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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY  
TYNDALL AIR FORCE BASE FL 32403-6001

22 DEC 1993

AD-A274 835  


FROM: HQ AFCEA/EN  
139 Barnes Drive, Suite 1  
Tyndall AFB FL 32403-5319

SUBJ: Engineering Technical Letter (ETL) 93-5: Fire  
Protection Engineering Criteria - Electronic  
Equipment Installations

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TO: See Distribution

1. PURPOSE. This ETL provides criteria for protection of electronic equipment from smoke and fire.
2. APPLICATION. This ETL applies to all commands with electronic equipment installations. It applies to new construction. To the extent possible, renovation, modernization and rehabilitation work shall also comply with the requirements of this ETL. It supersedes ETL 89-3. It is effective immediately.
3. SPECIFIC REQUIREMENTS. Atch 3 provides criteria and technical guidance for fire protection of electronic equipment installations.
4. POINT OF CONTACT. Mr Raymond N. Hansen, P.E., HQ AFCEA/DFE, telephone DSN 523-6317, commercial (904) 283-6317, or FAX 523-6499.

  
DENNIS M. FIRMAN, P.E.  
Director, Systems Engineering

- 3 Atch
1. Distribution List
  2. ETL Index
  3. Criteria and Technical Guidance

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**ENGINEERING TECHNICAL LETTERS (ETL)****SECTION A - CURRENT ETLs**

<b>ETL Number</b>	<b>Title</b>	<b>Date Issued</b>
82-2	Energy Efficient Equipment	10 Nov 82
83-1	Design of Control Systems for HVAC Change No. 1 to ETL 83-1, U.S. Air Force Standardized Heating, Ventilating & Air Conditioning (HVAC) Control Systems	16 Feb 83
83-3	Interior Wiring Systems, AFM 88-15 Para 7-3	22 Jul 87
83-4	EMCS Data Transmission Media (DTM) Considerations	2 Mar 83
83-7	Plumbing, AFM 88-8, Chapter 4	3 Apr 83
83-8	Use of Air-to-Air Unitary Heat Pumps	30 Aug 83
83-9	Insulation	15 Sep 83
84-2	Computer Energy Analysis Change 1 Ref: HQ USAF/LEEEU Msg 031600Z MAY 84 1 Jun 84	14 Nov 83
84-7	MCP Energy Conservation Investment Program (ECIP)	27 Mar 84
84-10	Air Force Building Construction and the Use of Termiticides	13 Jun 84
86-2	Energy Management and Control Systems (EMCS)	1 Aug 84
86-4	Paints and Protective Coatings	5 Feb 86
86-5	Fuels Use Criteria for Air Force Construction	12 May 86
86-8	Aqueous Film Forming Foam Waste Discharge Retention and Disposal	22 May 86
86-9	Lodging Facility Design Guide	4 Jun 86
86-10	Antiterrorism Planning and Design Guidance	4 Jun 86
86-14	Solar Applications	13 Jun 86
86-16	Direct Digital Control Heating Ventilation and Air Conditioning Systems	15 Oct 86
87-1	Lead Ban Requirements of Drinking Water	9 Dec 86
87-2	Volatile Organic Compounds	15 Jan 87
87-4	Energy Budget Figures (EBFs) for Facilities in the Military Construction Program	4 Mar 87
87-5	Utility Meters in New and Renovated Facilities	13 Mar 87
87-9	Prewiring	13 Jul 87
88-2	Photovoltaic Applications	21 Oct 87
88-3	Design Standards for Critical Facilities	21 Jan 88
88-4	Reliability & Maintainability (R&M) Design Checklist	15 Jun 88
88-6	Heat Distribution Systems Outside of Buildings	24 Jun 88
88-9	Radon Reduction in New Facility Construction	1 Aug 88

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(1 of 3)

**ENGINEERING TECHNICAL LETTERS (ETL)****SECTION A - CURRENT ETLs**

<b>ETL Number</b>	<b>Title</b>	<b>Date Issued</b>
88-10	Prewired Workstations Guide Specification	29 Dec 88
89-2	Standard Guidelines for Submission of Facility Operating and Maintenance Manuals	23 May 89
89-4	Systems Furniture Guide Specification	6 Jul 89
89-6	Power Conditioning and Continuation Interfacing Equipment (PCCIE) in the Military Construction Program (MCP)	7 Sep 89
89-7	Design of Air Force Courtrooms	29 Sep 89
90-1	Built-Up Roof (BUR) Repair/Replacement Guide Specification	23 Jan 90
90-2	General Policy for Prewired Workstations and Systems Furniture	26 Jan 90
90-3	TEMPEST Protection for Facilities Change 1 Ref: HQ USAF/LEEDE Ltr dated 20 April 90, Same Subject	20 Apr 90
90-4	1990 Energy Prices and Discount Factors for Life-Cycle Cost Analysis	24 May 90
90-5	Fuel and Lube Oil Bulk Storage Capacity for Emergency Generators	26 Jul 90
90-6	Electrical System Grounding, Static Grounding and Lightning Protection	3 Oct 90
90-7	Air Force Interior Design Policy	12 Oct 90
90-8	Guide Specifications for Ethylene Propylene Diene Monomer (EPDM) Roofing	17 Oct 90
90-9	Fire Protection Engineering Criteria for Aircraft Maintenance, Servicing, and Storage Facilities	2 Nov 90
90-10	Commissioning of Heating, Ventilating, and Air Conditioning (HVAC) Systems Guide Specification	17 Oct 90
91-1	Fire Protection Engineering Criteria Testing Halon Fire Suppression Systems	2 Jan 91
91-2	High Altitude Electromagnetic Pulse (HEMP) Hardening in Facilities	4 Mar 91
91-3	Water Supply for Fire Protection	14 Jun 91
91-4	Site Selection Criteria for Fire Protection Training Areas	14 Jun 91
91-5	Fire Protection Engineering Criteria - Emergency Lighting and Marking of Exits	18 Jun 91
91-6	Cathodic Protection	3 Jul 91
91-7	Chlorofluorocarbon (CFC) Limitation in Heating, Ventilating and Air-Conditioning (HVAC) Systems	21 Aug 91
93-1	Construction Signs	11 Mar 93
93-2	Dormitory Criteria for Humid Areas	13 Jul 93
93-3	Inventory, Screening, Prioritization, and Evaluation of Existing Buildings for Seismic Risk	18 Aug 93

**ENGINEERING TECHNICAL LETTERS (ETL)**

**SECTION A - CURRENT ETLs**

ETL Number	Title	Date Issued
93-4	Fire Protection Engineering Criteria - Automatic Sprinkler Systems in Military Family Housing (MPH)	18 Aug 93
93-5	Fire Protection Engineering Criteria - Electronic Equipment Installations	

**SECTION B - OBSOLETE ETLs**

No.	Date	Status
82-1	10 Nov 82	Superseded by ETL 83-10, 86-1, 87-4
82-3	10 Nov 82	Superseded by ETL 83-5, 84-2
82-4	10 Nov 82	Superseded by ETL 84-7
82-5	10 Nov 82	Superseded by ETL 84-1, 86-13, 86-14
82-6	30 Dec 82	Cancelled
82-7	30 Nov 82	Cancelled
83-2	16 Feb 83	Superseded by ETL 84-3
83-5	5 May 83	Superseded by ETL 84-2
83-6	24 May 83	Cancelled
83-10	28 Nov 83	Superseded by ETL 86-1
84-1	18 Jan 84	Superseded by ETL 86-14
84-3	21 Mar 84	Cancelled
84-4	10 Apr 84	Superseded by ETL 86-7, 86-15, 87-5
84-5	7 May 84	Superseded by ETL 84-8, 86-11, 86-18, 88-6
84-6	Not Issued	Cancelled/Not Used
84-8	19 Jun 84	Superseded by ETL 86-11
84-9	5 Jul 84	Superseded by ETL 88-7
88-5	2 Aug 88	Superseded by ETL 91-6
86-1	3 Feb 86	Superseded by ETL 87-7
86-3	21 Feb 86	Superseded by ETL 86-4
86-6	3 Jun 86	Superseded by ETL 86-11, 86-18, 88-6
86-7	3 Jun 86	Superseded by ETL 86-15
86-11	3 Jul 86	Superseded by ETL 88-6
86-12	3 Jul 86	Superseded by ETL 90-2
86-13	18 Aug 86	Superseded by ETL 86-14
86-15	13 Nov 86	Superseded by ETL 87-5
86-17	17 Dec 86	Superseded by ETL 89-6
86-18	18 Dec 86	Superseded by ETL 88-6
87-3	12 Mar 87	Superseded by ETL 87-6, ETL 88-5
87-6	21 Aug 87	Superseded by ETL-88-5
87-7	14 Oct 87	Superseded by ETL 89-1
87-8	19 Oct 87	Superseded by ETL 90-1
88-1	5 Jan 88	Superseded by ETL 89-2
88-7	24 Aug 88	Superseded by ETL 90-3, ETL 91-2
88-8	4 Oct 88	Superseded by ETL 91-7
89-1	6 Feb 89	Superseded by ETL 90-4
89-3	9 Jun 89	Superseded by ETL 93-5
89-5		Issued as ETL 90-7
91-8	24 Sep 91	Cancelled

**CRITERIA AND TECHNICAL GUIDANCE**  
**FOR**  
**FIRE PROTECTION OF**  
**ELECTRONIC EQUIPMENT INSTALLATIONS**

**1.0 INTRODUCTION.**

1.1 Electronic equipment requires protection from smoke and fire. Threats to this electronic equipment may originate from both inside and outside the electronic equipment space. The most significant fire and smoke threat originates outside the electronic equipment space and not within the electronic equipment space itself.

1.2 The Secretary of the Air Force has provided guidance on the use of halogenated fire extinguishing agents (halon systems) for the protection of the earth's atmospheric ozone. These requirements call for the reduction and eventual elimination of the agents. Previously, they were widely used in the Air Force for protection of electronic equipment. This ETL provides effective fire protection methods without the use of halogenated agents.

**2.0 REFERENCED PUBLICATIONS.**

2.1 MIL-HDBK-1008, Fire Protection for Facilities Engineering, Design and Construction<sup>1</sup>.

2.2 Secretary of the Air Force Memorandum, "Air Force Ban on Purchases of Ozone Depleting Chemicals," dated 7 Jan 93.

2.3 National Fire Protection Association (NFPA) Standard 13, Installation of Sprinkler Systems<sup>1</sup>.

2.4 NFPA Standard 70, National Electrical Code<sup>1</sup>.

2.5 NFPA Standard 72, Protective Signaling Systems<sup>1</sup>.

2.6 NFPA Standard 75, Electronic Computer Systems<sup>1</sup>.

2.7 NFPA Standard 90A, Air Conditioning and Ventilation Systems<sup>1</sup>.

2.8 Department of Defense Instruction (DODI) 6055.6, Department of Defense Fire Protection Plan.

<sup>1</sup> - The latest edition shall be used.

### 3.0 CRITERIA/TECHNICAL GUIDANCE.

#### 3.1 Definitions.

3.1.1 *Mission Essential Equipment.* Electronic equipment which has a direct impact on combat mission capability, including equipment integral to combat mission assets or used in direct control of these assets. (Note: Mission essential equipment is usually located in an automatic data processing area, communications center or other designated electronic equipment space. Most has duplicate, on-line, electronic back-up capabilities.) Examples of mission essential equipment include:

3.1.1.1 Command, control and communication systems which order the launch and recovery of tactical or strategic assets and intelligence systems essential to the defense of the United States and its allies. These are the bulk of mission essential assets.

3.1.1.2 Other command, control, communication and intelligence equipment necessary for implementation of wartime operational plans (OPLANS).

3.1.1.3 Direct flight/mission control systems.

3.1.2 *Mission Support Equipment.* Electronic equipment important to an individual unit or to base operations but which does not have a direct and immediate impact on combat mission capability. (Note: Mission support equipment is usually located in a computer room or other designated electronic equipment space. It typically requires plans to establish back-up computing/operational capabilities in 24 to 48 hours.) Examples of mission support equipment include:

3.1.2.1 Most base computers and training devices.

3.1.2.2 Most special/unique assets such as supercomputers.

3.1.3 *Incidental equipment.* Other electronic equipment including (but not limited to): word processing stations, printers, and systems; typewriters; desk top computers (micro computers); office automation systems; individual data output stations (printers, etc); individual computer work stations; telephones; video conferencing centers; administrative telephone switching systems; and reproduction equipment. (Note: Electronic equipment located outside of a computer room or other designated electronic equipment space is usually incidental equipment.)

### **3.2 Prohibited Fire Suppression Systems.**

**3.2.1 Halogenated agent fire suppression systems shall not be installed in electronic equipment spaces.**

**3.2.2 Carbon dioxide (CO<sub>2</sub>) fire suppression systems shall not be installed in electronic equipment spaces.**

**3.2.3 Other gaseous, non-halogenated agent fire suppression systems shall not be installed in electronic equipment spaces.**

*NOTE* - While many new chemicals are proposed as substitutes for halogenated agents, no chemical has yet met AF requirements for protection of electronic equipment. Only limited test and operational data is available for these new chemicals. Additionally, the proprietary chemical formulations and hardware raise concern in the areas of agent availability and system maintainability. HQ AFCESA/DFE will continue to monitor developments for possible future use of gaseous, non-halogenated fire suppression agents.

**3.3 Protection for Incidental Equipment.** Normal protection for a nonelectronic equipment facility shall be provided. No special or additional protection is required for the incidental equipment.

**3.4 Protection for Mission Support Equipment.** Normal protection for a non-electronic equipment facility shall be provided. Additional protection shall be provided for the mission support equipment as follows:

*NOTE* - Mission support equipment having a replacement value greater than two million dollars may be protected using the criteria for either "mission essential" or "mission support" equipment at the discretion of the MAJCOM fire protection engineering office.

**3.4.1 Electronic equipment spaces and associated raised floor spaces shall be provided with a standard or ultrasensitive smoke detection system per NFPA 72. (See Sections 3.7 and 3.8.)**

*NOTE* - Ultrasensitive smoke detection should be provided when the electronic equipment presents an unusual/high risk of internal fire ignition or is particularly sensitive to smoke damage. Additionally, ultrasensitive smoke detection may be more cost-effective than standard smoke detection in larger facilities.

3.4.2 Combustible materials shall be maintained at the minimum practical level. Recording media, paper stocks and other combustibles shall not be stored in the electronic equipment space. Modular office furniture shall not be located in the electronic equipment space unless it meets the requirements of NFPA 75.

3.4.3 Plastic materials shall not be used in suspended ceiling systems. Plastic shades/diffusers for ceiling lighting units are permitted.

3.4.4 Raised floor systems shall be of noncombustible materials.

3.4.5 Cable and wiring requirements include:

3.4.5.1 Communications and interconnecting cable and wiring between components within the electronic equipment space (and associated raised floor space) shall comply with NFPA 70, Article 645.

3.4.5.2 Communications and interconnecting cable and wiring between components in the equipment space and other areas of the facility or other facilities shall comply with NFPA 70, Article 725.

3.4.5.3 All power and distribution circuits shall comply with the appropriate NFPA 70 Article. Use of nonmetallic conduit is not permitted.

3.5 Protection for Mission Essential Equipment. Facilities containing mission essential electronic equipment shall comply with MIL-HDBK-1008, NFPA 75, other appropriate codes, and the following:

3.5.1 The entire facility (including electronic equipment and nonelectronic equipment spaces) shall be completely protected by a wet-pipe sprinkler system designed and constructed per NFPA 13. Activation of the automatic sprinkler system in the electronic equipment space shall not automatically disconnect power to the electronic equipment space.

*NOTE* - A protective means to disconnect power to all electronic equipment and to all dedicated air handling equipment shall be provided per NFPA 70, Article 645. Manually operated switches should be double-action style.

3.5.2 Electronic equipment spaces (and associated raised floor spaces) shall be provided with an ultrasensitive smoke detection system per NFPA 72 and Section 3.8.

3.5.3 Electronic equipment spaces shall be separated from other spaces/occupancies and from operationally distinct adjacent electronic equipment spaces in the facility by a minimum of one-hour fire rated construction. The one-hour rated construction shall extend from structural floor to structural ceiling/roof.

*NOTE* - Backup electronic equipment, if provided, should be physically located to minimize the potential for damage from fire, smoke, sprinkler system actuation or other cause which also damages the primary electronic equipment.

3.5.4 Combustible materials shall be maintained at the minimum practical level. Recording media, paper stocks and other combustibles shall not be stored in the electronic equipment space. Modular office furniture shall not be located in the electronic equipment space unless it meets the requirements of NFPA 75.

3.5.5 Plastic materials shall not be used in suspended ceiling systems. Plastic shades/diffusers for ceiling lighting units are permitted.

3.5.6 Raised floor spaces shall be divided in the same manner as the electronic equipment spaces above that they serve.

3.5.7 Raised floor systems shall be of noncombustible materials.

3.5.8 If the electronic equipment space is served by air handling equipment which also serves any other part of the facility (including an adjacent electronic equipment space), the following features shall be provided:

3.5.8.1 Automatic smoke and fire dampers per NFPA 90A shall shut off the electronic equipment space from the remainder of the facility upon any fire alarm indication in the facility. Smoke dampers and combination fire and smoke dampers shall be of the automatic-resetting type. Fire dampers shall be used to protect openings in fire rated construction per NFPA 90A.

3.5.8.2 Smoke detectors listed for use in air distribution systems shall be installed and shall provide facility fire alarm indication.

3.5.9 Air handling systems which exclusively serve the electronic equipment space need not be deactivated upon a fire alarm indication except for conditions originating in the electronic equipment space.

3.5.10 A smoke exhaust system shall be provided to remove smoke from the electronic equipment space to the exterior of the building. The system shall be designed to minimize damage to the electronics equipment from corrosive action of smoke and other by-products of the fire. The system shall be comprised of air handling equipment separate from that of the normal air handling equipment provided for the electronic equipment space. Features of the system include the following:

3.5.10.1 The system shall override all normal air handling equipment for the electronic equipment space. Automatic smoke and fire dampers shall isolate the electronic equipment space from the remainder of the facility.

3.5.10.2 The system should be automatically activated upon the detection of smoke within the electronic equipment space. The system shall be manually deactivated using a key operated switch at a location outside of the electronic equipment space.

3.5.10.3 The system shall provide a minimum smoke exhaust capacity of 900-liter per minute/meter<sup>2</sup> of floor area (3-CFM/ft<sup>2</sup> of floor area) against a differential pressure of 13 Pascal (0.05-inches water gauge).

3.5.10.4 The system shall be provided with emergency or standby power per NFPA 70. Connection ahead of, but not within, the main service disconnecting means should be used for facilities without other sources of emergency or standby power.

3.5.10.5 Materials used for the system shall comply with NFPA 90A.

3.5.11 Cable and wiring requirements include:

3.5.11.1 Communications and interconnecting cable and wiring between components within the electronic equipment space (and associated raised floor space) shall comply with NFPA 70, Article 645.

3.5.11.2 Communications and interconnecting cable and wiring between components in the electronic equipment space and other areas of the facility or other facilities shall comply with NFPA 70, Article 725. Listing markings shall be visible on the cable jacket/wiring insulation.

3.5.11.3 All power and distribution circuits shall comply with the appropriate NFPA 70 Article. Use of nonmetallic conduit is not permitted.

**3.6 Optional Protection Features.** The MAJCOM fire protection engineering office is authorized to require either of the following optional protection features for mission essential and mission support equipment:

*CAUTION* - These optional protection features are based on a typical Air Force installation with a fully equipped and manned fire department within the time and distance criteria of DODI 6055.6. Use of these optional protection features at other installations/ locations is not recommended without a complete fire engineering risk analysis.

**3.6.1** A physically separate Type I or Type II (fire resistive or one-hour) building to house the electronic equipment space. No offices or storage space would be permitted in such a building and combustible materials would be restricted to the minimum practical level. A wet-pipe sprinkler system would not be required.

**3.6.2** Installation of 4-hour walls (fire divisions) around the electronic equipment space. This eliminates the need for the wet-pipe sprinkler system in the electronic equipment space only.

*NOTE* - Backup electronic equipment, if provided, should be physically located to minimize the potential for damage from fire, smoke or other cause which also damages the primary electronic equipment.

**3.7 Requirements for Standard Smoke Detection.** Standard smoke detection shall comply with NFPA 72, NFPA 75 and the following:

**3.7.1** Sensitivity should be set at the detector's full alarm sensitivity (typically 2.5%-obscuration/ft for photoelectric detectors, 1.4%-obscuration/ft for ionization detectors, and 35%- to 40%-obscuration/path for photobeam detectors).

**3.7.2** Both spot-type ionization and photoelectric smoke detectors shall be installed in electronic equipment spaces. Ionization detectors will provide the quickest detection of flaming fires and photoelectric detectors the quickest detection of smoldering fires.

**3.7.3** Photobeam-type smoke detectors should not be installed in electronic equipment spaces as the primary method of smoke detection. The MAJCOM fire protection engineering office may require their installation in addition to spot-type ionization and photoelectric smoke detectors.

**3.8 Requirements for Ultrasensitive Smoke Detection.** This type of smoke detection should be specified when the fire risk profile requires detection of incipient fires (i.e., smoldering associated with overheating or low energy release rate fires) before they reach an energy release rate of about 1-kW or where environmental effects could result in significant delays in detection. Requirements include:

**3.8.1 Aspirating air sampling-type smoke detectors** should be specified for ultra sensitive smoke detection. Standard spot-type ionization and photoelectric smoke detectors shall not be used because significant false alarm problems are expected when the alarm threshold of standard smoke detectors is reduced into the ultra sensitive range.

**3.8.2 Sensitivity of the smoke detector** shall be selected based on the environmental conditions expected in the electronic equipment space.

**3.8.2.1** The maximum sensitivity of the smoke detector should be of a value no less than 0.003%-obscuration/ft. This sensitivity would be used in areas that are environmentally controlled and completely free of outside pollutants.

**3.8.2.2** The minimum sensitivity of the smoke detector should be of a value no greater than 0.15%-obscuration/ft. This sensitivity would be used in areas with a low level of pollutants (such as might be present if smoking were permitted).

**3.8.3** The smoke detector shall provide detection within a range of sensitivity. The acceptable lower (maximum sensitivity) limit within this range should not be less than 1/10 the upper (minimum sensitivity) limit. For example, if the upper limit for a detector is 0.09%-obscuration/ft, the lower limit should not be less than 0.009%-obscuration/ft.

**3.8.4** A minimum of three alarm points shall be provided within the sensitivity limits in addition to normal trouble and supervisory signals.

**3.8.4.1** The alarm points should be field selectable within the sensitivity limits.

**3.8.4.2** The least sensitive alarm point shall transmit an alarm to the Fire Alarm Receiving Center.

**3.8.4.3** The least sensitive alarm point shall sound the interior fire alarm and evacuation system. This connection is not required if sprinklers are provided in the electronic equipment space.

**3.8.4.4** All other alarm point notifications/functions should be locally defined.