTE: Secured and classified areas shall meet requirements of NACSIM 5203 for cable distribution and conduit installation.**  
\*\*\*\*\*

Install interior electrical work for telephone distribution system as specified in Section 16402 INTERIOR DISTRIBUTION SYSTEM.

### 3.3 GROUNDING

Provide copper ground bus for equipment ground. Total ground resistance shall be 5 ohms or less.

### 3.4 FIELD QUALITY CONTROL

Furnish test equipment, instrumentation, personnel, and supplies necessary to perform all testing. Contracting Officer shall be given [5] [\_\_\_\_\_] working days notice prior to [each] [\_\_\_\_\_] test[s].

#### 3.4.1 Test Plans

Develop a test plans defining all tests required to ensure that system meets technical, operational, and performance specifications. Plans shall define milestones for each test, equipment, personnel, facilities, and supplies required. Plans shall identify the capabilities and functions to be tested.

#### 3.4.2 Test Procedures and Reports

Develop test procedures from the test plan and design documentation. Procedures shall consist of detailed instructions for the best setup, execution, and evaluation of the tests. Procedures shall consist of visual inspection, basic system operation, trunk call-through, station feature operations, attendant console verification, and maintenance and administrative operations. Visual operations can begin at any period during installation and are used to list all newly installed equipment. Submit reports to the Contracting Officer within [7] [\_\_\_\_\_] working days after completion of each test.

#### 3.4.2.1 Basic System Tests

Tests shall verify that basic types calls can be made and to ensure confidence in system operations. Selected lines shall be verified to receive dial tone, receive ringback tone, talk to the called line, receive ringing, and trip ringing as required.

#### 3.4.2.2 Trunk Call-Through Tests

Verify all trunk groups can be accessed as required, and that trunks interface properly with connecting system.

#### 3.4.2.3 Station Feature Tests

Verify that the equipped station and system features function as required. Tests require the use of several telephones with each being assigned classes of service to verify the appropriate feature.

#### 3.4.2.4 Attendant Feature Tests

Verify that all attendant features function as required. Tests require that several calls be placed to and from attendant console from local stations, to attendant console from incoming trunks, and from attendant console to outgoing trunks.

#### 3.4.2.5 Maintenance and Administrative Tests

Verify that all maintenance and administrative operations can be accomplished as specified.

-- End of Section --