DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20332

REPLY TO
ATTN OF: LEED

SUBJECT: Engineering Technical Letter (ETL) 90-3:
TEMPEST Protection for Facilities

TO: SEE DISTRIBUTION LIST

1. Attached for your information and action is the guidance for planning, programming, design, construction and testing TEMPEST shielded facilities.

2. Purpose. This ETL:

a. Is authorized in accordance with AFR 8-7, Air Force Engineering Technical Letters (ETL) dated 9 January 1986, and is to be implemented accordingly.

b. Supersedes the TEMPEST portion of ETL 88-7: TEMPEST and High-Altitude Electromagnetic Pulse (HEMP) Protection for Facilities, 24 Aug 88.

c. Implements the directives of AFR 56-16, Control of Compromising Emanations (TEMPEST) (C).

d. Implements the guidelines of Under Secretary of Defense Memorandum, TEMPEST Countermeasures Applied to Industry, 3 Dec 84 (C) for a more reasonable and cost effective means to protect against the demonstrated vulnerability.

e. Establishes guidelines for determining the degree of protection during the facility planning stage.

f. Provides guidance for programming TEMPEST protection projects and for developing the project narrative and management plans for the Requirements and Management Plan (RAMP).

g. Establishes guidance for design, construction, and testing of protected enclosures or facilities.

3. Effective Date: This ETL is effective starting with those projects which have not reached the 30 percent preliminary design stage as of the date of this letter.

4. This letter has been coordinated with AF/SCTI/SCTX/INSCI/SCMC, HQ ESC/LEEEC, AFCSC/SRVT, and AFESC/DEMM.

5. Our point of contact is Mr. R.S. Fernandez at AV 297-4083 or (202) 767-4083.

FOR THE CHIEF OF STAFF

G. HAMMOND MYERS III, GM-15
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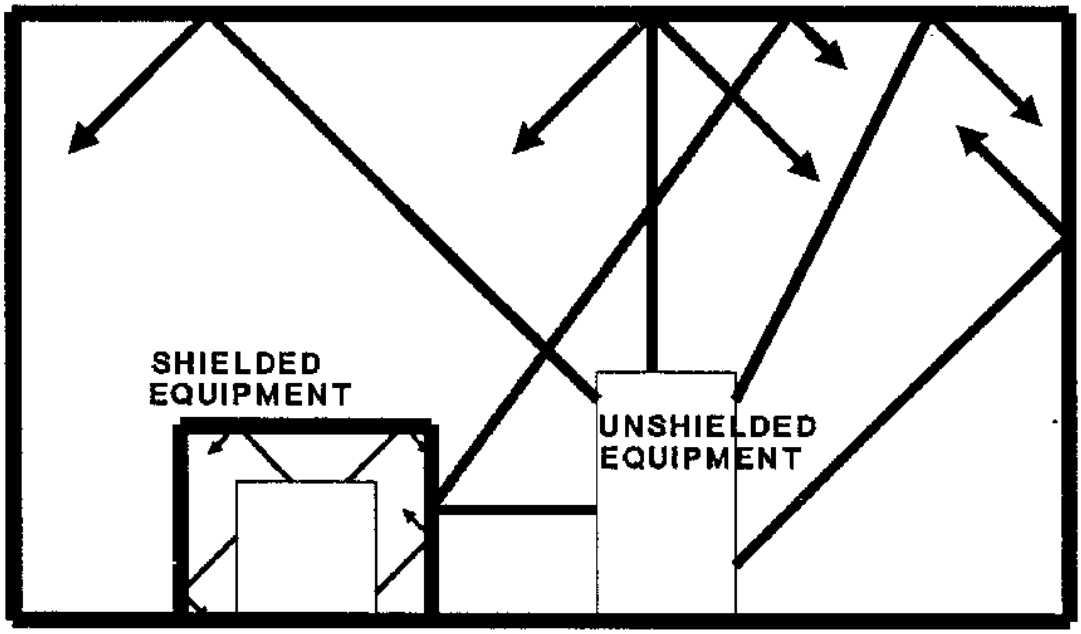


TEMPEST PROTECTION FOR FACILITIES

Atch 2

1. Referenced documentation: Applicable referenced publications are as follows:

a. Air Force Regulation (AFR) 56-16, Control of Compromising Emanations (TEMPEST), 3 Nov 86 (C).

b. AFR 56-3, Classification Guide for COMSEC Information, Nov 86, (S) (Implements NTISSI 7000)

c. Under Secretary of Defense Memorandum, TEMPEST Countermeasures Applied to Industry, 3 Dec 84 (C).

d. USAF Handbook for the Design and Construction of HEMP/TEMPEST Shielded Facilities, November 89 (U).

e. USAF Guide Specification for HEMP/TEMPEST Shield Doors, Electrical Filter/ESA Assemblies, and other Shield Penetrations, June 1988 (U).

f. Military Handbook 419A (MIL-HDBK-419A), Grounding, Bonding, and Shielding for Electronic Equipments and Facilities, 29 Dec 87 (U).

g. National Communication Security Information Memorandum (NACSIM) 5203, Guidelines for Facility Design and RED/BLACK Installation (C).

h. National Communication Security/Electromagnetic Security Information Memorandum (NACSIM) 5204, Shielded Enclosures (C).
Note: This document addresses NSA Specs 73-2A, 65-5 and 65-6.

i. National Telecommunications and Information Systems Security (NTISSI) 7000, TEMPEST Countermeasures for Facilities, 17 Oct 88 (S).

j. Military Standard 188-124A (MIL-STD-188-124A), Grounding, Bonding, and Shielding (U).

k. MIL-HDBK-232A, RF Shielded Enclosures for Communications Equipment, 30 Oct 64 (U).

l. MIL-STD-285, Attenuation Measurements for Enclosures, Electromagnetic Shielding, for Enclosures, Electromagnetic Shielding for Electronic Test Purposes, Method of (U).

m. MIL-STD-248, Qualification Test for Welders (other than Aircraft Weldments) (U).

o. U.S. Department of Commerce/National Bureau of Standards, Federal Information Processing Standards Publication, Guideline on Electrical Power for ADP Installations, (FIPS PUB) 94, 21 September 1983 (U).

2. Definitions.

a. Acceptance Test. Contractor's final test of the shield to verify if the government can accept the completed shield and penetrations. Note: The shielded enclosure at the time of this test will not have interior finishes on the ceiling, walls and floors, or any electronics equipment. This test shall include all shield penetrations and protective measures such as waveguide-beyond-cutoff entry construction or devices, power and signal filters (HVAC, security, EMCS, fire alarm, etc.).

b. Attenuation. The shielding signal reduction requirement is 50 decibels (dB) (nominal) at the frequencies and radiated fields shown on Appendix 1.

c. "BLACK" Lines. A BLACK line is a one which handles or processes signals which are unclassified, either because of content of the text or because the intelligence is obscured by encryption.

d. Certification. A statement in the DD Form 1391 (Military Construction Project Data) and the "Requirements and Management Plan" (RAMP) narrative that the 50 dB shielding is required: it will be signed by the Base TEMPEST Manager.

e. Compromising Emanations. Unintentional intelligence-bearing signals which, if intercepted and analyzed, disclose national security information transmitted, received, handled or otherwise processed by any information-processing system.

f. Global Shielding. Shielding of an entire facility versus of a room or enclosure.

g. Independent Testing Laboratory. This is an agency acceptable to the government which is contracted by the construction contractor to perform his acceptance testing.

h. In-Progress Tests. Tests performed by the contractor during the installation/welding of the shielding before room finishes are intended to help him ensure welded joint integrity. Note: These tests are usually performed when the contractor seeks assurance that the shield joints and penetrations are not leaking radio frequency (RF), and the shielded enclosure or facility is ready for the final acceptance test. At the discretion of the Base TEMPEST OPR, in-progress tests could suffice as the acceptance test, depending on the size of the shielded facility.

i. Requirements and Management Plan (RAMP). It is a set of criteria normally prepared by the BCE staff with portions of it sometimes developed by a design contractor and consists of an accelerated design process which includes: project narrative, project management plan, sub area development plan,

infrastructure requirements, environmental issues, base design standards, base architectural guide, and project cost estimate. The RAMP will go into effect starting with the FY 92 Milcon process.

j. "RED" Equipment or Circuit. Wire lines, components, equipments and systems which process national security signals that are classified.

k. TEMPEST is a short name referring to the investigations and studies of compromising emanations. Basically, TEMPEST shielding is designed to keep classified information from being monitored by unfriendly agents. This contrasts with high altitude electromagnetic pulse (HEMP) shielding which protects against nuclear electromagnetic effect infiltration into sensitive electronic equipment.

l. TEMPEST Manager. The SC (Command, Control, Communications and Computers) representative at the Base and/or MAJCOM level who determines whether communications equipment or facility housing communications equipment will require TEMPEST shielding. The Base TEMPEST Manager is sometimes referred to as the Unit TEMPEST Manager.

m. TEMPEST OPR. The Engineering and Services representative on TEMPEST technical requirements responsible for the successful design and construction of shielded facilities. Reference Appendix 2 for a listing of TEMPEST shielding contacts. Note: The BCE and the MAJCOM must appoint, and if necessary train (AFIT or other government or non-government courses), an engineer as the TEMPEST OPR in both the DEE and DEM offices to be knowledgeable in design and maintenance, respectively. The AFRCE and/or MAJCOM must appoint, and if necessary train, a design and construction manager (DM and CM respectively) to become an expert in the design and construction of TEMPEST shielded facilities.

n. User. Operator of the equipment in the shielded facility for whom the shield was installed. The user is the organization which has the sensitive equipment/mission listed on its Table of Allowance.

o. Validation Test. Air Force test funded by the using activity of the shielded enclosure or facility after all the interior finishes have been installed by the facility contractor and electronics equipment have been installed by the user. This test is not required if additional penetrations are not made to the shield after the Air Force has accepted the facility from the contractor. The test is normally accomplished after the construction contractor has left the site.

3. Shielding Cost Estimate

a. General. Modular panels are preferred for shielding an area

within a facility. Foil is an inexpensive type of shielding, but not the least from a maintenance life cycle cost. Welded or soldered sheets of metal is the most expensive first cost but the least expensive in maintenance life cycle cost.

b. Modular Room Cost. For individual rooms, the cost for installation of mechanically connected light steel panels (the preferred way to go) varying anywhere from 15 to 30 dollars per square foot, depending on the size of the room.

c. Global Shielding Cost. Installation of welded steel sheets or plates is the highest first cost method and can be around $50 per surface square foot (SSF) if the facility is new, or $75 per SSF if an existing facility is being renovated. The costs include special doors, filters, penetration protection, and testing by the facility contractor. These cost estimates do not include costs associated with the basic facility structure.

d. Acceptance Testing Costs. Testing itself is approximately $1.60 per tested SSF and is included in the costs shown above.

4. Implementation - General. The goal of TEMPEST shielding is adequate protection at the best life cycle cost per AFR 56-16 (NTISSI 7000). The AFR 56-16 dictates which countermeasure is applicable or if shielding is justified. There are locations in CONUS and overseas where TEMPEST shielding is justified. Shielding requirements are determined by the Base and MAJCOM TEMPEST Managers, with verification by AFCSC/SRVT.

a. For CONUS facilities, fencing (chain-linked or concrete masonry units) around a facility must be considered as the first solution to create a prescribed control space for the TEMPEST shielding requirement. This is applicable when the mission equipment cannot provide adequate TEMPEST protection and when shielding of the room or facility is not cost effective. For overseas locations, fencing may not be the solution in most cases.

b. Shielded Equipment First-Cost Versus Modular or Global Shielded Maintenance Life Cycle Cost. If a TEMPEST shielded version of an "off the shelf" piece of equipment, such as a personal computer, is available (generally at a substantial premium), then equipment level protection might be an option. To retrofit TEMPEST shielding on a non-standard or one-of-a-kind piece of equipment can be extremely expensive. However, even this high first cost compared with the life cycle cost of a shielded facility may be relatively small.

c. Shielding Large Quantities of Sensitive Equipment Versus Modular or Global Shielding. Modular or global shielding of a facility or room may be more economical if a large quantities of sensitive equipment need(s) to be installed

at a single location. Large quantities of equipment shielded at the room/building level will typical]y have significantly fewer filters and gaskets to maintain and periodically test. Hence, in this case, the first cost of a shielded facility may be higher but life cycle cost effective.

d. Alternate countermeasures are:

(1) Equipment Modifications. It is possible to reduce the compromising emanations to a level that can be adequately contained within available control space boundaries.

(2) Control Space Determination. The TEMPEST Managers can provide the control space necessary to safely contain sensitive equipment. The Base Tempest Manager can obtain safe distances for various kinds of equipment from his MAJCOM TEMPEST Manager. The MAJCOM TEMPEST Manager can obtain this information from the AFCSC/SRVT at Kelly AFB.

(3) Control Space Modifications. A trade-off would be to expand the control space sufficiently to permit the use of a fence around the building or a modular panel enclosure in preference over a global shielded facility.

(4) Trade-off Consideration. After determining the extent of the control space, the MAJCOM TEMPEST Manager must recommend to the System Program Office (SPO) or direct/recommend to the Base Tempest Manager whether it is more cost effective to expand the control space perimeter to minimize the hazard, modify or replace the emitting equipment/system, shield the equipment/system or combine these choices in the most cost-effective manner.

5. Planning Requirements.

a. General. Reference Appendix 3 for a flow chart of the TEMPEST shielding planning procedure. A series of verification and validation steps have been establish to ensure unnecessary shielding is not installed. Validation of the shielding requirements must be done per AFR 56-16 and this letter.

b. Base Level.

(1) Initial Requirement. The user must certify the shielding requirement before he/she submits an AF Form 332 (BCE Work Request) to identify the requirement for a new facilitY or renovation of an existing facility. The Base DEP will include this TEMPEST Officer certification in the initial DD Form 1391 (Military Construction Project Data).

(2) Non-Sensitive Compartmented Information Facility

(Non-SCIF) Facilities. The user of the proposed facility will ensure the Base Communications or SC TEMPEST Manager reviews and evaluates TEMPEST shielding requirements for the proposed new facility, new addition, or renovation to existing facility. Use the form of Appendix 4 for coordination among the user, BCE, Base and Requiring MAJCOM TEMPEST Managers and OPRs. This form will be attached to the project description of the RAMP.

(3) SCIF Facilities. The Base Special Security Office (SSO) must submit the TEMPEST requirements to the Requiring MAJCOM SSO

(4) Base Comprehensive Plan. The required control space size shall he depicted on the Base Comprehensive P]an (BCP) and the real property records. The Base TEMPEST manager will calculate this control space and maintain documentation of these calculations. The BCP will reference this calculation.

c. MAJCOM Level.

(1) General. TEMPEST shielding verification information must be available at the pre-project definition conference to avoid delays.

(2) Non-SCIF. If the Requiring MAJCOM TEMPEST Manager (SC) verifies the requirement for a shielded enclosure (area within a facility or an entire facility), the requirement must then be reviewed by the Air Force Cryptologic Support Center (AFCSC/SRVT) for verification. If either the Requiring MAJCOM TEMPEST Manager or AFCSC/SRVT does not verify the requirement for a shielded enclosure, the TEMPEST shielding requirements will not be included in programming documentation.

(3) SCIF Approval. The Requiring MAJCOM SSO must submit the requirement for shielding to DIA/OSC-2 through USAF/INS for approval.

(4) Shielding Not Required. If the Requiring MAJCOM TEMPEST Manager, AFCSC/SRVT, or DIA/OSC-2 does not verify the requirement for a shielded enclosure, the Base TEMPEST Manager shall notify the BCE TEMPEST OPR (DEE) that no TEMPEST shielding requirements will be included in the facility project programming documentation.

6. Programming Requirements.

a. General. Reference Appendix 3 for a programming flow chart.

b. Command Submittal.

(1) The Base or Host MAJCOM OPRs must include a separate line item

entitled "TEMPEST Shielding" under "Supporting Facilities" in Block 9 of the DD Form 1391.

(2) The cost estimate must be included as dollars per square foot of surface area.

(3) The statement: "TEMPEST SHIELDING VALIDATION: The TEMPEST shielding requirement is valid and has been justified IAW AFR 56-16" will be signed by the Base TEMPEST Manager or Base Special Security Office (for SCIFs) shall be included in the DD Form 1391c. Shielding requirements without this certification will be considered for deletion by AF/LEED and LEEP. Submit such validation for FY 92 MILCON you have already submitted to this HQ and include in future MILCON submittals.

c. Funding. The cost for TEMPEST shielding must be programmed as follows:

(1) Shielding a room(s) in an existing facility.

(a) Modular shielded enclosures are preferred as most cost effective for the Air Force. First cost and life cycle cost are minimal compared with a fixed shielded enclosure. The user shall justify modular shielded enclosures for funding and procurement.

(b) Modular shielded enclosures which can be assembled and disassembled without loss of capability and are used solely for the purpose of providing TEMPEST shielding for a specific piece or several pieces of operating equipment will be procured under the existing expense/investment funding threshold.

(c) Enclosures will primarily be funded in the Other Procurement (3080) appropriation. However, those costing less than $15,000 are within the Operation and Maintenance (3400) expense appropriation.

(2) Shielding for new facilities or shielding which requires construction resulting in a permanent change (removal of existing or construction of new fixed walls, roofs, etc) to an existing facility or a section of that facility because of a mission change will follow the funding guidance and thresholds applicable to construction in the Military Construction (3300) and Operation and Maintenance (3400) appropriations.

(3) For existing facilities, when new equipment is installed and it needs shielding, the cost of shielding is an expense and will not be a construction cost. Normally, shielding will be provided by the SPO of the equipment or the Requiring Command.

(4) In-progress and acceptance tests will be funded per above

paragraphs. However, the validation test by the Air Force, done after the contractor turns the facility over to the Air Force,is always an unfunded cost (another source other than MILCON) by the user (SPO or Requiring Command).

7. Design Requirements.

a. General. Electromagnetic radiation and conducted signals will be attenuated to 50 dB (Appendix 1) per NACSEM 5204 and specific systems security classification guidelines. Reference Appendix 5 for a design flowchart.

(1) The design must be sufficiently detailed and clear to minimize misinterpretations, installation problems, schedule delays and cost overruns. Contractors often experience technical difficulties when installing shielding and filtering systems.

(2) Based on the Air Force Requirements and Management Plan (RAMP), the designer will consider a modular system or metal-shielding materials: stainless or galvanized steel plates or sheets, or copper or stainless steel foils. Aluminum foil and aluminum plates shall not be used in fixed ground-based facilities. Reference the USAF shielding handbook for further details.

(3) Security Classification. There are no special provisions for classification of TEMPEST design and construction documentation, except for SCIF-type installations. The level of accreditation of the operation within a SCIF shall not be shown on any design documentation. Otherwise, all TEMPEST shielding (SCIF and non-SCIF) will be unclassified. There are no restrictions in using the word "TEMPEST" to describe any filter, shield etc. There are no special provisions for classification of calculations and analyses to develop the TEMPEST requirements in the drawings and specifications.

b. Requirements and Management Plan (RAMP). The project narrative shall contain the requirement for TEMPEST shielding followed by the statement, "This shielding requirement has been validated by the Base TEMPEST Manager" or Special Security Officer for SCIFs.

c. Planning Instruction (PI). This is the initial design instruction issued by the Air Staff. It will identify TEMPEST shielding projects as "Special Interest." This means that AF/LEEDE and/or Hq ESC/LEEEC may be interested in attending the predesign and preconstruction conferences and reviewing project drawings and specifications.

d. Commerce Business Daily (CBD) Announcements. For TEMPEST shielding projects, the CBD announcement must say, "RF shielding design experience will be a rating factor."

e. Architect-Engineer Firm (A-E) Selection.

(1) The selection criteria will include credits for:

(a) Experience in designing electromagnetic shielded facilities (enclosures), and

(b) Proper clearances.

(2) DM TEMPEST OPR Involvement. The DM TEMPEST OPR should be involved in the selection process. As a minimum, he/she should act as an advisor to the selection panel.

f. Pre-Project Definition Conference. For facilities or portions of facilities which will have shielded areas of 5,000 SF (building footprint) or larger, the TEMPEST OPRs from the Base, Requiring MAJCOM and DM should attend the pre-design conference to ensure the A-E understands the requirements for shielding. When smaller areas will be shielded, at least the DM TEMPEST OPR or his representative must be present. Note: The question of whether shielding is or isn't required should have already been answered by the Air Force personnel before the meeting.

g. Design Criteria.

(1) The designer shall follow the TEMPEST shielding design guidance of USAF Guide Specification and Handbook for the Design and Construction of HEMP/TEMPEST Shielded Facilities. Copies of the handbook can be obtained from HQ ESC/LEEEC or AF/LEEDE.

(2) Conflicts between the USAF handbook, guide specifications and any others should be reported through the DM or Host MAJCOM to AF/LEEDE for resolution.

(3) Performance specifications are not acceptable. Each design must be completely detailed to leave no aspect to chance or guess work by the construction contractor.

(4) Standard off-the-shelf items should he specified from the preferred products listing (PPL). This includes doors, electrical filters, ventilation filters, latches, surge or transient suppressors, gaskets, etc. If necessary, to assure the quality required, proprietary items must be included in the specifications.

(5) Design Checklist. Appendix 6 is provided to assist the designers in preparing the drawings and specifications for the TEMPEST shielding.

(6) Design Classification. The design will be unclassified to allow normal review and construction procedures.

h. Fire Alarm Systems.

(1) Global Shielded Facilities. Filter-protected, communication-type circuits can be used for fire reporting between the shielded facility and base fire department. However, fiber optics systems are preferred and should be used where cost effective.

(2) Shielded Enclosures within Buildings. Install an alarm panel inside the shielded enclosure to receive signals from alarm heads within the protected area. Run two filtered signal lines or fiber optics cables from the shielded enclosure to the building fire alarm panel. One line will alert the fire department and residents in the unshielded portion of the building, while the other will alert the residents of the shielded enclosure of an alarm outside the shielded area. Exercise caution when selecting the signal filters. They must be compatible with the alarm system.

(3) Care should be exercised by designers when locating lighting circuits and sprinkler piping systems within entryways which are used as waveguides. These systems can negate the effectiveness of the waveguides if piping or conduit are not installed properly.

i. High Voltage Filters. Avoid usage of filters greater than 600V. At present, high voltage filters are not reliable and can be safety hazards. Use commercially available filters with standard voltages and current ratings. Recommend using lowest ampacity size possible. Power filters leak reactive current to ground which increases power loss and lowers the power factor.

j. Shield Penetrations. Various items of mechanical equipment are often located outside of the shielded enclosure. Note: Control wiring, pneumatic tubing, refrigerant lines, HVAC ducts, etc need to be designed with adequate filtering/waveguides to attenuate RF signals per this ETL.

k. Shielded Equipment in Shielded Facilities. Double filtering has been known to cause problems with SATCOM facilities equipment, communication lines and with fire alarm and intrustion detection systems. Caution should be exercised in design of these systems.

l. Design Reviews. The user, Host MAJCOM and DM TEMPEST OPRs and Managers, and HQ ESC/LEEEC must be included in review of the Project Definition phase and at the preliminary and pre-final design review stages. AF/LEEDE must be included in the design reviews of shielded enclosures or facilities which exceed 5000 SF

scope. Construction cannot be authorized for advertisement until both the Host MAJCOM and DM TEMPEST OPRs approve project design documentation.

8. Construction Requirements.

a. General. For facilities or portions of facilities with footprint of less than 5,000 SF, which will be shielded, the user, DM TEMPEST OPR or his/her representative should attend the pre-construction conference. For facilities having a shielded room equal to or greater than 5,000 SF (footprint), the user and the DM TEMPEST OPR or his representative must attend the conference, and Base and Host MAJCOM TEMPEST OPRs should be invited. The OPRs must ensure that the contractor is aware of the special shielding requirements of the design and is capable of completing them.

b. Welder/Installer Qualifications. An experience clause for the TEMPEST shielded enclosure installer must be included in the design documents. Shield installers must be certified for the type of shield to be installed.

(1) If the shield is to be welded, then the welder must he certified according to the applicable requirements of the American Welding Society. Shield welders must be qualified according to the welding procedures and welding operator performance using MIL-STD-248C and shall comply with the Structural Welding Code of the American Welding Society. The specialty will be inert gas shielded metal arc welding. Where both structural integrity and shielding quality are required for a given weldment, both criteria shall be met simultaneously.

(2) If the welder or installer is to bolt or solder the shield, he or she must show previous experience in at least two successful construction projects.

c. Inspector Qualifications. A TEMPEST-qualified construction inspector shall inspect the progress of the 50 dB shielding and/or filtering installations. The inspector must have experience in inspecting at least two successful 50 dB shielding installations, attended TEMPEST shielding training, and been certified qualified for TEMPEST shielding inspection by the Construction Agent.

d. Extended Warrantees. Warrantees for shielding, including shielding material and workmanship, doors, filters, etc, should be given special attention. These components are very expensive to maintain during the hardness surveillance/hardness maintenance life cycle portion of the facility. The following shielding materials and components shall be warranteed for a period of not less than five years against RF leakage above the required attenuation:

(1) All bolted, soldered, taped, or welded metal panels or

sheets

(2) All power and signal filters

(3) All shielding doors

(4) All honeycomb filters in mechanical systems

(5) All waveguides

e. Submittals.

(1) All shielding submittals (shop drawings and literature for doors, filters, etc.) shall be approved prior to installation by the construction inspector. Any deviations from the 50 dB shielding specifications and drawings must be approved by the Contracting Officer (CO) after consultation with the Air Force Construction Manager (CM) and the MAJCOM TEMPEST OPR and/or HQ ESC/LEEEC.

(2) Shop drawings of the contractor's proposed 50 dB shielded equipment and components must be reviewed by the Construction Inspector (CI) with the assistance of Air Force DM and MAJCOM TEMPEST OPRs. These equipment and components are those boxes, filters, waveguides, i.e., hardness critical items which will be installed between the shielded and non-shielded areas.

f. Construction Monitoring. The same MAJCOM TEMPEST OPR responsible for monitoring the design should also he responsible for monitoring the 50 dB shielding installation during construction. This is to ensure continuance not only of knowledge of critical parts of the design, but also to ensure these are properly installed during the construction. Following are a set of lessons learned during construction inspection.

(1) All penetrations into the shielded enclosure shall be tested and visually inspected for corrosion and bad workmanship before being covered up: waveguides, welded pipes, and pipes between buildings.

(2) Properly fabricated and installed honeycomb waveguides for ventilation ducts can be trouble-free. An example of a better method is an array of one foot long metal pipes less than 1/2-inch diameter which can also act as a waveguide to provide 100 dB of attenuation.

(3) Installers continue to install wiring, sprinkler pipes, and ducting along waveguide penetrations negating frequency effectiveness of waveguides.

(4) Installation of shielded doors will be done by the manufacturer of the door or his representative. After acceptance testing, the building

contractor should protect doors and finger stock by a constructing a temporary wooden or steel structure around the shielded doors, while he finishes installing the facility cosmetics. This is to ensure the doors are not damaged by traffic during installation of interior finishes. Reinstallation of doors will require the door manufacturer or his representative to be present again. This will be an additional cost.

g. Job Site Visits. The Host and Operating Command TEMPEST OPRs or their representatives must visit the construction job site to ensure the facility's operating command is aware of the progress and intricacies of the construction. The frequency of these visits will be determined during the pre-construction conference. When the shielded facility ;s 1,000 SF (footprint area) or larger, the CM should also invite AF/LEEDE and AFESC/DEMM to participate in the job site visits.

h. Conflicts and Discrepancies. TEMPEST shielding discrepancies, deficiencies, and conflicts that occur during construction must be documented by the CM and resolved by the Contracting Officer in coordination with the CM and the MAJCOM TEMPEST OPR. Copies of these documents, along with the OPR's resolutions and recommendations will be provided to AF/LEEDE.

9. Testing Requirements.

a. General. Shield testing has three main objectives: ensure good mechanical and electrical joints, detect problems early so they can be corrected with minimum cost and demonstrate spec compliance by the contractor. Reference Appendix 7 for contractor test plan and results approval flow chart.

b. Security Classification of TEMPEST Testing. Validation TEMPEST testing documentation which indicates that a facility has failed shall be marked "Secret" or "Confidential," or whatever is the classification of the mission within the facility. Otherwise, the test results are not classified.

c. In-Progress Test by the Contractor. For shielded enclosures or facilities with 5,000 SF minimum footprint scope, the contractor should perform in-progress tests of shield welds or soldered joints, and waveguide and utilities penetrations to better assure himself that the expensive acceptance test will probably pass. For facilities less than 5,000 SF footprint scope, greater emphasis must be given to in-factory testing of components and good quality assurance. Appendix 9 has several testers which have been used in the past.

(1) One hundred percent of the shield welds or soldered joints will be tested for radiation leaks as described below.

(2) The most common tests are non-destructive. The contractor can use the Shielded Enclosure Leak Detection System (SELDS) or "sniffer" test. Sniffer testing entails direct-driving the shield with an RF current, usually around 100 kHz. Joints are swept with a hand-held ferrite probe that will detect RF energy leaking through the joints, either by direct diffusion or via small holes. The "sniffer" test has limitations, it is effective during the In-Progress testing. Reference the USAF Handbook for the Design and Construction of HEMP/TEMPEST Shielded Facilities for details.

d. In-Factory Shielding Effectiveness Tests.

(1) Doors. All RF shielded doors will be tested per MIL-STD-285 for an attenuation of at least 10 DB greater than the required room shield effectiveness.

(2) Honeycomb Waveguide Panels. One sample of each type of construction to be installed in the facility or enclosure shall be tested prior to installation per MIL-STD-285.

(3) Filter/Surge Arrester Assembly. At least one of each type of filter and surge arrester to be installed shall be tested per MIL-STD-220A as noted in the Air Force handbook.

(4) RF Shielded Enclosure. A representative sample of RF filter enclosures, pull boxes and junction boxes in the shielding and penetration protection subsystem shall be tested at the factory to ensure compliance with shielding effectiveness performance requirements, per MIL-STD-285.

(5) Test data will be submitted to the Contracting Officer for approval prior to user equipment delivery to the site.

e. Acceptance Test. This will be the contractor's final facility acceptance test.

(1) General. The contractor will subcontract an independent testing laboratory to perform this test. The independent lab shall perform an RF-tightness acceptance test after the contractor completes installation of the shield, penetrations and/or filters, and prior to the installation of any interior finishes. Correct timing for testing is when the building or room(s) is RF-tight, all shielded doors are in place (including associated fingerstock and gasketing), all electrical/electronic lines have filters in place, but no cosmetics, such as sheetrock, paneling, etc will be installed to conceal welded, soldered or taped joints.

(2) Purpose. This shield effectiveness test will inform the contractor and the Air Force whether the shield installation is

acceptable. As a minimum, a probe must be made for RF leaks at the shield joints, shielded doors, and signal and power line penetrations. The test can consist of a SELDS or equivalent test, and H-field, E-field and plane wave sweep tests per MIL-STD-285. Reference the USAF handbook for more details.

(3) Test Time. This test may range from only one to two weeks for small rooms to several months for large facilities. The contractor may save time by fielding several independent testing teams.

(4) An Air Force agency must monitor testing by the contractor's independent testing team to verify its correctness.

(5) The building contractor must provide support to the independent testing team. The testing team only tests. The contractor corrects any deficiencies.

(6) Acceptance Test Plan Approval. The contractor must submit the acceptance test plan for approval by the 1839 EIG/EIX, Keesler AFB MS 39534-6348 (Attn Mr. Conley) (with prior approval from EID/EIW) or HQ ESC/LEEEC, San Antonio Tx 78243-5000 (Attn Mr. Tom Klein) before the plan can be used. This review could require a minimum of 30 days and must be submitted in a timely fashion by the CM to HQ ESC or the 1839th. The results of this review should be available within one week after arriving at HQ ESC or the 1839th. Appendix 8 provides a listing of minimum information required in a test plan.

(7) Independent Testing Laboratory. The contractor can subcontract a qualified, independent testing firm to perform this test. Qualified means the testing firm has the expertise to perform 50 dB shield testing and has a good track record (successfully tested four or five facilities with 4,000 SF or greater floor area) of testing 50 dB shielded facilities or enclosures. Note: The testing subcontractor and the shielding installer subcontractor shall be separate entities.

(8) Air Force Test Monitor. An Air Force TEMPEST OPR or his representative must be present during at least part of contractor testing to ensure it is being done according to the test plan. The 1839th EIG/EIX can be contacted through the EID/EIW to serve as the Air Force representative during the contractor's test. It is possible that a private consultant may have to be hired by the operating command to perform this work if the workload at 1839th does not permit it to be the Air Force rep. The monitoring team must work closely with the contracting officer or his representative in the correction and testing of deficiencies by the contractor.

(9) Contractor Test Result Approval. The test results must be submitted to the 1839th EIG (with prior approval from EID/EIW) or

HQ ESC/LEEEC for review within 30 days after the test is performed. Copies of the test results will also be provided to the user or operating command, and the MAJCOM TEMPEST Manager. Results of the review should be available within one week after reception of the test results at HQ ESC or the 1839th.

(10) Contractor Test Failure. If the test indicates a shielding failure, the contractor will be responsible for making appropriate repairs to the shield, filtering components, etc. and must retest. It is critical that the test results not be designated as "TEMPEST," but rather "RF." Constraints for time to repair of shielding deficiencies by the contractor during or immediately following acceptance testing must be included in the facility construction contract. Otherwise, repairs could take an inordinate amount of time.

(11) The contractor shall maintain appropriate records to ensure that all welds are checked and results recorded. All unsatisfactory welds shall be repaired and retested. Records shall be available for review by responsible Air Force offices. After the acceptance test, these records must be turned over to the user or operating command.

f. Shielded Enclosure Test Set Included in the Construction Contract. The shield installation contract shall require the contractor to furnish and turn over to the government "a sniffer" or SELDS-type tester similar to those described in Appendix 9. This tester should be the type used during the In-Progress testing. The tester will be maintained and operated by the user.

10. Post Construction - Validation Tests - By Air Force.

a. General. The validation test is not required, if no new penetrations are made after the equipment is installed and ready to run. This test will be performed around new penetrations made to accommodate the user's equipment requirements. The test usually occurs at a much later date after the Air Force has accepted the shielded enclosure or facility from the building contractor. The user(s) or operating command(s) wi]] contact EID/EIW (AV 884-9386) at Tinker AFB to schedule testing of any additional penetrations and associated filters, waveguides, etc.. EID tasks the 1839th EIG/EIX (AV 868-3920) at Keesler AFB to perform the tests. If the 1839th cannot perform the test, then the user or operating command may have to contract with a private sector laboratory to perform this test.

b. Life-Cycle Protection.

(1) Post Occupancy Testing. The user(s) will be responsible for TEMPEST surveillance of the shielding to ensure the integrity of the shield. Validation testing as described above will be done by the user at least once

every three years or whenever any structural change (alteration, addition, penetration, etc.) is made to the shielded enclosure or facility. The user should perform more frequent testing every three months using SELDS. While this test is not a comprehensive test it does indicate where shielding is leaking and needs repair and/or comprehensive testing after the repair. Usual shielding leakage often occurs around the doors, penetrations and along the corners of the shield foil, sheets, or plates.

(2) Test Plan. The user must develop a validation test plan with the assistance of HQ ESC/LEEEC or the 1839th EIG/EIX (through EID/EIW) for periodic testing of critical facilities after beneficial occupancy of the facility.

(a) Monthly Tests. This plan will consist of frequent visual inspections for shield cracks, corrosion along the shield, dirty fingerstock, and shield door malfunctions.

(b) Tri-Monthly Tests. This includes SELDS testing to identify leakage along shield welded joints (corners are weak links) and around the shielded doors.

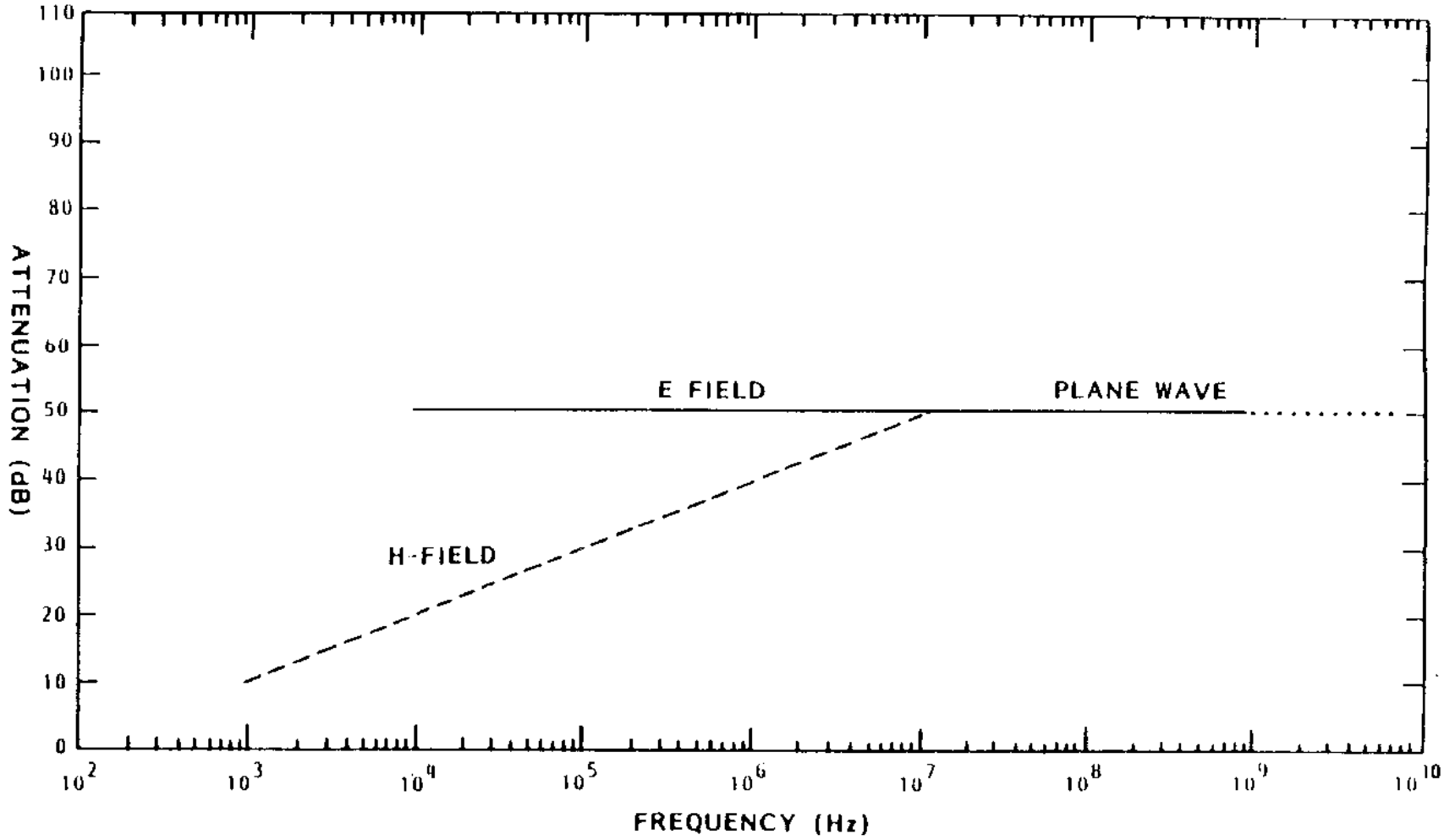
(c) Three-Year Tests. A test should consist of a Shielded Enclosure Leak Detection System (SELDS) test, and H-field, E-field and plane wave sweep tests per MIL-STD-285 either by the user or by agencies mentioned in Para 9e(7). Reference the USAF Handbook for more details.

c. Correction of Deficiencies. The test team will not have the capability to correct any deficiencies. The user must have a readily available construction team to correct any deficiencies. Otherwise, the testing team will be forced to make repeated trips to retest the facility or room after the deficiencies have been corrected.

d. Unlimited Access to the Facility. The test team (government or private contractor) must have unlimited access to the shielded facility or room. Therefore its personnel must have adequate security clearances. Because of mission requirements, access to shielded areas can be very difficult because during testing, the mission of the facility has to be curtailed. Personnel door usage will be very limited or even impossible during the testing.

e. Testing Support. The user of the shielded facility to be tested will coordinate requirements for support sufficiently in advance. An AF Form 1879, BCE Job Order Record, or AF Form 332, BCE Work Request, will initiate this. The BCE cannot perform any work which will invalidate a warranty. The test team (1839th or other government testing agency) may need such things as scaffolding, and removal of any building cosmetics to access the shield or penetrations and

communications through shielded walls. If a non-government test firm performs the testing, then it will provide it own supporting equipment. Removal of building cosmetics will still have to be done by the government, if the testing firm determines it is necessary to access the shield material.



Reasonable worst case TEMPEST shielding attenuation requirement

Requirement]

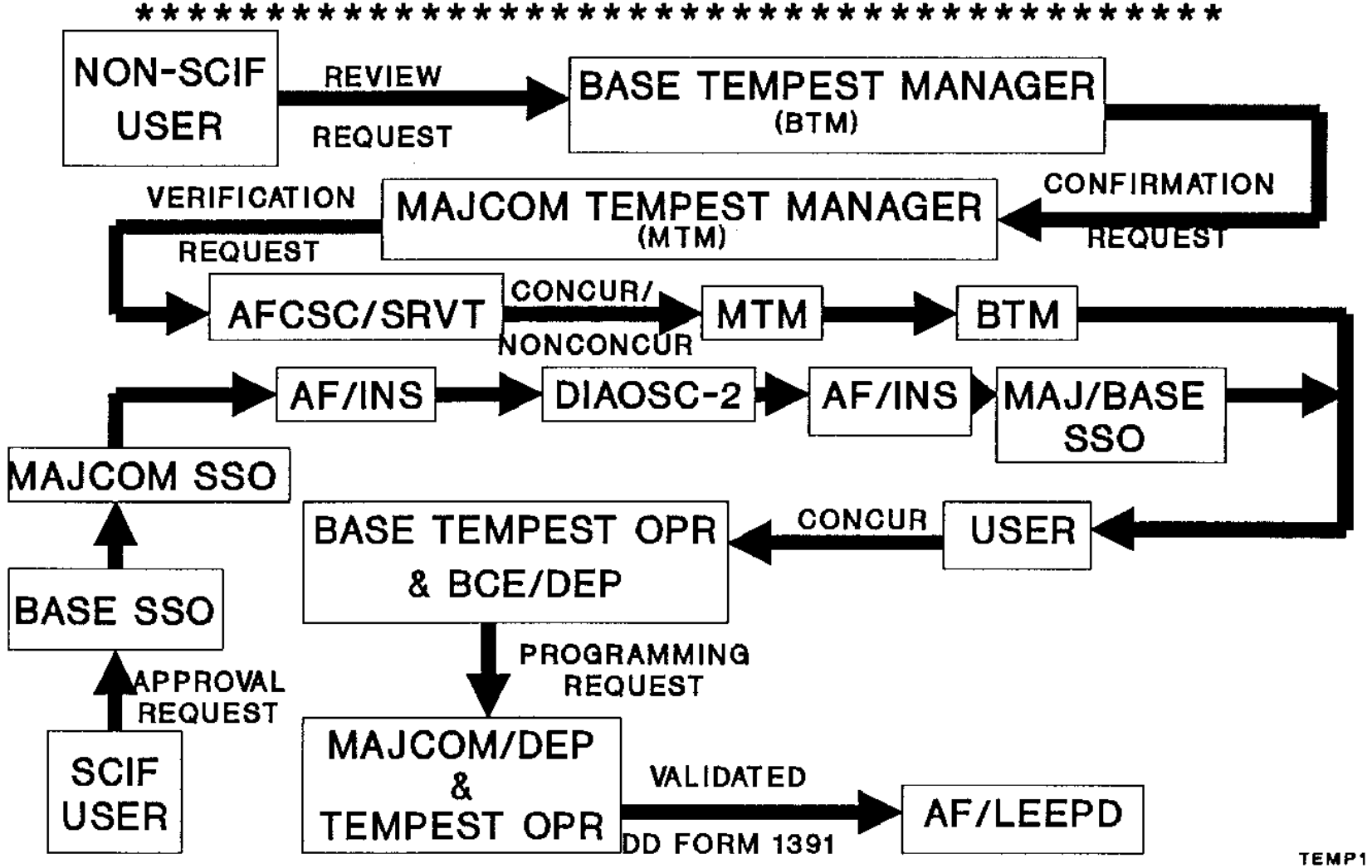
AIR FORCE

TEMPEST SHIELDING MAJCOM/AFRCE OPRS AND MANAGERS

****

ORGANIZATION	NAME	PH NUMBER
AAC/DEE	Mr Alan Quesnel	AV 371-552-5187
AFCC/DEEE	Mr Harlen Mayberry	AV 576-6121
AFCC/DEME	Mr Chales Ondrej	AV 576-6121
AEDC/DEE	Capt Dennis Greer	AV 340-5139
AFCC/AITI	Mr McKinnon	AV 576-3197
AFCC/DSST	Lt Suzanne McKee	AV 576-3197
AFLC/DEE	Mr Richard Winters	AV 787-4563
AFLC/DEM	Mr Stan Blum	AV 787-4107
AFLC/SCZPS	Mr Hank Miller	AV 787-7333
AFRCE-ER	Mr Gary Lowe	(404) 331-6566
AFRCE-CR	Mr Cleo Walton	(214) 653-3327
AFRCE-WR	Mr Nick DiMario	(415) 556-8326
AFRCE-BMS/DEEC	Mr Eugene Shonka	AV 876-5615
AFRES/DEE	Mr Bud Garner	AV 468-5755
AFRES/DEM	Mr J. Hugh Maddox	AV 468-2903
ATC/DEE	Mr A.G. Pinson	AV 487-2786
ANGSC/DEE	Mr Fred MacDonald	AV 858-2461
AFSC/DEE	Mr Jerry Lohsl	AV 858-6017
MAC/DEM	Mr Sam Sivewright	AV 576-3067
MAC/DEEE	Mr Rodney Hartleib	AV 576-5895
SAC/DEE	Mr Gary Eddy	AV 271-7364
SAC/DEM	Mr Robert Jay	AV 271-5917
SPACECOM/DEES	Mr Fred Loudon	AV 692-5030
PACAF/DEE	Mr Andy Hirano	AV 449-5120
TAC/DEE	Mr Steve Coleman-White	AV 574-3539
TAC/DEM	Mr Cal Poole	AV 574-3237
USAFA/DEE	Mr Ken Walters	AV 259-3460
USAFE/DEE	Mr Romel Madlangbayan	AV 480-6795/6
USAFE/DER	Mr Don Castamore	AV 232-4251
USAFE/DER	Mr Joe Nicks	AV 230-4249
USAFE/DEM	Capt Cruz-Gonzalez	AV 480-7213
AFFTC/DEEE	Mr Ron Smoldt	AV 527-8307
SD/DEE	Mr Peter Campbell	AV 833-0930
AU/DEED	Mr Michael Allen	AV 875-6908
ESD/DEE	Mr Charles Wire	AV 478-8604
EID/EIER		
1839th EIG/EIX	Mr Gordon Conley	AV 597-3920
AFIT/DET	Capt Brad Beer	AV 785-4552
ASD/DEE	Mr Andrew Ernest	AV 785-5368
ESC/LEEE	Mr Tom Klein	AV 945-2831
AFCSC/SRVT	Mr David Conovaloff	AV 945-2511
AFESC/DEMM	Mr David Conkling	AV 523-6358
AF/LEEDE	Mr Refugio Fernandez	AV 297-4083
AF/LEEDF	Mr Satish Abrol	AV 297-6247
AF/LEEPD	Mr Art Markowitz	AV 227-1235
AF/INS	Mr Steve Fager	AV 297-9240
AF/SCTI/SCTX		
SAF/AQQS	Lt Col Jim Kee	AV 224-3816

TEMPEST SHIELDING PLANNING & PROGRAMMING



TEMP1

VALIDATION
FOR
50 dB SHIELDING

****

FY:___ FUNDTYPE:_____ PDC NUMBER: _____ BASE: _____
REQUIRING COMMAND: _____ HOST COMMAND: _____
PROJECT TITLE: _____

****

1. SHIELDING REQUIREMENTS:

   a. MAINTAINED ATTENUATION ----------_____dB

   b. MEETS NTISSI 7000 CRITERIA (Y/N)----------_____

   c. MEETS LOWEST COST APPROACH PER AFR 56-16 (Y/N)----------_____

   d. VALIDATED PER NACSIM 5204 (Y/N)----------_____

   e. APPROVED BY AFCSC/SRVT (NON-SCIF) (Y/N)----------_____
      IF NOT, WHY NOT: _____

   f. APPROVED BY SAF/INS (SCIF)(Y/N)----------
      IF NOT, WHY NOT: _____

2. SHIELDED AREA DESCRIPTION:

   a. SCOPE (SF):----------_____

   b. EXTEND OF PROTECTION (ROOM, BUILDING)----------_____

3. APPROVAL:

_____	_____
FACILITY USER	REQUIRING COMMAND TEMPEST MGR
_____	_____
BASE TEMPEST MANAGER (NON SCIF) OR BASE SECURITY OFFICIAL (SCIF)	MAJCOM SECURITY MGR
_____	_____
BASE TEMPEST OPR	(NON-SCIF)AFCSC/SRVT OR (SCIF) AF/INS

TEMPEST SHIELDING
RAMP DEVELOPMENT & PROJECT DESIGN

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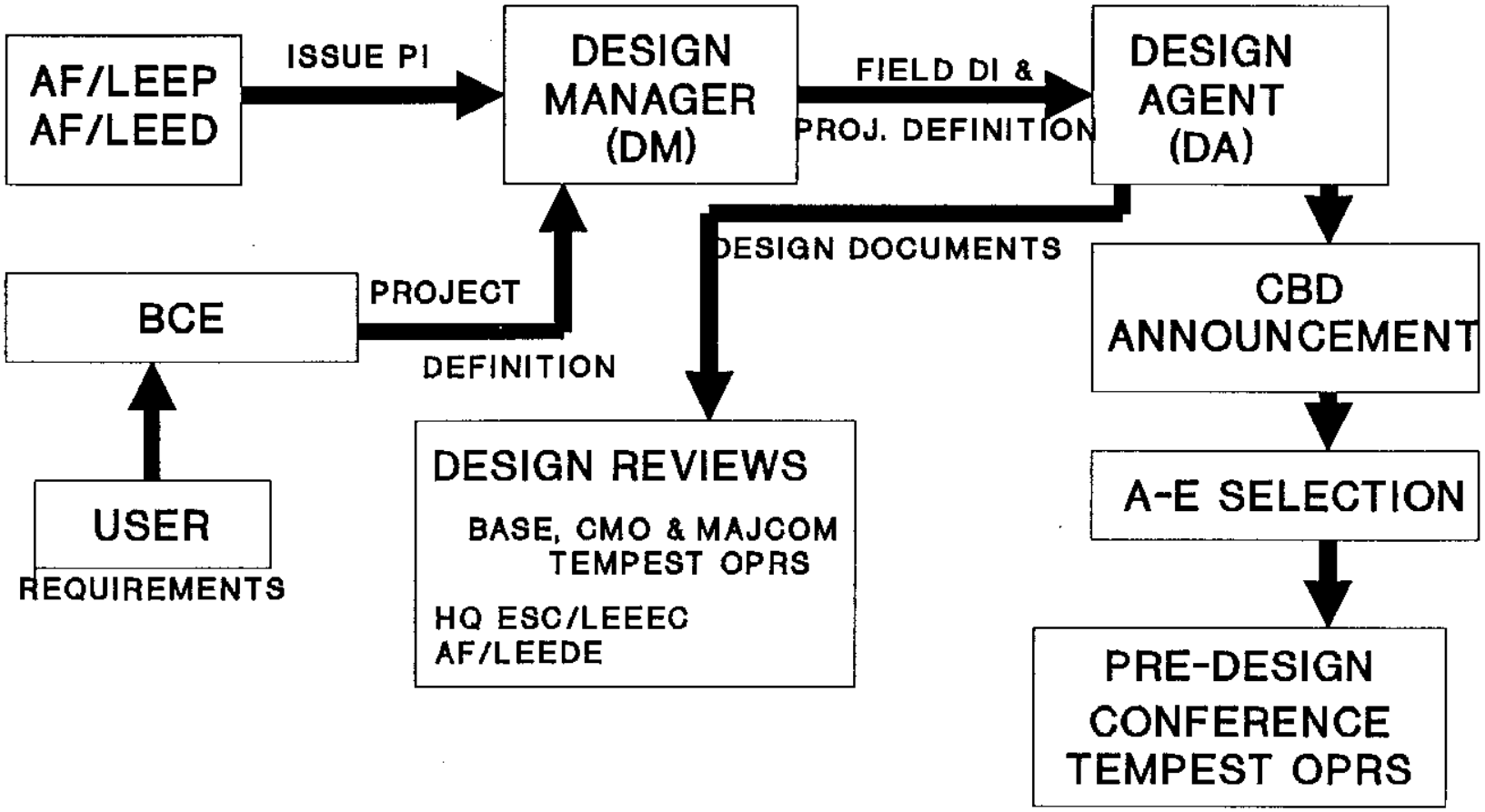

TEMP2

CHECKLIST FOR THE RF SHIELD

1. Designer

a. Overview

(1) Show shielding envelope by distinctive markings on the building floor plan and elevation cross-section drawings.

(2) Ensure that the design approach is constructible and maintainable.

(3) The word "TEMPEST" shall not appear in any design document (drawings, specifications, etc) otherwise the documentation will have to be classified according to the mission's classification.

b. Drawings

(1) Provide wall, floor and ceiling sections through each unique shield feature:

(a) Seams between adjacent sheets
(b) Wall-floor joints
(c) Wall-ceiling joints
(d) Wall-wall joints
(e) Wall-wall-floor and -ceiling intersections
(f) Anchoring details
(g) Treatment of interior columns
(h) Shield and false ceiling suspensions
(i) Expansion joints
(j) Other

(2) Specify type and thickness of shield materials.

(3) Specify methods of welding and type of welding materials.

c. Specifications

(1) State shield performance requirements explicitly.

(2) Include materials certifications.

(3) Include shop drawing requirements.

(4) Include welder qualification and certification.

(5) Specify maintenance procedure requirements.

(6) Include quality assurance for:

(a) In-progress weld testing
(b) Complete shield test
(c) Acceptance shielding effectiveness measurements

(7) Determine if a shielding construction or quality assurance specialist will be required by specifications

2. Mechanical

a. Overview

(1) Identify all shield penetrations and ensure that each one is properly protected. Group penetrations wherever possible.

(2) Minimize penetrations by combining functions or making other design changes.

(3) Implement the utility entrance vault concept to the maximum practical extent.

(4) Ensure that penetration protection designs are constructible and maintainable.
(5) Provide physical security for mechanical penetration protection devices (PPDs) as required for TEMPEST protection.

b. Drawings
(1) Include a complete schedule of shield penetrations.
(2) Provide detailed drawings which show EM isolation-critical features of the design for each unique shield penetration:
(a) Shielded joints
(b) Floor drains and other piping or waveguide sleeve penetrations
(c) Ventilation honeycomb panels
(d) Lengths and diameters for waveguides
(3) Define shield door interlock and alarm circuits.

c. Specifications
(1) Explicitly define performance requirements for each type of PPD.
(2) Include maintenance procedure requirements.
(3) Specify replacement parts requirements.
(4) Include quality assurance test requirements for:
(a) 60 DB (nominal) shield doors
(b) Honeycomb panels
(d) In-progress inspections of PPD installation welds
(5) Address evaluation of PPDs during final shield acceptance testing.

3. Electrical
a. Overview
(1) Identify all shield electrical penetrations and ensure that each one is properly protected.
(2) Minimize penetrations by combining functions or making other design changes.
(3) Use dielectric decoupling (fiber optics, pneumatics) where possible.
(4) Ensure that penetration protection designs are constructible and accessible for maintenance and inspection.
(5) Ensure PPDs are secure from unauthorized access (TEMPEST).
(6) Ensure that PPDs are protected from the elements and provided with environmental control (especially large power filters).

b. Drawings
(1) Include a complete schedule of shield electrical penetrations.
(2) Provide detailed drawings which show EM isolation critical features of the design for each unique type of electrical penetration:
(a) Power filters

(b) Signal line filters
(c) RF filters
(d) Grounding interface with shield
(e) Door interlock and alarm circuits

(3) Call out where RF gaskets will be used.
(4) Indicate split filter box covers.
(5) Indicate "clean" and "dirty" sides of filter enclosures.
(6) Show exact electrical surge arrestor (ESA) installation details.

c. Specifications
(1) Explicitly define performance requirements for each type of PPD.
(2) Define maintenance requirements.
(3) List recommended replacement parts.
(4) Specify quality assurance test requirements:
(a) Filters
(b) ESAs
(c) Enclosures
(d) Factory quality control tests
(5) Include evaluation of PPDs during final acceptance testing.

4. Special Cases

a. Overview
(1) Determine all electrical/electronic equipment and controls to be placed outside the shield.
(2) Analyze these special cases to determine if supplementary measures are required. Define the tailoring approach, and derive performance criteria.

b. Drawings. Define the additional protective features in sufficient detail to ensure that the delivered facility satisfies the Government requirements.

c. Specifications
(1) Specify the 50 dB protection actions required by the contractor, including quantitative performance criteria.
(2) Include quality control testing provisions appropriate to the particular tailored protective design in specification articles.

TEMPEST SHIELDING
IN-PROGRESS & ACCEPTANCE TEST

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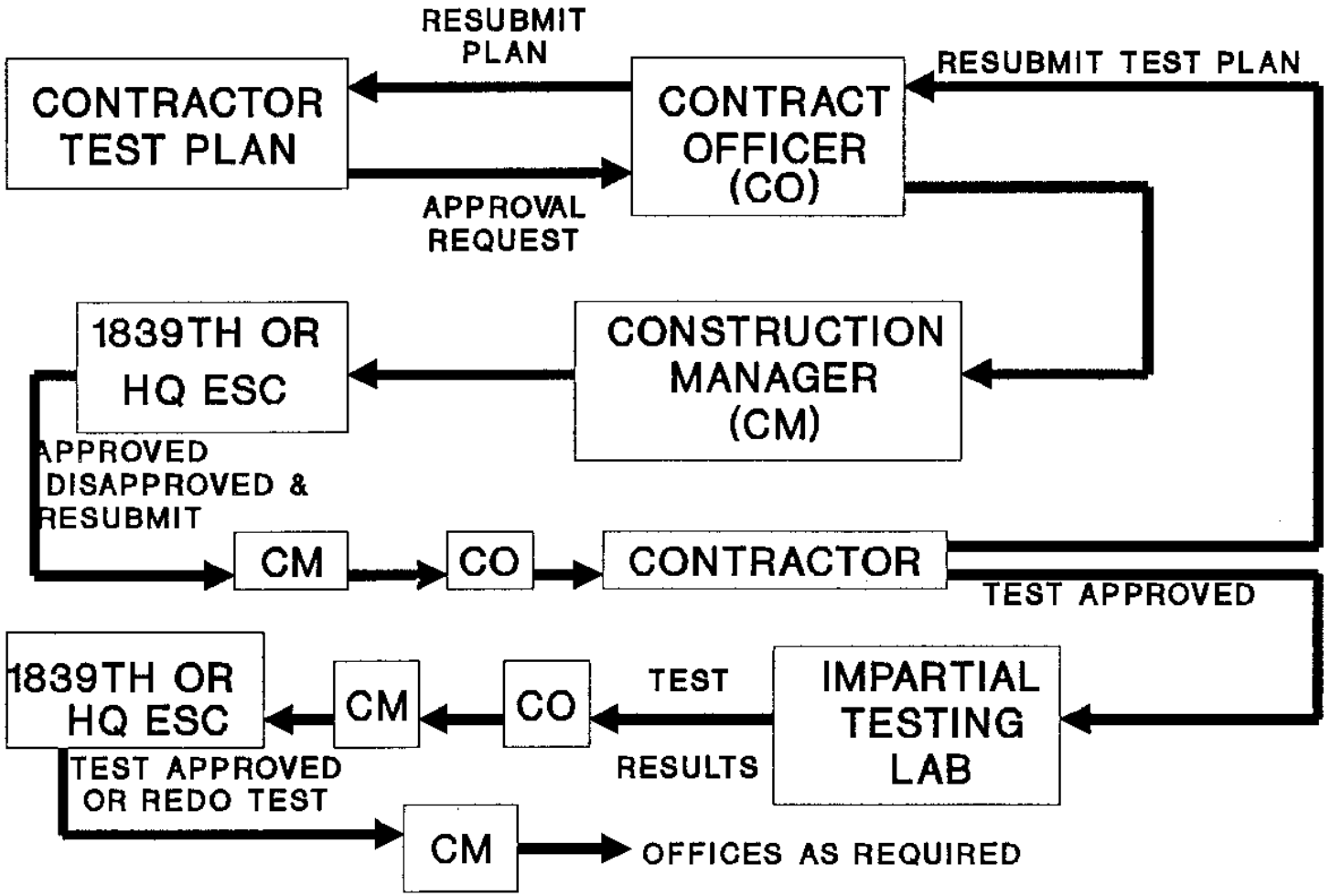

TEMP3

APPENDIX 7

50 dB SHIELDING TEST PLAN REQUIREMENTS

****

1. FACILITY IDENTIFICATION:

   A. CATEGORY CODE
   B. PROJECT PDC NO.
   C. PROJECT TITLE
   D. TOTAL SCOPE (SF)
   E. SCOPE OF PROTECTED AREA (SF)
   F. TYPE OF PROTECTION REQUIRED

2. APPLICABLE SPECIFICATIONS AND DOCUMENTS

3. PERFORMANCE REQUIREMENTS (FREQUENCIES, FIELD, & SHIELDING EFFECTIVENESS)

   A. HIGH FREQUENCY (E-FIELD & PLANE WAVE) TEST AREA AND ANTENNA LOCATION IDENTIFICATION
   B. LOW FREQUENCY (H-FIELD) TEST AREA AND TRANSMITTING ANTENNA LOCATION IDENTIFICATION

4. DETAIL TEST PROCEDURE
   A. DESCRIPTION OF TEST METHODOLOGY
   B. ARRANGEMENTS OF TEST EQUIPMENT
   C. PRECAUTIONS

5. TEST POINTS
   A. PERIMETER OF DOORS
   B. FILTER AREAS
   C. ALL PENETRATIONS
   D. WALL SEAMS

6. TEST EQUIPMENT USED (DESCRIPTION, MODEL NO. AND MANUFACTURER)

7. INDICATE ANY DEVIATIONS FROM REQUIRED PROCEDURES

8. IDENTIFY THE SECURITY CLASSIFICATION OF THESE RESULTS

SHIELDED ENCLOSURE TESTERS

Following are five currently available "sniffers." These or similar are the type that are recommended for used in periodic checks of shielded rooms or facilities. The testers must have an operating frequency of up to 450 MHz and a dynamic range of 110 DB. Cost is approximately $5,000 or less per set.

Manufacturer	Description	Model No.
Retlit, Inc,	Shielded Enclosure Test Set	TS45U
Euroshield Oy	RF Leak Detector	4F-130
Keene Corp, Ray Proof Div	Shielding Integrity Monitoring System	SIMS II
Eaton Corp, Electronic Instr Div	Shielded Enclosure Leak Detection System	Eaton 3500
Lindgen RF Enclosures, Inc	RF Shielding Integrity Monitor	

ENGINEERING TECHNICAL LETTERS (ETL)

SECTION A - CURRENT ETLs

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

ENGINEERING TECHNICAL LETTERS (ETL)

SECTION A - CURRENT ETLs

ETL Number	Title	Date Issued
88-2	Photovoltaic Applications	21 Jan 88
88-3	Design Standards for Critical Facilities	15 Jun 88
88-4	Reliability & Maintainability (R&M) Design Checklist	24 Jun 88
88-5	Cathodic Protection	2 Aug 88
88-6	Heat Distribution Systems Outside of Buildings	1 Aug 88
88-7	TEMPEST & High Altitude Electromagnetic Pulse (HEMP) Protection for Facilities	24 Aug 88
88-8	Chlorofluorocarbon (CFC) Limitation in Heating, Ventilating and Air-Conditioning (HVAC) Systems	4 Oct 88
88-9	Radon Reduction in New Facility Construction	7 Oct 88
88-10	Prewired Workstations Guide Specification	29 Dec 88
89-1	1988 Energy Prices and Discount Factors for Life-Cycle Cost Analysis	6 Feb 89
89-2	Standard Guidelines for Submission of Facility Operating and Maintenance Manuals	23 May 89
89-3	Facility Fire Protection Criteria for Electronic Equipment Installations	9 Jun 89
89-4	Systems Furniture Guide Specification	6 Jul 89
89-5	Air Force Interior Design Policy	not yet
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	23 Mar 90

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
83-6	24 May 83	Cancelled
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
84-5	Not Issued	Cancelled/Not Used
84-9	5 Jul 84	Superseded by ETL 88-7
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
86-12	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	]7 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, 88-5
87-6	21 Aug 87	Superseded by ETL 88-5
87-7	14 Oct 87	Superseded by ETL 89-1
Change 1	30 Dec 87	Superseded by ETL 89-1
87-8	19 Oct 87	Superseded by ETL 90-1
88-1	05 Jan 88	Superseded by ETL 89-2