

MIL-T-81821

8 February 1974
superseding
MIL-T-7755C(AS)
16 June 1969
and
MIL-T-6328J
17 December 1970

MILITARY SPECIFICATION
TRAINERS, MAINTENANCE, EQUIPMENT AND SERVICES
GENERAL SPECIFICATION FOR

**This specification is approved for use by all Departments
and Agencies of the Department of Defense**

1. SCOPE

1.1 Scope, General. This specification establishes the general requirements for Maintenance Trainer Sets (MTSs) and Maintenance Training Equipment (MTE).

1.1.1 *Scope of items and services.* The scope of items and services specified herein shall be as required to supply the Using Activity with all items, material, data, and services required to demonstrate, instruct, and provide practical experience in the operation, servicing, adjustment, calibration, troubleshooting, repair, and maintenance at organizational, intermediate and direct/general levels as defined by the Procuring Activity and the applicable related end item Logistics Support Analysis data for all systems, installations, components, and equipment of the related series end items.

1.1.2 *Separate procurement.* This specification may also be utilized for the separate procurement of individual maintenance trainers, related items, and services for organizational, intermediate and direct/general or dual level maintenance training capability for individual systems, subsystems, or equipment.

1.2 Style Classification. Maintenance trainers shall consist of one or more maintenance trainer panels of the style classifications listed below and defined in Section 6. These classifications are not intended to limit or preclude the development or design of additional or different styles;

MIL-T-81821

however, different styles shall be provided only when authorized by the Procuring Activity and specified in the Detail Specification. The panel style classifications are:

- a. Vertical display (see Figures 1 & 2)
- b. Equipment group (see Figures 3 & 4)
- c. Open frame (see Figures 5 & 6)
- d. Electronic workbench (see Figures 7 & 8)
- e. Animated/simulation (see Figures 9 & 10)
- f. Integrated trainer (see Figures 11 & 12)

1.3 Items. Items to be provided shall include, but not necessarily be limited to: maintenance trainers, power supplies, environmental control equipment, repair parts, ground support equipment, audio/visual aids (A/Vs), and related items as defined or specified herein.

1.4 Data. Data items include but are not necessarily limited to Detail Specifications, Manuals of Operation and Maintenance Instructions (MOM Is), illustrated parts breakdowns, drawings, microfilm, reports, inspection and test outlines, equipment service records, photographs, instructor training material, Index of Audio/Visual Aids, related end item Engineering Change Proposals (ECPs), Technical Directives, manuals and revisions thereto, and other related data as specified herein. These data shall be provided in support of the items and materials specified herein in accordance with the requirements of the Data Item Descriptions (DIDs) referenced in the applicable requirements paragraphs and specified in 6.2 herein. No data are required by this specification, or by the applicable documents referenced in Section 2, unless specified in the contract or order on the Contract Data Requirements List DD Form 1423. When required in accordance with 3.1.4.3, a "Make-or-Buy" program plan covering the maintenance trainers, related items, and services procured shall be provided for Government review and approval. The scope, format, and requirements for the "Make-or-Buy" program plan shall be in accordance with Armed Services Procurement Regulation (ASP R), Section 3, Part 9.

1.5 Services. Services including but not necessarily limited to administrative support, conferences, "Make-or-Buy" program, configuration control, documentation, and other services that do not contribute directly to the production of the deliverable items and materials specified herein, but are determined necessary for the overall performance of the maintenance training equipment program shall be provided in accordance with the requirements of 3.3.1.36 and 3.5.3.

2. APPLICABLE DOCUMENTS

2.1 Applicable Documents, General. , The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein. Later issues of these specifications, standards, documents, and publications, or new specifications, standards, documents, and publications, may be used subject to joint agreement of Procuring Activity and Contractor.

SPECIFICATIONS

FEDERAL

TT-L-32	Lacquer, Cellulose Nitrate, Gloss, for Aircraft Use
FF-C-88	Casters, Rigid and Swivel, Industrial Duty
NN-P-530	Plywood; Flat-Panel

MILITARY

MIL-C-3767/12	Connector, Plug, Electrical (Power, Three-Wire, Polarized, Spring-Loaded Pivoted Grounding Blade), Type UP131M
MIL-T-4782	Transparencies Technical Training, General Specification for
MIL-W-5088	Wiring, Aircraft, Installation of
MIL-C-5756	Cable and Wire, Power, Electric Portable
MIL-M-7793	Meter, Time Totalizing
MIL-A-8421	Air Transportability Requirements, General Specification for
MIL-I-8500	Interchangeability and Replaceability of Components/Parts for Aircraft and Missiles
MIL-W-8604	Welding of Aluminum Alloys; Process for
MIL-W-8611	Welding, Metal Arc and Gas, Steels and Corrosion and Heat Resistant Alloys; Process for
MIL-Q-9858	Quality Program Requirements
MIL-C-10799	Cloth, Coated, Cotton, Vinyl Coated, Fire and Mildew Resistant

MIL-T-81821

MIL-D-26715 Descriptive Identification Data to be Furnished by Government Suppliers

MIL-T-27615 Test Outline, Engineering, For the Inspection of Training Equipment; Requirements for the Preparation of

STANDARDS

MILITARY

MIL-STD-12 Abbreviations for Use on Drawings and in Technical-Type Publications

MIL-STD-17 Mechanical Symbols for Aeronautical, Aerospacecraft and Spacecraft Use

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-130 Identification Marking of US Military Property

MIL-STD-143 Specifications and Standards, Order of Precedence for the Selection of

MIL-STD-454 Standard General Requirement for Electronic Equipment

MIL-STD-461 Electromagnetic Interference Characteristics, Requirements for Equipment

MIL-STD-462 Electromagnetic Interference Characteristics, Measurement of

MIL-STD-470 Maintainability Program Requirements (For Systems and Equipments)

MIL-STD-480 Configuration Control-Engineering Changes, Deviations and Waivers

MIL-STD-490 Specification Practices

MIL-STD-704 Electric Power, Aircraft, Characteristics and Utilization of

MIL-STD-721 Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety

MIL-STD-808 Finishes, Protective, and Codes, for Finishing Schemes for Ground and Ground Support Equipment

MIL-T-81821

MIL-STD-810	Environmental Test Methods
MIL-STD-882	System Safety Program for Systems and Associated Subsystems and Equipment, Requirements for
MIL-STD-889	Dissimilar Metals
MIL-STD-1247	Identification of Pipe, Hose, and Tube Lines for Aircraft, Missile and Space Systems
MIL-STD-1472	Human Engineering Design Criteria for Military Systems Equipment and Facilities

DEPARTMENT OF DEFENSE

USAS Y32.2-1967	Graphic Symbols for Electrical and Electronics Diagrams
USAS Y32.16-1968	Reference Designations for Electrical and Electronics Parts and Equipments

AIR FORCE-NAVY AERONAUTICAL

AN2551	Cable Assembly, Power, Electrical, 28 Volt DC
AN2552	Receptacle – External Power, 28 Volt DC

PUBLICATIONS

DEPARTMENT OF DEFENSE INSTRUCTIONS AND DIRECTIVES

DOD INST 3224.1	Department of Defense Engineering for Transportability Program
DOD DIR 5010.19	Configuration Management

AMERICAN WELDING SOCIETY

AWS A-2.2-58	Monodestructive Testing Symbols
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(Application for copies should be addressed to the American Welding Society, 2501 NW 7th Street, Miami, Florida 33125)

MIL-T-81821

DATA ITEM DESCRIPTIONS (DEPARTMENT OF DEFENSE)

DI-A-6100	Report, Make or Buy Analysis, Maintenance Training Equipment
DI-A-6103	Report, Material Requirements/Receipt, Maintenance Training Equipment
DI-E-6106	Drawings or Associated Lists, Preparation of (Non-Government Design Activity) Forms 1 or 2
DI-E-6118	Reports, Engineering Changes Status - Maintenance Training Equipment
DI-E-6119	Report, Equipment Configuration Accountability, Maintenance Training Equipment
DI-E-6122	Specifications - Trainers, Maintenance, Equipment and Services
DI-E-6123	Index, Audio/Visual Aids - Training Equipment and Training Courses
DI-E-6124	Audio/Visual Aids, Master Reproducible and Review Copies, Training Equipment and Training Courses
DI-F-6125	Report, Cost, Maintenance Training Equipment
DI-H-6129	Outlines, Acceptance and Test - Maintenance Training Equipment
DI-H-6132	Records, Equipment Service, Maintenance Training Equipment
DI-H-6133	Manuals, Photographic, Maintenance Training Equipment
DI-H-6134	Reports, Engineering and Production Progress Maintenance Training Equipment
DI-H-6135	Reports, Facilities - Maintenance Training Equipment
DI-H-6136	Reports, Acceptance - Maintenance Training Equipment
DI-L-6139	Reports, Rejected/Non-Operable Parts Utilization Maintenance Training Equipment
DI-M-6152	Manuals, Operation and Maintenance Instruction, Maintenance Training Equipment
DI-P-6164	Report, Materiel Shortage - Maintenance Training Equipment
DI-P-6167	Forms, Student Evaluation - Training Courses

DI-H-6197	Outlines - Training Courses
DI-H-6198	Guides, Lesson -Training Courses
DI-H-6199	Sheets, Student Information/Instructor Training - Training Courses
DI-P-6200	Proposals, Training Courses and Instructor Training Services
DI-P-6201	Minutes, Conferences, Formal Reviews, Inspection and Audits - Training Equipment and Courses
DI-P-6202	Agenda, Conferences and Conference Requests Training Equipment and Training Courses
DI-F-6203	Report, Funding Status, Basic Ordering Agreement - Maintenance Training Equipment
DI-E-6204	Exhibits, Engineering Change Proposals - Training Courses, Maintenance Training Equipment Related Items, and Services
DI-H-6205	Charts, Milestone - Maintenance Training Equipment

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the Procuring Activity or as directed by the Contracting Officer.

2.2 Precedence of Documents. In case of conflict between requirements contained in this specification, any Contractor documents, and those in the documents referenced in 2.1 herein, the requirements of this specification shall govern.

MIL-T-81821

3. REQUIREMENTS

3.1 System and Item Definitions. The definitions given herein are presented in a manner for application in programs consisting of complete Maintenance Trainer Sets (MTS) and programs consisting only of individual Maintenance Training Equipment (MTE) items.

3.1.1 Detail Specification. Detail design/performance specifications and appropriate revisions thereto shall be developed to define the specific training equipments, related items and services specified herein. The Detail Specification shall conform to the requirements of DOD Authorized Data List (ADL), Data Item Description (DID) Number DI-E-6122.

3.1.2 Item definition. The primary items which individually constitute the Maintenance Training Equipment (MTE) or collectively integrate into the Maintenance Trainer Sets (MTS) shall consist of a series of maintenance trainers or maintenance trainer panels including: equipment groups, mock-ups and animated displays; requisite electrical, hydraulic, and pneumatic power supplies; environmental control equipment; repair parts; A/Vs; manuals; drawings; reports; data; applicable Ground Support Equipment (GSE); and other related items and services defined and specified herein.

3.1.3 Interface definition. Maintenance trainers specified herein shall be designed and fabricated to represent interfaces of the actual related series end items during normal maintenance operation. Not only must the facility interface requirements be considered, but also the interface requirements of interconnected maintenance training equipment. These interface requirements are specified by 3.2.1.2 for objectives and functional requirements; 3.2.1.5.1 and 6.3.17 for interconnected systems; 3.2.1.11.1 for electrical power facilities; 3.3.1.33 for hydraulic and pneumatic power facilities; 3.3.1.20, 3.3.1.21.2.1, and 3.3.1.21.5, for electrical power interconnection; and 3.3.1.34 for hydraulic and pneumatic interconnection.

3.1.4 Government furnished equipment. The Government will supply to the Contractor, all Government Furnished Equipment (GFE) required for installation on, or in support of, the training equipment, related items, and services specified herein. GFE specified herein shall be limited to those items in the categories listed below, as defined in Section 6 herein, which are also provided as GFE for installation in, or support of, the related series end items. These items shall be specifically designated in the Detail Specification. Individual parts, components, bits and pieces of these complete items (excluding spares and repair parts therefore), required for the trainers, related items and services specified herein, which, are in addition to, or in lieu of, the complete item, will not be supplied as GFE and shall be provided as CFE. GFE shall consist of the following categories:

- a. G F E – *End item and support equipment technical manuals;*
- b. G F E – *Government installed operational equipment;*
- c. G F E – *Contractor installed operational equipment;*
- d. G F E – *Common ground support equipment;*
- e. G F E – *Peculiar ground support equipment.*

3.1.4.1 Contractor furnished equipment. Contractor Furnished Equipment (CFE) required shall include all systems, subsystems, equipment and materials, excluding GFE, required for fabrication, installation on, or support of, the training equipment, related items, and services specified herein in accordance with the design, operational, and training capability requirements of the training equipment Detail Specification. CFE shall consist of the following categories of equipment and materials as defined in Section 6 herein:

- a. CFE – *Related end item operational equipment;*
- b. CFE – *Peculiar ground support equipment; (normally provided GFE);*
- c. C F E – *Trainer peculiar equipment and materials.*

3.1.4.2 Government and Contractor furnished equipment quantities and limitations. The quantities of GFE and CFE items to be provided shall consist of the quantity necessary to provide the training capability, design, construction, operational, and performance requirements of the training equipment Detail Specification. All information and guidance furnished by the Procuring Activity shall be utilized in establishing the required quantity of GFE and CFE. These quantities need not be identical to the quantities required for the related series end items, and consideration shall be given to time sharing of selected operational equipment and portable support equipment between a minimum of two (2) and a maximum of three (3) trainer panels which do not require simultaneous operation in the planned training utilization of the Using Activity. All items and quantities of GFE and CFE, as defined herein, which are required for the maintenance trainers and related items specified herein shall be specified in the training equipment Detail Specification. Subsequent changes, revisions, or additions to the GFE and CFE items and quantities, after initial

MIL-T-81821

approval by the Procuring Activity of the Detail Specification or revision thereto, shall not be considered an increase in scope under the applicable specification or order unless the change, revision, or addition resulted from an approved Government responsibility Class I Change to the related series end items, a Government directed change in maintenance philosophy for the related series end items, or a Government directed design change to the trainers and related items to increase the scope of training capability to be provided.

3.1.4.3 “Make-or-Buy” program. All Maintenance Training Equipment and services specified herein shall be subject to a “Make-or-Buy” program when the estimated price for the trainers, related items, and services to be provided under a single order exceeds one million dollars (\$1,000,000.00) or when specifically directed by the contracting officer. Specific requirements and procedures for the “Make-or-Buy” program and Government approval thereof shall be in accordance with Armed Services Procurement Regulations (ASPR) Section 3, Part 9.

3.1.4.4 Priority for the use of Government and Contractor furnished equipment. The first production configured units of CFE items and initial GFE receipts, after related end item test program requirements have been met, shall be utilized for the fabrication and support of the Maintenance Training Equipment and services specified in the Detail Specification, in accordance with the training equipment priority directives of the Using Service.

3.1.4.5 Support equipment. All Government and Contractor furnished support equipment, as defined in Section 6 herein, required for installation on, or in support of, the Maintenance Training Equipment and services specified in the Detail Specification shall be supplied and delivered concurrently.

3.2 Characteristics

3.2.1 Performance. The trainers shall be designed to represent optimal consideration of the factors which facilitate learning and influence transfer of training. To the extent feasible, this shall include near-exact representation of system maintenance tasks, derived from the related end item Logistics Support Analysis operating conditions, and emergency procedures; widest range of task simulations and performance requirements; representation of realistic cues required for early detection of impending malfunctions; and elimination of irrelevant cues (i.e., the student sees or hears the instructor prepare the trainer for system malfunction simulation).

3.2.1.1 Training capability. Maintenance trainers, related items, and services specified herein shall be capable of supporting instruction for organizational and intermediate and direct/general maintenance levels applicable to related series end items in accordance with the Logistics Support Analysis (LSA) Program Data and the maintenance concept for the related end items in accordance with the maintenance support plan of the Using Service. Unless otherwise specified in the trainer description in the Government approved Detail Specification, each trainer and related items shall be designed and constructed to provide applicable maintenance level training capability for systems, subsystems, and items of equipment which are applicable to a personnel specialty as determined by the Personnel Requirements Documents of the Using Service for the related series end items. The training capability to be provided by each trainer shall be determined by a thorough Contractor conducted task analysis.

3.2.1.2 Authentic operation. Maintenance trainers specified herein shall be designed and fabricated to authentically represent the operation of the actual related end items. All equipment functions, operations, responses and interfaces shall be identical to the functions, operations, responses and interfaces of the actual related series end items during normal maintenance operation. Provisions shall be included to permit the utilization of all applicable maintenance support equipment in the same manner as utilized on the actual related series end items. In cases where maintenance instructional value would be reduced by these requirements, specific deviations shall be indicated in the appropriate trainer descriptions in the Detail Specification.

3.2.1.3 Animation capability. An animation capability may be required. The definition of this requirement and its characteristics are given in 3.3.1.35 and 3.3.1.35.1.

3.2.1.4 Simulated failure of systems. The various operating systems on the trainer panels shall be designed and constructed in such a manner that the instructor can simulate typical malfunctions which are typical of the system similar to the estimated failures on the related series end items. Simulated malfunctions shall be limited to those necessary to train the student to troubleshoot the system. All simulated malfunctions incorporated in the trainer panels shall be indicated, in the appropriate trainer descriptions in the Detail Specification.

3.2.1.4.1 Electronic failures. Simulated electronic failures shall be incorporated in electronic trainer panels only when it is not feasible to introduce failures through the use of faulty substitute items. Faulty substitute items such as assemblies, subassemblies, or components (modules, resistors, transistors, tubes) shall be supplied to simulate failure or malfunctions for troubleshooting purposes for CFE items only. The items provided shall be specified in the appropriate trainer description in the Detail Specification. Faulty components supplied shall be

MIL-T-81821

limited to those items with known defects which are generated in the Contractor's test and production programs, which would otherwise be scrapped and which can be provided at minimum cost applicable to the items and services specified herein. Reasonable effort shall be exerted to retain the aforementioned faulty subcomponents for delivery with the applicable trainer panels. In the event sufficient faulty items are not available, a proposed Detail Specification revision shall be submitted for review, approval, and contractual authorization for the provision of modified or blank modules, subassemblies, or components as Contractor furnished trainer peculiar equipment under the Detail Specification.

3.2.1.5 *Electronics trainer panels, general.* Operable related end item electronic systems shall be grouped in accordance with the electronic personnel specialties recommended by the applicable personnel requirement documents, provided such personnel specialty grouping does not seriously degrade or impair the training objectives of the trainer panel. Operable electronic equipment shall be provided in such a manner as to permit the use of all Government approved support equipment for the performance of organizational, intermediate and direct/general levels of maintenance, as applicable.

3.2.1 .5.1 *Organizational level electronics maintenance trainers.* Organizational level electronics maintenance trainers shall be designed and constructed to authentically represent the applicable system as installed in the related series end items. System equipment or its simulated equivalent, shall be mounted as in the related end items to permit the use of all Government approved organizational support equipment for the performance of organizational level maintenance on equipment of the system while still interconnected as an operating system. These trainers shall be independently operable and shall be provided with interconnect capability to operationally integrate with other related system organizational level trainers, or in lieu thereof, shall include simulated signal inputs in accordance with 3.3.15, provided that the simulation does not reduce training capability. The operational interconnection and integration capability of related organizational level electronic trainers shall duplicate the integration of the represented systems in the related end items.

3.2.1.5.2 *Intermediate and direct/general level electronics maintenance trainers.* Intermediate and direct/general level electronics maintenance trainers shall be designed and constructed to provide all instruction required for intermediate and direct/general level maintenance of the equipment including, as applicable, calibration, repair, or replacement of damaged or unserviceable parts, components, or assemblies, and maintenance of applicable support equipment. Operable electronic equipment shall be mounted on electronic work benches as used in the operational maintenance activity and shall be capable of being brought to the working surface of the bench for maintenance troubleshooting without being disconnected from the trainer.

3.2.1.5.3 Dual maintenance level electronics trainers. Trainers providing both organizational, intermediate and direct/general level maintenance training capability On a single trainer shall be designed to comply primarily with the requirements of intermediate and direct/general level electronics maintenance trainers specified herein, and shall provide the maximum feasible additional capability for organizational level maintenance training.

3.2.1.6 Noise level. Items such as pumps, motors, and frequency converters shall be shock-mounted to minimize vibration and noise level. If the combined noise level, when measured at a horizontal distance of 10 feet from the trainer in any direction exceeds the noise level limits specified in Table 1, the items involved shall be grouped together on a mobile platform which may be readily removed from the trainer and placed outside the classroom, or soundproofing shall be provided as part of the trainer (soundproofing is preferred). It shall be possible to operate such items while they are installed on, or remotely located and interconnected to, the trainer panel.

TABLE I, Noise Level Limits

Frequency (Octave) Band Center Frequency (Hz)	Noise Level (db)
63	71
125	65
250	59
500	54
1,000	52
2,000	50
4,000	49
8,000	48

3.2.1.7 Availability. The trainer availability factor for scheduled operation in the training environment shall be a minimum of nine-tenths (0.9) based on the following formula:

$$A = \frac{MTBF}{MTBF+MTTR}$$

A = Availability

MTBF = Mean time between failure (see 3.2.3)

MTTR = Mean time to repair (see 3.2.4)

MIL-T-81821

3.2.1.8 *Heat dissipation and cooling.* Trainer panels or items of equipment containing heat-producing components shall be designed and arranged so that stabilized operating temperatures do not exceed the rated temperatures of parts, equipment, and components exposed thereto. If this cannot be accomplished, adequate provisions shall be made for the removal of heat. Where the rate of heat emission is too high to warrant reliance upon natural convection for cooling, forced ventilation shall be installed. Such ventilation shall prevent the stabilized operating temperatures of parts, components, and equipment mounted in the enclosures from exceeding their rated temperatures with an ambient air temperature of 90° F. Under any condition of operation, at an ambient temperature of seventy-seven degrees (77°) F, the temperature of exposed parts and surfaces shall not exceed one hundred and forty degrees (140°) F, except that the operating controls and control panels shall not exceed one hundred degrees (100°) F. Trainers shall be capable of operating continuously for 4 hours or for the three complete cycles of operation, whichever is longer, without overheating or damaging the equipment.

3.2.1.9 *Input signals.* Simulated input signals may be provided in lieu of duplication of equipment or system interface/interconnection with actual equipment on related trainer panels when interface/interconnection is not feasible. Simulated input signals shall be identical to the full range of variations which would be encountered on the actual system during normal maintenance operation. Provision shall be incorporated for the utilization of all applicable organizational level support equipment for complete organizational checkout of the system on organizational or dual maintenance trainers in the same manner as it is used on the actual related end item. All simulated input signals provided in lieu of actual equipment interface/interconnection shall be indicated in the appropriate trainer descriptions in the Detail Specification. The method of simulation and characteristics of the simulated signal shall be specified therein.

3.2.1.10 *Output signals.* A means shall be provided for monitoring all output signals. All applicable output signals incorporated in the trainer panels shall be listed, and the means of monitoring these signals shall be indicated in the applicable trainer descriptions in the Detail Specification.

3.2.1.11 *Power requirements, general.* The maintenance trainers programmed for use within the continental limits of the United States shall be designed to operate from a 120/208 VAC, three (3) phase, four (4) wire, sixty (60) Hz power source, or appropriate power conversion units utilizing this input power.

3.2.1.11.1 *Permanent power distribution systems.* Unless otherwise specified in the Detail Specification the Government facility will include permanent electrical, hydraulic, and pneumatic power distribution systems. The power conversion units required for the trainer operation shall be contractor-furnished and shall be specified in the Detail Specification. The facility power distribution requirements shall be specified in the facilities report specified in 3.4.7.2.

3.2.1.11.2 *Power from overseas sources.* For overseas use, the voltage and frequency of the electrical power source at the overseas trainer facility shall be specified in the trainer Detail Specification. The power conversion units required to convert the voltage and frequency of the facility power source to the voltage and frequency required for trainer operation shall be contractor-furnished and shall be specified in the Detail Specification.

3.2.1.11.3 *Power design for foreign military sales.* Trainers to be sold under the foreign military sales program shall be designed to operate from power sources compatible with those available in-country, insofar as power voltage and frequency are concerned. Necessary power conversion units, whether these units are to be contractor-furnished or furnished by the customer, shall be specified in the trainer Detail Specification.

3.2.1.11.4 *Power supply and environmental control equipment.* Unless otherwise specified in the Detail Specification, basic electrical, hydraulic, and pneumatic power supply and environmental control equipment required shall be furnished by the contractor.

3.2.1.11.5 *Central power conversion and environmental control units.* Unless otherwise specified in the Detail Specification, the electrical power conversion units, hydraulic power units, and pneumatic power units (air compressors) required to supply power to the permanent power distribution systems of the facility, and any special environmental control equipment required to operate the trainers in the classroom environment, shall be furnished by the Contractor. The central power conversion units shall provide sufficient continuous power of each type required (electrical, hydraulic, and pneumatic), to simultaneously operate the complete maintenance trainer set, plus a growth factor allowance of at least twenty-five percent (25%). The central power conversion units shall be designed to operate from a one hundred twenty/two hundred eight (120/208) VAC, three (3) phase, four (4) wire, sixty (60) Hz power source. Maximum effort shall be exerted to utilize standard federal stock listed power units, if appropriate. The central electrical power conversion units shall provide one hundred twenty/ two hundred eight (120/208) VAC, three (3) phase, four (4) wire, four hundred (400) Hz power to supply the facility buss duct network. Electrical power conversion unit output tolerance, such as frequency and voltage regulation, shall conform to the requirements specified in MIL-STD-704, The central hydraulic and pneumatic power units shall provide the volume and pressure of hydraulic and pneumatic power output to supply the facility hydraulic and pneumatic power distribution systems. The environmental control units shall provide the required temperature and humidity control to satisfactorily operate the trainers under the classroom environmental conditions specified in 3.2.5. Each central power conversion unit shall be equipped with input and output overload protection, a duplicate remote control and monitor panel, and a timer to register the hours of operation. The central power conversion units and environmental control equipment to be furnished shall be specified in the Detail Specification.

MIL-T-81821

3.2.1.11.6 Individual trainer power conversion units. When permanent power distribution systems are not utilized, individual electrical power conversion units, hydraulic power units, and pneumatic power units, as required, shall be provided for operation of each maintenance trainer or individually operated trainer panel. Each individual power conversion unit shall be equipped with input and output overload protection and a timer to register the hours of operation. When applicable, 120/208V, 3-phase, 400-Hz power shall be provided by appropriate power conversion units, as approved by the Procuring Activity, which are capable of operating from a 208V, 3-phase, 4-wire, 60-Hz, or a 230V, 3-phase, 60-Hz power source. The power conversion unit shall provide 208V, 3-phase, 400-Hz and 120V, single-phase, 400-Hz power. Power conversion unit output tolerances, such as frequency and voltage regulation, shall conform to the requirements specified in MIL-STD-704. An output cable equipped with a connector on one end that will mate with the power conversion unit input receptacle on the applicable power distribution box shall be provided. A 50-foot power input cable shall also be provided. The type and quantity of power conversion units required shall be determined jointly by the Contractor and the Procuring Activity and shall be specified in the Detail Specification. Trainer panels requiring four hundred (400) Hz power exceeding five thousand (5,000) VA may receive this power from a separate frequency converter. Trainers requiring less than five thousand (5,000) VA four hundred (400) Hz power will normally receive power from a frequency converter mounted on the trainer panel.

3.2.1.11.7 Standard power supply. Standard power supply equipment (Government stock or commercial) shall be used when available in lieu of nonstandard power supplies.

3.2.1.11.8 Power supply – 28 VDC. Each trainer, independently operable trainer panel, and panel group which requires less than twenty-five-hundred (2,500) VA of twenty-eight (28) VDC power shall contain an integrally mounted solid-state power supply to provide sufficient power required for operation plus a minimum twenty percent (20%) growth factor. Trainer panels requiring power exceeding twenty-five-hundred (2,500) VA of twenty-eight (28) VDC may receive this power from a solid-state power supply mounted on the trainer panel, or from a separate solid-state power supply, to provide sufficient power required for operation plus a minimum twenty percent (20%) growth factor. The number of units required shall be based on the total 28 VDC power requirements for the trainer set, as determined jointly by the Contractor and the Procuring Activity, and specified in the Detail Specification.

3.2.1.12 Hydraulic and pneumatic power units. Hydraulic power units and pneumatic power units shall be provided as required for operation of each maintenance trainer or individually operated trainer panel, or as required to supply central power to the permanent power distribution system of the facility. Hydraulic and pneumatic connections shall be strain-relieved as necessary to prevent undue stresses on lines and plumbing. Components required (reservoir, pressure regulator,

relief valves, filters, and similar items) to supply regulated pneumatic or hydraulic pressure shall be built into the power units. A means of depressurization of the pressure lines shall be incorporated in each unit to relieve line pressure prior to detachment of the power unit from the facility distribution system or trainer panel.

3.2.1.13 *Fluids.* Any simulated fluids to be used in fluid system trainers shall have characteristics (such as dielectric constant, specific gravity, etc.) similar to those of the related end item fluid represented, except for the following: its flash point shall be at least two hundred degrees (200°) F, and it shall not give off toxic fumes which would create a personnel safety hazard. The simulated fluid shall be free of materials which support bacterial growth or have a corrosive or deteriorative effect on the materials used in construction of the trainer. Coloring may be added to the simulated fluid if desired. The fluid system trainers shall be designed and constructed to withstand the weight of the simulated fluid.

3.2.2 *Physical characteristics*

3.2.2.1 *Construction.* The construction of the trainers and affiliated items shall be based upon all of the requirements of this document as reflected in the Government approved Detail Specification. The construction shall optimize performance, physical characteristics, life phases such as operation, transportation, storage, cost, procurement time and other applicable features.

3.2.2.2 *Weights, dimensions and moments.* The actual operating and transporting dimensions and weight of each trainer panel shall be listed in the appropriate trainer description in the Detail Specification. Dimensions and weight shall be held to a minimum consistent with cost , available space and training effectiveness. The maximum transporting dimensions of any trainer panel shall be seventy-two (72) inches in height, sixty (60) inches in width, and one hundred forty-four (144) inches in length. The weight of each trainer panel in the transporting and operating configuration shall not exceed three thousand (3,000) pounds. Dimensions and weights in excess of these limitations will be acceptable only when specifically authorized by the Procuring Activity, and reflected in the Detail Specification as an authorized deviation to this requirement.

3.2.2.2.1 *Reduction of component size and weight.* If the size or weight, or both, of actual related end item components used in the trainers preclude compliance with the size-weight limitations specified herein, and deviations are not acceptable to the Procuring Activity, both the size and weight of these components may be reduced by removing those sections or portions which contribute the least significant training value. For example, to reduce the length of a landing-gear

MIL-T-81821

strut, that portion of the landing-gear strut between the mounting trunions and the pneumatic portion should be cut away and the two surfaces welded together. Modifications to related end item components for the purpose of size or weight reduction shall be indicated in the Detail Specification.

3.2.2.2 *Moment.* In shipping configuration the center of gravity of each trainer panel shall not be more than twenty-five (25) percent of its height above the bottom, more than twenty-five (25) percent of its length longitudinal from the center, or more than twenty-five (25) percent of its width fore or aft from the center. In operational configuration the trainer panel shall not be capable of being overturned by a seventy-five (75) pound horizontal force applied in any direction at the top of the panel.

3.2.2.3 *Dimensions and tolerances.* Dimensions and tolerances not specified shall be as close as is consistent with the best workmanship practices. Where dimensions and tolerances may affect interchangeability, operation, or performances of the trainers, they shall be held or limited accordingly.

3.2.2.3 *Bench top construction.* To reduce the possibility of personnel injury due to contact with high voltages inherent in certain electronic equipment, the trainer bench top, including any folding extensions, shall be surfaced with a nonconductive material cemented to the bench top or secured with nonconductive fasteners. The material selected shall be durable, wear resistant, impervious to moisture, and shall not support combustion. The edges of the bench top shall be trimmed with a nonmetallic, nonconductive material. The horizontal work surface (bench top) shall be approximately 36 inches above floor level.

3.2.2.4 *Attachment of components.* Each major component and subassembly shall be attached in a manner that will permit easy and ready access to its interior parts, terminals, and wiring for complete circuit checking and for removal of component parts. It shall not be necessary to displace or remove wires, cables, or subassemblies in order to gain access to mounting screws, terminals, soldered connections, etc. Components which are subject to replacement or servicing shall not be permanently secured by rivets, welding, or other means which prohibit ready removal. Detachable sectionalized items shall be mounted in accordance with 3.3.1.16.2. Parts other than cutaways shall be attached by conventional means. Clocks, cameras, and other high pilferage items shall be secured in a manner that will discourage ready removal. Provisions for sectional teardown and breakaway of major components shall be incorporated in the trainer panels for maintenance and transportation considerations. Means of attachment of components shall consider safety engineering factors.

3.2.2.5 Panel plumbing. Fluid lines and tubing shall be mounted on the trainer panels in a manner that will provide a maximum view of individual fluid lines and tubing, and will not obstruct the view of other components or preclude visual tracing of individual fluid lines and tubing in the normal classroom situation. All fluid lines and tubing shall be installed in such a manner that they are parallel to any given edge of the trainer panels and the line bends shall be ninety degrees (90°). Extended lines or tubing runs shall be adequately supported to minimize vibration and resonance.

3.2.2.6 Antennas, dummy loads, and absorption enclosures. If an electronic trainer panel should require an antenna that is considered too large for installation on the panel, and if little instructional value would be gained from utilizing the actual antenna, a substitute shall be provided as space permits. When radiation or R F energy exists, which might interfere with established warnings or communications systems or be injurious to human safety, dummy loads or absorption/attenuation enclosures shall be provided to insure human safety. When dummy loads are other than that specified in the approved support equipment for the system represented they shall be accurately matched to the equipment and carefully tested by the Contractor to insure that radiation of RF energy is in accordance with 4.2 through 4.2.1.7 of MIL-STD-461. Any substitute antennas provided in lieu of actual antennas under authority of this paragraph shall be listed as simulated items in the appropriate trainer descriptions in the Detail Specification.

3.2.2.7 Other physical properties. Each trainer shall be designed and constructed so that parts will not work loose in service. This shall be accomplished by the maximum use of appropriate locking devices. Trainers shall be built to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service. Adequate ventilation shall be provided for all items which generate heat when operating.

3.2.3 Reliability. Design reliability requirements for trainer peculiar items shall provide the MTBF factor needed in meeting the availability requirement specified in 3.2.1.7. A formal reliability demonstration is not required; however, failure to meet the reliability and trainer availability factors specified herein in service utilization during the applicable warranty period shall be subject to corrective action under the applicable warranty provisions. Quantitative reliability requirements will be established by the Procuring Activity for each trainer of a maintenance trainer set on an individual basis and will be expressed in terms of Mean-Time-Between-Failures (MTBF) or Mean-Cycles-Between-Failures (MCBF). A cycle is one complete operation of the trainer in accordance with the operating instructions, regardless of the time required. The Contractor shall be responsible only for failure of trainer-peculiar items, including trainer-peculiar vendor items. The Contractor shall not be responsible for failure of unmodified Government-Furnished Equipment

MIL-T-81821

(GFE), unless the failure is a result of the Contractor's trainer design, which is not within the design limits of the equipment operation.

3.2.4 Maintainability. Maintainability requirements shall be in accordance with MIL-STD-470, except that there shall be no requirement for a written maintainability program plan or a design review and evaluation plan prepared specifically to satisfy the requirements of MIL-STD-470. However, during the design drawing review, the Procuring Activity will review the Contractor's maintainability considerations for compliance with the requirements specified herein. The Contractor shall only be responsible for the maintainability requirements of trainer-peculiar items. Emphasis shall be placed on design and construction to provide the following considerations:

- (a) A minimum number of parts consistent with reliability and performance specified herein.
- (b) Minimum time and training necessary for assembly, disassembly, location of trouble sources, and maintenance including servicing.
- (c) Permit maintenance with general-purpose tools and equipment normally available commercially. The requirement for special-purpose tools and equipment shall be subject to approval by the Procuring Activity.
- (d) Permit adjustments, servicing, replacement of parts and components, and other maintenance with minimum disturbance to other equipment parts or components.
- (e) Permit rapid visual inspection of all parts and components that are most likely to fail and that could cause personnel hazards if they fail during use.
- (f) Where adjustment may be required, all cams, gears, pulleys, etc., mounted on a shaft shall be secured to the shaft by two hex socket setscrews located approximately 90° to 135° apart. Where adjustment is not required, these items shall be secured to the shaft with a keyway and a pin.
- (g) Require minimum time to repair each failure, excluding parts acquisition time.

- (h) The trainer panels and related trainer peculiar materials and equipments shall be designed to keep the maintenance requirements to a minimum, both in level of skills and number of personnel required to maintain the trainer.
- (i) Minimum Mean Time To Repair (MTTR). The MTTR for the trainers shall be based on the sum of the corrective maintenance down time for a given period of time divided by the sum of all corrected maintenance actions for that same period, excluding parts acquisition time. This period of time or the MTTR requirement will be specified in the Detail Specification.

3.2.5 Environmental conditions. All maintenance training equipment shall be designed for normal operation in the average classroom environment, and to withstand transportation and storage environments to be encountered. Average classroom environments include temperature range of sixty-five degrees (65°) F to ninety-five degrees (95°) F; humidity range from twenty-percent (20%) RH (relative humidity) to one-hundred percent (100%) RH at seventy degrees (70°) F; and atmospheric pressure encountered at sea-level to one (1) mile altitude. The range of conditions encountered during transportation and storage include temperature range from minus-twenty degrees (-20°) F to two-hundred degrees (200°) F; humidity range of ten percent (10%) RH at seventy degrees (70°) F to one-hundred percent (100%) RH at one-hundred degrees (100°) F; and atmospheric pressure range from sea-level to thirty-thousand (30,000) ft altitude for unpressurized aircraft cargo spaces. In addition, transportation environments include conditions such as vibration, dust, acceleration, acoustical noise, shock, etc. encountered in transportation by aircraft, trucks, and sea craft, and shock due to fork-lifting.

3.2.6 Transportability. Trainer panels shall be designed to comply with the transportability requirements of DOD INST. 3224.1. The trainers covered by this specification are transported primarily by air-ride van and military transport aircraft. Design for transportability shall comply with the requirements for these modes of transportation.

3.2.6.1 Air transportability. Trainers designated in the Detail Specification for air transportability shall be designed to comply with the appropriate air transportability requirements of MIL-A-8421.

3.2.6.2 Disassembly for shipment. In the event the size and weight limitations specified in 3.2.2.2, severely limit trainer design for optimum training capability or would result in excessive costs, consideration shall be given to the feasibility of partial disassembly of the trainer for

MIL-T-81821

shipment purposes. When partial disassembly of the trainer for shipment purposes is required, appropriate disassembly instructions shall be included in the trainer MOMI specified in 3.4.2.

3.3 Design and Construction

3.3.1 *Materials, processes and parts.* Specifications and standards for all materials and parts, and Government certification and approval of the processes and equipment that are not specifically designated herein and that are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143 and 3.3.1.9.

3.3.1.1 *Panel materials.* All panels shall be durable, hard surfaced, relatively rigid structures. Plywood, aluminum bonded plywood, balsa sandwich board, honeycomb (metal, plastic, or cardboard), or other lightweight materials may be used for paneling, except that metallic surfaces shall not be used for electrical or avionics trainers. The choice of material shall be based on specific needs of the particular trainer, economy, local manufacturing techniques, or like criteria. If the panel material is plywood, it shall conform to the requirements of NN-P-530 for Type I exterior fully waterproof bond plywood. Any splice made in unsupported areas shall be further reinforced by plywood gusset plates or hardwood ribs to such an extent that original plywood strength will be restored. All paneling or laminated material used in the construction of the trainer panels shall be edged with a material entirely suitable for the purpose, such as aluminum, stainless steel, plastic, or nonconductive channel/angle on all exposed edge surfaces. Where electrical potential hazards exist, nonconductive materials shall be used.

3.3.1.2 *Frame materials.* The type of material and method of fabrication for trainer panel frames shall be indicated in the appropriate trainer description in the Detail Specification. The shape and size of the frame will be predicated on structural requirements and minimization of cost and weight. Trainer frames shall be constructed from round, rectangular, square, angular formed, or extruded metal. Vertical frame members shall be supported by braces welded or bolted to the vertical and horizontal frame members.

3.3.1.2.1 *Skid materials.* When wooden skids are specified in the Detail Specification, materials used to fabricate the skids shall be selected from the most practical grade A commercial hardwoods available (i.e., oak, maple, birch, etc.), taking into consideration splintering, splitting characteristics, and durability.

3.3.1.3 *Finish and protective coatings.* When materials that are subject to deterioration during service usage are used in the construction of the trainer panels, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance

requirements of this specification. The use of any protective coating that will crack, peel, chip, or scale shall be avoided. Precautions shall be taken to adequately seal all laminated material to prevent delamination due to the absorption of moisture.

3.3.1.4 *Fungus inert materials.* Materials that are nutrients for fungus shall not be used where it is practical to avoid them. Where used and not hermetically sealed, they shall be treated with a fungicidal agent that will render the resulting exposed surface fungus resistant and will pass the fungus test specified in Method 508 of MIL-STD-810. Fungus resistant materials shall conform to Requirement 4 of MIL-STD-454.

3.3.1.5 *Finish.* Finish shall be applied to all surfaces where required for considerations of appearance, personnel safety, and protection against corrosion or other deterioration. Application of finish shall be accomplished in accordance with FED SPEC-TT-L-32 in such a manner as not to impair performance of the trainer. All related end item equipment shall be the same color as on the actual related end item. All framework and unfinished paneling shall be finished in aircraft gray. Walking surfaces shall be finished with a nonskid material.

3.3.1.6 *Cleaning, painting, plating, anodic films, and chemical treatments.* Cleaning, painting, plating, anodic films, and chemical treatments shall be in accordance with MIL-STD-808. The procedures specified herein shall be utilized. Additional procedures required for the finishing of the trainers shall be selected by the contractor from those specified in MIL-STD-808.

3.3.1.6.1 *Chromate primer and lacquer coating.* The trainers shall be coated with chromate primer and lacquer as specified in MIL-STD-808. The color shall be gray, film designation LG.

3.3.1.6.2 *Treatment of display panel surfaces.* All display panel surfaces shall be treated to eliminate distracting light reflections and glare.

3.3.1.6.3 *Sealing of plywood panel surfaces and edges.* Each plywood panel shall have all surfaces and edges thoroughly sealed against moisture and contamination and shall be fungi-protected with a grade A commercial sealer. The sealer shall not be required beneath the aluminum sheet that is cemented to the plywood panel. Plywood duplex panels of trainers containing systems which are subject to fluid leakage shall be covered with aluminum alloy sheets.

3.3.1.6.4 *Sectionalized components.* All exposed surfaces resulting from specified sectionalization requirements shall be free from rough marks, scoring, etc., caused by machining

MIL-T-81821

operations. Cutting-plane surfaces resulting from the sectionalization process shall be primed and lacquered red, film designation BG in accordance with MIL-STD-808. If desired, additional colors may be used for contrast, to differentiate between sectionalized surfaces where they mate together, or for coloring the interior of certain cutaways to differentiate between pressures, etc.

3.3.1.6.5 *Animated parts.* When coatings are required for animated parts, such coatings shall be lacquer. The colors selected shall provide maximum contrast between the lines and the background and shall cause minimum light reflection.

3.3.1.6.6 *Animated trainer tines.* All lines applied to the vertical panels of animated trainers shall be covered with lacquer, shall provide maximum contrast between the lines and the background, and shall cause minimum light reflection.

3.3.1.6.7 *Cleaning of lacquered surfaces.* All lacquered surfaces of the trainers shall be capable of withstanding frequent washing with mild soap and water. The trainer MOM I shall specify the recommended cleaning agents.

3.3.1.7 *Metal.* Trainer peculiar metal parts shall be of a corrosion-resistant material or suitably treated to resist corrosion. The type of metal to be used for trainer peculiar metal parts shall be indicated in the appropriate trainer descriptions in the Detail Specification, by specifying to the appropriate general categories of metal to be used (i.e., copper, steel, aluminum, etc.). Identification of specific type of metal for each trainer peculiar part is not required in the Detail Specification.

3.3.1.7.1 *Dissimilar metals.* Dissimilar metals, as defined in MIL-STD-889, shall be suitably protected against electrolytic corrosion when used in intimate contact with each other.

3.3.1.8 *Component requirements, general.* Unless otherwise specified in the Detail Specification, actual related end item components, plugs, connectors, parts, and equipment shall be used in the trainer panels.

3.3.1.9 *Standard parts.* Common military standard parts shall be used wherever they are suitable for the purpose and shall be identified by their part numbers. Commercial utility hardware parts such as screws, bolts, and nuts may be used, provided they have suitable properties and are replaceable by AN or MIL Standard parts without alterations, and provided the corresponding AN or MIL part numbers are referenced in the drawings and associated lists. In applications for which

no suitable corresponding AN or MIL parts are in effect on the date of submittal of the basic Detail Specification, commercial parts may be used, provided they conform to the requirements of this specification. Where standard related end item parts are suitable for the purpose and economically feasible, they may be used in lieu of military standard parts.

3.3.1.10 *Prototype or preproduction equipment.* Nonrepresentative, prototype, or preproduction equipment shall not be used in the construction of or supplied in support of the items and services specified herein. All common related end item parts, components, and equipment provided with, or utilized in the construction of the trainer panels shall be identical to the equivalent operational related end item, system, subsystem, or equipment.

3.3.1.11 *Rejected/nonoperable parts, general.* Related end item rejected/nonoperable parts may be used when use of such parts does not create a safety hazard to operating or maintenance personnel; does not adversely affect the training capability; does not create unique maintenance, supply or configuration requirements; and provided such use results in special consideration to the Government.

3.3.1.12 *Rejected/nonoperable parts, Government approval.* The utilization by the Contractor of available related end item rejected/nonoperable parts in accordance with 3.3.1.11, shall be proposed to the Administrative Contracting Officer (ACO) for approval contingent upon appropriate consideration to the Government. If approved by the ACO, such rejected or nonoperable parts shall be marked as specified in 3.3.3.10, incorporated in the trainer panels specified herein and subsequently reported to the Procuring Activity in accordance with 3.4.7.

3.3.1.13 *Fasteners.* Trainer peculiar fasteners used to secure removable components, casters, access doors and other detachable items shall require a minimum number of turns to the locked position commensurate with stress requirements. Captive type one-quarter (1/4) turn fasteners shall be used where feasible.

3.3.1.14 *Modification of Government-furnished property.* Government-furnished property may be modified or cut away, if practicable, to aid in simulation of related end item system operation or to increase the instructional value of the trainers.

3.3.1.15 *Alteration of operable system components.* When it is necessary to alter operable system components (such as hydraulic pumps, pressure switches, and indicators) for trainer use, a notation to that effect shall be included in the trainer Detail Specification with an explanation of the changes made and the trainer MOMI shall include data and modification instructions in

MIL-T-81821

sufficient detail to permit service personnel to perform an equivalent modification on a standard related end item replacement part. All related end item, and M I L Standard parts which have been modified for trainer use shall appear in the parts lists under the standard part number; however, in each case the part number shall be preceded by an asterisk to indicate that it has been modified for trainer use. Such altered components shall be marked in accordance with 3.3.3.10.

3.3.1.16 *Cuts way and plasticized parts, general.* “Where practicable, and when a significant increase in instructional value can be realized, components of a system, both Contractor and Government furnished equipment, unless of common design, may be exposed to reveal the internal mechanism. This shall be accomplished either by cutting away or plasticizing the item to be displayed. Cutaways are preferred. It is desirable to have such parts remain operable within a system, but when not practicable, duplicate parts or components that have been cutaway or plasticized shall be provided. A/Vs shall be provided to illustrate the internal construction and operation of components which do not lend themselves as cutaways or plasticized parts, or where the cost of using the actual component is prohibitive. Electrical components whose internal arrangement cannot be shown by other means shall have clear plastic covers or windows, or be completely plasticized when a benefit to training can be derived. Plastic covers shall be provided with fasteners for removal. All cutaway or plasticized parts installed on, or provided with, the trainer panels shall be listed in the applicable trainer descriptions in the Detail Specification.

3.3.1.16.1 *Provision of cutaway components.* Unless otherwise specified in the Detail Specification, all cutaway components provided with or installed on the trainer panels specified herein will be cutaway by the Government. The Contractor Furnished Equipment (CFE) and Government Furnished Equipment (G FE) components shall be provided to the designated Government Activity for cutaway as soon as practicable, but not later than one hundred twenty (120) days prior to the scheduled trainer fabrication completion date. Assembly drawings only of the CFE components to be cutaway shall be provided and shipped concurrently with the components. The cutaway components will be returned to the Contractor within ninety (90) days after receipt by the designated Government Activity.

3.3.1.16.2 *Mounting of cutaway and plasticized parts.* Cutaway and plasticized parts which are to be used for individual student instruction shall be securely attached to the trainer panel by means of quick disconnect mounts. Nonferrous metal mounting plates shall be permanently installed to prevent damage to the panel surface during removal and replacement of such items. When it is impractical to mount cutaway and plasticized components on the applicable trainer, a reusable shipping container shall be provided.

3.3.1.17 *Presentation of identical units.* When identical units are mounted on dry-system panels, one shall be sectionalized and the other shall be portrayed by silhouette. Silhouettes shall be painted dull black and fabricated from 3/8-inch plywood or composition hardboard material. The silhouettes shall be securely attached to the main panel by countersunk screws. Silhouettes of actuating cylinders, valves, etc., shall have the inner mechanism indicated by colors which will provide suitable contrast against the black background. Silhouettes installed on an animated-type panel shall be constructed essentially as above except that the inner or operating mechanism shall be constructed to show the motion of key operating parts in a manner similar to that of the actual component being represented. The movement of these parts shall be manual or, in specified exceptional cases, shall be mechanically or electrically actuated. Such silhouettes shall be joined with connecting lines which shall be repainted or silk-screened on the face of the panel, or with plastic or metal strips attached to the panel by conventional means. All such lines shall be color-coded to agree with the color system used in the related end item technical order to indicate their function. Contrast with the background panel shall be provided. Such parts shall be readily discernible from a distance of at least 20 feet.

3.3.1.18 *Duplication of equipment.* Unless otherwise specified in the Detail Specification, the installation of identical or near-identical parts or systems shall be avoided.

3.3.1.19 *Special controls.* Special controls required to operate the trainer panels that are not a part of the actual related end item or are not used to control signal simulators shall be grouped in an area not readily visible to the students, but readily accessible to the instructor. For ease of teaching system operation, special controls for signal simulators on electronic trainer panels shall be located in an area visible to both instructor and student. All special controls, malfunction control handles, control valves, switches, and other variable controls shall be clearly marked to show all settings of the controls. All special controls shall be provided with friction locks or equivalent positioning devices. The location and means of hiding required for these special controls shall be indicated in the Detail Specification. All special controls shall be marked in accordance with 3.3.3.22.

3.3.1.20 *Trainer power and signal distribution.* Each trainer, independently operable trainer panel, and panel group shall be supplied with all hoses, lines, cables, and fittings necessary to provide interconnection for required signal and power transmission between related trainer panels and the power source in the training facility at the Government site. A 50-foot extension cord, cabling, tubing, or lines, as necessary, shall be provided to interconnect the units to the trainer where units must be placed outside the classroom for noise reduction purposes as specified in

MIL-T-81821

3.2.1.6 herein. Extension cords, cables, etc., may be stored on the rear of the vertical panel in the trainer cover if a hard cover is provided, or in another accessible place by means of brackets or holddown straps.

3.3.1.21 *Power distribution*

3.3.1.21.1 *Power connections.* Each electrical, hydraulic, and pneumatic power unit shall be supplied with the cables, hoses, connections, switches, valves, etc., required to connect these power units to the facility input power and the facility built-in power distribution systems or trainer panels, as appropriate.

3.3.1.21.2 *Electrical power cables.* Each trainer, independently operable trainer panel, and panel group which requires the use of external electrical power shall be provided with one (1) twenty-five (25) foot power cable for each type of external electrical power required. These power cables shall be strain-relieved and permanently attached to the rear center of each trainer, independently operable trainer panel, or panel group and equipped with an appropriate male plug. All power cables shall be designed with a minimum wire size that is rated to carry the full load of electrical current required for the trainer panels. The cable shall be electrically connected to the trainer through the master switch on the trainer power control panel. Provisions shall be included for storage of the power cable when not in use. The power cables for different types of external power may, if economically feasible, be combined into a single power cable.

3.3.1.21.2.1 *Electrical power cable pigtails.* When permanent facility power distribution systems and central power conversion units as specified in 3.2.1.11.1 and 3.2.1.11.5 are required by the Detail Specification, a separate three (3) foot pigtail shall be provided for each electrical power cable specified in 3.3.1.21.2. The male plug on each power cable shall mate with a female receptacle on the pigtail. The bare end of the pigtail shall have six (6) inches of outer cover removed and two (2) inches of the wires stripped and tinned so that it may be connected to the facility power distribution system. The male plugs on the power cables and female receptacles on the three (3) foot pigtails shall be interchangeable between related trainer panels requiring interconnection or operation in series from a single power source.

3.3.1.21.2.2 *Electrical power cable connectors.* When individual trainer power conversion units specified in 3.2.1.11.6 are required by the Detail Specification, the electrical power cable specified in 3.3.1.21.2 shall be equipped with the following types of connectors:

- (a) Cable carrying 80 amp or less at 28VDC shall be equipped with a connector that will mate with a two (2) pole receptacle.
- (b) Cable carrying 80 to 500 amp at 28VDC shall be equipped with an AN2551 connector.
- (c) Cable carrying 120/208V, 400-Hz and 28VDC shall be equipped with a connector that will mate with a seven (7) pole receptacle.
- (d) Cable carrying 120V, 60-Hz shall be equipped with a 3-pole connector conforming to MIL-C-3767/12.

3.3.1.21.3 *Electrical power interconnection.* For each power cable provided in accordance with 3.3.1.21.2 a receptacle shall be electrically connected to, and installed near, the permanent attached end. Each receptacle shall mate with the applicable male plug required by 3.3.1.21.2 and shall be designed or otherwise identified to prevent improper connections.

3.3.1.21.4 *Electrical power receptacles.*

3.3.1.21.4.1 *Utility receptacles.* Two 115V, 60-Hz grounding-type utility duplex receptacles shall be provided and appropriately marked on each trainer panel. Power for these receptacles shall bypass the master keyed lock switch but shall be routed through the emergency control switch, and the elapsed time meter registering power used by the trainer. In cases where a trainer consists of two or more trainer panels, two utility receptacles shall be installed on each panel.

3.3.1.21.4.2 *Test equipment power receptacles.* When applicable, two easily accessible 115V, 400-Hz power receptacles shall be provided on each trainer panel for use with system test equipment. The receptacles shall be located adjacent to the utility receptacles and shall be appropriately marked. Trainer-peculiar interconnect cables shall be provided, as required, to accommodate the test equipment.

3.3.1.21.5 *Power distribution cables and junction boxes.* When permanent facility power distribution systems are not used and individual trainer power conversion units specified in 3.2.11.6 are required by the Detail Specification, power distribution cables and junction boxes as necessary shall be furnished by the Contractor. When required, the type and quantity of power distribution cables and junction boxes shall be determined jointly by the Contractor and the Procuring Activity and shall be specified in the Detail Specification.

MIL-T-81821

3.3.1.21.6 Power control panel. Each trainer, independently operable trainer panel and panel group which requires external electrical, hydraulic, or pneumatic power shall be provided with a power control panel. This panel shall contain the master keyed lock switch, elapsed time meter(s), "Power On" light(s), circuit breakers and phase indicating warning light(s) as required. The power control panel shall be installed in a clearly visible location.

3.3.1.21.6.1 Master keyed lock switch. A master keyed lock switch shall be provided on each trainer power control panel to control the availability of power for components of the training panel. Power for the ground support equipment receptacles on the trainer panel shall bypass the master keyed lock switch. The switch or circuit breaker shall return to and remain in the OFF position in the event of power interruption. The switch shall be marked in accordance with 3.3.3.15.

3.3.1.21.6.2 Power on light. A separate one (1) inch diameter red pilot light for each type of electrical, hydraulic, and pneumatic power required shall be installed on each trainer power control panel in a clearly visible location. The light(s) shall be appropriately marked to indicate POWER ON for the master switch, and for each type power required for the trainer panel. The light(s) shall illuminate when the applicable type of power is available on the trainer panel.

3.3.1.21.6.3 Phase sequence indicating light. For 3-phase power, a red warning light shall be provided on the power control panel to indicate incorrect phase rotation when appropriate. The light shall be connected to the power input side of the three phase power source to the trainer panel.

3.3.1.21.7 Circuit protective devices. Circuit breakers in accordance with requirement No. 37 of MIL-STD-454 shall be provided for each type of electrical power required on each trainer panel. Circuits shall be protected in accordance with requirement No. 8 of MIL-STD-454. Phase-reversal relay(s) to protect equipment from damage in case of incorrect phase sequence shall be incorporated in each trainer requiring 3-phase power.

3.3.1.21.8 Emergency power control switch. An emergency power control switch shall be incorporated on each trainer panel to deactivate all electrical, hydraulic and pneumatic power as applicable. Actuation of any emergency power off switch on a multiple panel trainer shall deactivate the power from all inter-connected panels. Emergency power control switches shall be connected to the equipment side of the master keyed lock switch and shall be mounted in an area readily visible and accessible from the front side of the trainer panel. Emergency power control switches shall be marked in accordance with 3.3.3.21.

3.3.1.22 *Elapsed time meters.* Four-digit time totalizing meters conforming to MIL-M-7793 registering in one hour increments shall be installed on each power conversion unit to register total hours of operation and on each trainer, independently operable trainer panel and panel group as required to separately record the following where applicable:

- a. A meter on the equipment side of the master keyed lock switch to record total number of hours that power is used for equipment which is normally on stand by when the lock switch is in the ON position.
- b. A meter on the equipment side of the master keyed lock switch to record the total number of hours that power is used for the actual operation of the trainer and components or equipment installed thereon.
- c. A meter to register the total number of hours that power is used by the trainer for the operation of support equipment through the trainer power receptacles.
- d. A meter shall be installed to record the total hours of operation of each power conversion unit.

On short cycle operations type trainers, such as landing gear, speed brake and arresting hook trainer panels, for which hours of actual operation would not provide a meaningful measure of trainer utilization, an operational cycle counter may be substituted for the elapsed time meter registering total hours of actual trainer operation.

3.3.1.23 *Malfunction control panel.* This panel shall contain the switches and controls necessary to allow the instructor to insert typical simulated system malfunctions or failures, as specified in the trainer Detail Specification. When it is necessary to alter operable system components in order to simulate malfunctions or failures, the provisions of 3.3.1.15 shall apply.

3.3.1.24 *Wiring, general.* Specification MIL-W-5088 shall be used as a guide for wiring the trainer panels. The wiring shall be equal to the best commercial standards and adequate for the trainer requirements.

3.3.1.24.1 *Wire bundling.* The same wire coding systems used on the related end item shall be used on the trainer panels. All wiring shall be neatly bundled. Continuous lacing shall not be used

MIL-T-81821

for bundling. Wiring or bonding which is not typical of the related end item shall be hidden from the students' view, preferably behind the trainer panel, or concealed in an existing harness. Sufficient slack shall be provided in all wiring to permit a minimum of three (3) receptacle replacements. Connectors shall be provided at all disassembly points on trainers requiring disassembly for shipment.

3.3.1.24.2 *Grounding.* All non-current-carrying conducting materials such as metallic conduit, cable sheath or armor, enclosures, and switch boxes, which could short to potentials greater than 30V, shall be electrically bonded and connected to a common ground buss, which shall be connected to the grounding terminal of the power input receptacle.

3.3.1.24.3 *Accessibility.* The related end item junction boxes, terminal strips, buss terminals, quick disconnect plugs or breakers, etc., installed on the trainer panels shall be readily accessible and limited to those required for maintenance or troubleshooting.

3.3.1.24.4 *Component relocation.* Where it has been determined that it will be necessary to relocate a radio, radar, or electrical system component from the stowage shelf for installation on the bench top for instructional purposes, sufficient length of cable or patch cords shall be provided to permit the units to be removed to the work area on the bench top without affecting their operation. Space for stowage of the extra lengths of cable or patch cords shall be provided.

3.3.1.24.5 *Insulation protection.* Wherever electrical wiring is routed through holes in material less than one-eighth (1/8) inch in thickness, the holes shall be equipped with suitable grommets for protection of insulation subject to abrasion. Paneling one-eighth (1/8) inch or more in thickness shall have grommets or shall have the hole edges rounded to a radius equal to one-half (1/2) the thickness of the material. Care shall be exercised in the support and routing of hookup wiring to insure that it is not carried over or bent around any sharp corner or edge which could damage the insulation, or routed near any sources of heat or substances which might cause accelerated deterioration of the conductor insulation.

3.3.1.24.6 *Terminal strips.* Terminal strips shall be made of suitable low moisture absorption arc-resistant material. Terminal spacing or barriers shall be employed to prevent breakdown or low leakage resistance. Spacing between terminals or barriers shall permit use of standard hand tools for maintenance. Exposed terminal strips shall be provided with protective covers for personnel safety. These coverings shall be of plastic material and simple design.

3.3.1.24.7 Potting. Connectors shall not be potted except when required for reasons of safety, or when actual related end item harnesses are used on the trainer panel.

3.3.1.25 Relays. Trainer peculiar relays shall be of a minimum number of different types and shall be selected from types having a known history of long life and reliability. Plug-in relays with standard base configuration shall be used to the maximum practicable extent. Except for sensitive relays (100 mw or less), they need not be hermetically sealed but shall have self-wiping contacts and shall be dust-tight.

3.3.1.25.1 Mounting of sensitive relays. Sensitive relays shall not be mounted on a base of magnetic material, held by brackets made of a magnetic material, or mounted within four (4) inches of any transformer, inductor, or similar device having a strong magnetic field.

3.3.1.25.2 Stepping relays. Stepping relays shall be installed in dust-tight enclosures or covers.

3.3.1.25.3 Motor control relays. Motor relays shall be used where frequent stopping and starting of alternating current motors larger than one-sixth (1/6) horsepower (hp) is required. For infrequent operation, relays shall be provided only with alternating current motors of one-half (1/2) hp and larger.

3.3.1.25.4 Arc suppression (relay contacts). Adequate arc suppression shall be provided. Where space permits, a series capacitor-resistor combination is preferred to diode suppression.

3.3.1.26 Micro electronic and thin film devices. The use of micro electronic, thin-film device, and other similar microminiaturized devices are acceptable in trainer peculiar applications. All applications shall be specified in the Detail Specification.

3.3.1.27 Selection of micro electronic devices. Development effort shall be minimized wherever possible by selection and use of available standardized, off-the-shelf micro electronic devices. In the selection of devices, a minimum number of different types shall be selected for any specific system application.

3.3.1.28 Compatibility. Devices selected from multiple sources shall be mechanically and electrically compatible.

3.3.1.29 Mounting. The mounting configuration shall be such as to provide the most efficient heat dissipation, interconnection lead arrangement flexibility, and space utilization.

MIL-T-81821

3.3.1.30 *Shielding.* Shielding shall be provided to protect sensitive, low-power level circuits against the electromagnetic interference effects of conducted or radiated radio frequency energy whether internally or externally generated. Shielding shall not prevent replacement of defective wafers.

3.3.1.31 *Plug-in modules.* To prevent wafer destruction caused by inadvertent dislocation, each male module connector and corresponding receptacle shall have a positive safety device to physically prevent insertion of a module into the wrong receptacle.

3.3.1.32 *Drawing identification.* All micro electronic modules, wafers, or other units identifiable as a functional entity shall be identified by reference designator and nomenclature on all corresponding drawings used for assembly, test, maintenance, repair, or training purposes. All critical electrical performance characteristics or parameters necessary for normal operation and test or repair shall be identified. Where possible, circuit functions shall be shown by discrete electrical component equivalents.

3.3.1.33 *Hydraulic and pneumatic power hoses.* Each trainer, independently operable trainer panel, or panel group which requires the use of hydraulic or pneumatic power shall be provided with twenty-five (25) foot flexible hoses, as required, for connecting the trainer panels to the facility or trainer hydraulic or pneumatic power supply system or for trainer panel interconnect, as applicable. Appropriate female quick disconnect fittings, with dust covers, shall be installed in each end of each hydraulic or pneumatic hose to provide for mating with the male quick disconnect fittings on the trainer panels and the facility hydraulic or pneumatic power supply system. When pressure and volume flow is the same, all hydraulic pressure hoses shall be interchangeable and all hydraulic return flow hoses shall be interchangeable; however, hydraulic pressure hoses and return flow hoses shall not be interchangeable with each other. When pneumatic pressure and volume flow is the same all pneumatic hoses shall be interchangeable with each other.

3.3.1.34 *Hydraulic and pneumatic in interconnection.* Individual trainer panels requiring external hydraulic or pneumatic power shall have hydraulic/pneumatic manifolds with appropriate male hydraulic quick disconnects or pneumatic fittings installed on the rear center of the panel, and shall be capable of conducting hydraulic or pneumatic power through the manifold connections to two (2) or more related trainer panels, with the individual trainer panel power either "OFF" or "ON" when connected in series from a single hydraulic or pneumatic power source. Each maintenance trainer and individual trainer panel which is not part of a panel group shall be capable of independent operation when connected to the power supply, and shall contain an appropriate control panel for this purpose. Connectors shall be provided at all disassembly points on trainers requiring disassembly for shipment.

3.3.1.35 Animation. Animation shall be provided where essential to the understanding of component or system theory and function. When animation is necessary, the requirements of 3.3.1.35.1 shall apply.

3.3.1.35.1 Animation techniques. Animation provided shall depict system operations involving flow of energy, liquids or gases such as electrical or RF signals, fuel, hydraulic fluid, air, oxygen, etc., or shall illustrate progressive action in various stages of an operation, mechanical motion or energy, gas or fluid flow. Components may be represented by replicas, outline block diagrams, simulated items, cutaways, or actual components. Interface wiring, tubing, ducting, etc., between components may be represented by translucent plastic blocks, strips, or lines attached to the surface of the panel in such a manner as to permit illumination from the edge or behind the panel by means of concealed lights. When illuminated, the illusion of motion or flow may be created to simulate system operation.

3.3.1.35.2 Operating controls. When animated panels are used, the controls required for operation of the trainer shall be located in one area on a control panel, or, if too numerous, a separate instructor console shall be provided. Illumination shall be controlled so that the instructor can progressively teach system or component operation.

3.3.1.35.3 Methods of construction. Materials used in the construction of animated trainers shall be standard wherever possible. Consideration shall be given to the selection of construction methods and materials for ease of replacement and repair. Transparent or translucent plastic or laminated fiberglass sheet on which the lines and components are silk-screened or painted is permissible provided such methods lend themselves to economical modification, repair, or replacement. Maximum use shall be made of the optical properties of plastic, if used, to minimize the number of lights required.

3.3.1.35.4 Ventilation or cooling. Adequate means for ventilation or cooling, or both, shall be provided where necessary to prevent distortion of trainer materials.

3.3.1.35.5 Lighted line widths. Lighted line widths shall be selected to provide maximum visibility and yet retain symmetry and a balanced appearance. Unless otherwise specified in the Detail Specification, line widths shall not exceed 1 inch.

3.3.1.35.6 Electrical circuits. Electrical circuits shall be kept as simple as possible. The use of automatic devices for transferring electrical energy from one circuit to another in automatic sequence shall be avoided.

MIL-T-81821

3.3.1.35.7 Color coding. The lines shall be color-coded to differentiate between the various conditions being depicted. The colors used shall be selected to enhance the contrast between the various conditions or circuits, or both. For pipe, hose, and tube lines representing corresponding lines in related end items, the color-coding system used shall be in accordance with the marking requirements specified in 3.3.3.12.

3.3.1.35.7.1 Color material. Color may be obtained by dyeing the plastic strips with a suitable dye or translucent plastic ink, by inserting a thin sheet of colored plastic material between the light source and the exterior reflectors and baffles, by colored bulbs or bulb covers, or a combination of these methods. The brilliancy of illumination shall be controlled by use of a hidden rheostat or similar device to provide maximum light through the plastic without glare, or as specified in the Detail Specification. Insofar as possible, each color or shading shall be the same on all panels of multipanel trainers.

3.3.1.35.7.2 Color-coded legend. A color-coded legend or plaque shall be mounted on the face of the panel in an accessible location and shall depict color chips and the purpose of each color.

3.3.1.36 Modifications, changes, and configuration control. Modifications and changes shall be incorporated in the trainers, related items and services provided or specified herein in accordance with the requirements of MIL-STD-480. Engineering Change Proposals (ECP) submitted for the related series end item shall include information defining the effect of the change on the maintenance trainers, related items, data, and services specified herein. Contents, scope, format, and distribution of the information concerning trainers, related items and services to be included shall be in conformance with requirements of DID No. DI-E-6204. An organized configuration control and documentation program for the trainers, related items, data, and services specified herein shall be established and administered in accordance with the requirements of the DOD Directive 5010.19, Configuration Management, and the implementing directives of the Using Service.

3.3.2 Electromagnetic Radiation. Design shall be such that electromagnetic radiation is kept at a minimum in accordance with MIL-STD-461 for Class 1D equipment.

3.3.3 Data plates and product marking

3.3.3.1 Marking general. Equipment, assemblies and major parts shall be marked for information and identification in accordance with MIL-STD-130 and as specified herein. All marking, decalomania, and instructional data pertaining to the system units as found on the operational item shall likewise be furnished on the applicable trainer panel.

3.3.3.2 Data plate. An aluminum or brass data plate, one-eighth (1/8) inch thick, permanently and legibly engraved or stamped with the following information, shall be securely attached to each trainer panel in a place not readily visible to the student:

Military Serial Number

Trainer Nomenclature

Panel No. * of * panels

Related End Item Serial No. Reflected

Configuration:

	Cube	Height	Width	Length	Weight	Floor Loading		
						With Casters	Without Casters	With Jack Pads
Operating	*cu. ft.	*in.	*in.	*in.	*lbs.	+*PSI.	*PSI.	*PSI.
Shipping	*cu. ft.	*in.	*in.	*in.	*lbs.	+*PSI.	*PSI.	*PSI.

Manufacturer's Name and Code

Manufacturer's Part Number

Manufacturer's Serial Number

Federal Stock Number (When Applicable)

Name of Contractor

Contract Number

Acceptance Insp. Date

Property of U.S. Government

* Applicable data shall be entered in maximum extended dimensions.

+ Maximum single caster load.

(1) Floor loadings shall be calculated in accordance with 3.7.2.1 herein.

3.3.3.3 Serial Number. Each trainer panel will be assigned a military serial number established by the Procuring Activity. This assigned serial number shall be used in all correspondence, reports and technical data pertaining to trainer sets, trainers and trainer panels.

3.3.3.7.1 Security cover. On all trainers classified CONFIDENTIAL or higher, the inner fabric security cover shall be marked with the appropriate security classification in red letters not less than two (2) inches high. These letters shall appear against a white or similar high contrast background. The security classification shall not be indicated on the exterior of the outside cover.

3.3.3.7.2 Removal of hard cover. A weatherproof decal with instructions for removal of the hard cover and installation of the casters shall be placed on the cover near the caster access door.

3.3.3.8 Center of balance. A vertical red arrow, approximately 2 by 6 inches, shall be stenciled on both longer sides of the trainer frame and outer cover, near the bottom edge, to indicate the point of balance of the trainer for forklifting. At the top of the arrow, in red letters not less than 1 inch high, shall appear the legend CENTER OF BALANCE. If space is not available on the trainer frame for the 2-by 6-inch arrow, a red triangle or dot will be sufficient.

3.3.3.9 Marking of trainer with modified, rejected or non-operable parts. When modified, rejected or non-operable parts are used, the trainers shall be appropriately marked by metal plate, decalcomania, etc., as follows:

PARTS AND COMPONENTS OF THIS TRAINER WHEN INDIVIDUALLY MARKED MODIFIED, REJECTED OR NON-OPERABLE ARE TO BE USED FOR GROUND TRAINING PURPOSES ONLY.

3.3.3.10 Marking of modified, rejected and non-operable parts. Modified parts which by means of depot level overhaul could be returned to Ready For Issue/Serviceable (RFI) condition for operational use on the related end item shall be appropriately marked by stenciling or decals as follows "MODIFIED – NOT FOR OPERATIONAL USE". All rejected, non-operable parts and those modified parts which could not by means of depot level overhaul be returned to RFI condition for operational use on the related end item shall be individually and permanently marked by stamping or engraving "REJECTED – NOT FOR OPERATIONAL USE". Where the size of a part renders marking impractical or ineffective, the next higher assembly in which the part is used shall be so marked. Such marking will not be required on obviously cutaway parts.

3.3.3.11 Electric motors. All trainer peculiar unidirectional electric motors shall be marked to indicate direction of rotation.

MIL-T-81821

3.3.3.12 Fluid/gaseous transmission lines. All fluid/gaseous transmission lines and tubing shall be marked in accordance with MIL-STD-1247 with standard decals to indicate direction of flow, and shall bear the appropriate color code tape.

3.3.3.13 Electrical requirements. The electrical power required to operate each trainer, independently operable trainer panel, panel group and related trainer powered support equipment under specific load conditions shall be permanently marked on a plate similar to the manufacturer's data plate. The plate shall be permanently attached adjacent to the master keyed lock switch and shall indicate the following as applicable:

Power Requirements			Amperage		
Voltage	Frequency	Phase	Standby	Start	Operate
28V	DC		*	*	*
120V	60 Hz		*	*	*
120V	400 Hz	Single	*	*	*
120/208V	400 Hz	Three			
		A	*	*	
		B	*	*	
		c	*	*	

* Applicable data shall be entered.

3.3.3.14 Mounting of identification plates for sectionalized components. Where the manufacturer's identification plate has been removed due to the sectionalization requirements, the plate shall be attached to that portion of the item that is mounted on the trainer, if possible. Otherwise, the identification plate shall be attached to the component mounting plate.

3.3.3.15 Power switch warning plates. A warning plate indicating "WARNING - PLACE MASTER KEYED LOCK SWITCH IN OFF POSITION BEFORE CONNECTING OR DISCONNECTING EXTERNAL POWER" shall be attached to the plug end of each trainer power cable. Another warning plate with same legend shall be placed near the master-keyed lock switch.

3.3.3.16 Fluid tank or reservoir. The liquid capacity contents, and the words **MUST BE DRAINED PRIOR TO SHIPMENT** shall be stenciled on any trainer fluid storage tank or reservoir.

3.3.3.17 Cover assembly installation. When hard outer covers are provided, one corner of the cover and a corresponding point on the trainer base panel shall be appropriately marked to indicate the correct installation of the cover assembly.

3.3.3.18 Cover handles. When hard outer cover handles are provided, which are not suitable for hoisting or cargo plane tiedown attachment, the following legend shall be centrally located above the handles on each side or end of the cover in red letters approximately 1 inch in height:

**WARNING
FOR LID LIFT ONLY**

3.3.3.19 Hoisting instructions for heavy trainers. Hoisting instructions for lifting a heavy trainer shall be stenciled on the cover, including lifting points, need for spreader bar, and area for forklifting. A heavy trainer shall be defined as having a weight exceeding the one-man lift values of Table X in Paragraph 5.9.11 .3.2 of MIL-STD-1472.

3.3.3.20 Safety marking. All safety hazards shall be provided with adequate and conspicuous warning signs. Signs designed in accordance with 3.3.6.1 herein shall display the words **STAND CLEAR** in 1/2-inch high white letters on red translucent material. Trainers generating electromagnetic radiation shall have the minimum safe distances identified and marked.

3.3.3.21 Emergency power control switch marking. The emergency power control switch on each trainer shall be labeled with the words "EMERGENCY POWER-OFF" in one-half (1/2) inch high white letters on a red background.

3.3.3.22 Special Control marking. All special trainer controls shall be labeled "TRAINER CONTROLS" "NOT USED ON OPERATIONAL SYSTEMS".

3.3.3.23 Marking for shipment and storage. All trainer equipment shall be marked for shipment and storage in accordance with MIL-STD-129.

3.3.4 Workmanship. Trainer panels, including all parts and accessories thereof, and related items, shall be manufactured and finished in a manner to enhance the acceptability of the product. All welding shall be accomplished in accordance with MIL-W-8604 and MIL-W-8611, as applicable. After final assembly, all items shall be thoroughly cleansed of loose, spattered, or excess solder, metal chips, and other foreign material. All surfaces shall be clean and free from smudges scratches, or other marks detracting from a new appearance. Touchup of minor imperfections shall be accomplished prior to acceptance of the trainer panels. Dimensions and tolerances not specified shall be as close as is consistent with the best shop practices. Where dimensions and tolerances affect the interchangeability, operation, or performance of the system, subsystem, or equipment, they shall be limited accordingly.

MIL-T-81821

3.3.4.1 Screw assemblies. Assembly screws and bolts shall be torqued to the proper design values, without overtightening, based on their dimensions, material, and type of application, and shall be of a single thread type for each size used.

3.3.5 Interchangeability. Related end item parts shall be interchangeable or replaceable in accordance with the requirements of MIL-I-8500, as applicable to the related end item; however, this application shall not prohibit the use of rejected or modified parts, as specified herein.

3.3.6 Safety. The design and construction of the trainer panels shall consider optimum safety of personnel when installing, operating, adjusting, maintaining or moving the trainer. All potentially dangerous items, such as high-voltage wiring, high-pressure lines, chemicals, electronic devices radiating RF (Radio Frequency) energy, fast-acting mechanisms of landing gear, flight controls, and speed brakes that may lead to injury of personnel, either by manipulation of the system or as a result of component failure, shall be safety engineered in accordance with requirement 1 of MIL-STD-454 and marked in accordance with 3.3.3.20 herein. All pyrotechnics (missile squibs, warheads, propellants) shall be inert. The procedures described in MIL-STD-882 shall be used to minimize potential hazards and to reduce the possibility of system degradation and personnel injury. All potential dangers or dangerous situations shall be clearly noted in the trainer MOM I; all actual related end item hazards shall be represented and shall be appropriately labeled or marked.

3.3.6.1 Warning sign. A back-lighted warning sign shall be centrally located on each of the four sides of all trainers used to demonstrate the operation of fast-acting mechanisms such as landing gear, flight controls, control surfaces, and speed brakes. The warning sign shall be illuminated any time the power source is turned on at the trainer. The warning lamp shall be enclosed in a metal box, the front surface of which shall be of a red translucent material not less than two (2) by three and one-half (3 1/2) inches and marked in accordance with 3.3.3.20.

3.3.6.2 Warning lights. A flashing type red warning light shall be provided to indicate failure of any forced ventilation system installed on applicable trainer panels. On multipanel trainers, warning lights shall be installed on each panel and shall indicate the specific panel on which the failure has occurred.

3.3.7 Human performance/engineering. In order to achieve optimum performance of instructor, student, and maintenance personnel, and to ensure a high degree of man-machine compatibility, the trainers shall be designed in accordance with the applicable human engineering design criteria presented in MIL-STD-1472. The training equipment shall provide efficient, safe,

and effective training on those tasks required of the student in his operational assignment. Selection of the type of trainer and the design features necessary to the training tasks shall be in accordance with the training requirements determined by the related end item Logistics Support Analysis for the applicable maintenance level.

3.4 Documentation and Supplemental Materials. When specified in the Contract Data Requirements Lists, supplemental materials, data, reports, and documentation, as specified in 3.4.1 through 3.4.8, shall be provided in support of the maintenance trainers, related items, and services specified herein. These supplemental material requirements shall be in accordance with the applicable Data Item Description (DIDs) (DD Form 1664) listed in the DOD Index of Data Item Descriptions TD-3 and specified herein.

3.4.1 Drawings and microfilm. When specified in the Contract Data Requirements List DD Form 1423, engineering drawings and associated lists reflecting the detail design, manufacturing processes, and configuration of the maintenance trainers and related items specified herein shall be prepared in accordance with DID Item No. DI-E-6106 and microfilm of these drawings and associated lists shall be provided and delivered as specified on DD Form 1423. General arrangement drawings of the training equipment shall be reviewed and approved by Government representatives prior to final approval and release by the Contractor for production and fabrication of the related training equipment. This review and approval shall be for the purpose of concurrence with the design concept; acceptability and validity of simulation items responses and methods; possible design alternatives; and general system or component arrangement on the trainers for training purposes. Drawing approval and concurrence with the design concept at this conference shall not be construed as indicating Government concurrence that the trainers and related items fully comply with the Detail Specification requirements, or as authorization to deviate from any requirements specified therein.

3.4.2 Trainer Manuals of Operation and Maintenance Instructions (MOMI). When specified in the Contract Data Requirements List DD Form 1423, complete trainer manuals of operation and maintenance instructions shall be provided to define requirements to set up, operate, maintain, service, adjust, calibrate, and repair the complete set of trainers and individual trainers procured herein. Preliminary copies of the trainer MOMIs shall be available for review, verification, and use during the applicable training courses for Using Activity instructors on the maintenance training equipment, related items, and services. Final verified copies of the MOMIs shall be delivered concurrently with the related training equipment. The contents and format of the trainer MOMIs shall be in accordance with DID No. DI-M-6152.

MIL-T-81821

3.4.2.1 *Illustrated parts breakdown.* The trainer MOMI(s) shall include an illustrated parts breakdown for each trainer panel.

3.4.3 *Equipment service/historical record.* When specified in Contract Data Requirements List DD Form 1423, an equipment service/historical record shall be initiated by the Contractor for each trainer, independently operable trainer panel, and panel group in accordance with DID No. DI-H-6132. Blank forms and detailed instructions for this record shall be provided to the Contractor by the Using or Procuring Activity. Data entries shall be initiated on completion of fabrication effort and prior to use of the trainers in any factory training program, in accordance with the instructions provided with the blank forms. Such entries shall be based on records and data maintained by the Contractor of trainer fabrication effort and trainer operation and maintenance, from completion of fabrication to acceptance inspection. When trainer is modified, the history of the modification (i.e., Technical Order Change (TOC), Modification Work Order (MWO), Technical Directive (TD) or Contract Change Notice (CCN)) shall be recorded by the modifying activity. All elapsed time appearing on the trainer elapsed-time meters at the time of operational acceptance inspection shall be verified in the applicable portion of the trainer equipment service/historical records.

3.4.3.1 *Data case.* The equipment service/historical record for each trainer shall be stowed in the data case. The data case shall be constructed of nonferrous metal of sufficient size to hold trainer MOMI and equipment service/historical records. It shall be mounted On the trainer in a nonconspicuous location.

3.4.4 *Instructor training material.* Each Using Activity instructor undergoing training on the trainers and related items specified in the Detail Specification shall be provided one (1) copy of all applicable training pamphlets, lesson guides, information sheets, instruction/student evaluation forms, and other graphic or written training material used in training that instructor. Format and contents of this instructor training material shall be in accordance with DID Nos. DI-P-6167, DI-H-6197, DI-H-6198, and DI-H-6199 or as otherwise directed by the Procuring Activity in the procurement contract or order for the applicable instructor training courses.

3.4.5 *Technical manuals.* When specified in the Contract Data Requirements List DD Form 1423, copies of technical manuals, and printed or graphic material containing current information that affects the maintenance and operation of the related series end items and the support equipment applicable thereto, shall be provided with each set of trainers or individual trainers, related items, and services. Technical manuals to be provided shall, where applicable, include but not necessarily be limited to, maintenance manuals, operation and service manuals, illustrated parts breakdowns, scheduled maintenance requirements manuals and card decks, information sheets,

service bulletins, and other manuals and related documentation authorized for procurement under the technical data and publications items of the contracts for the related series end items, or support equipment applicable thereto. These technical manuals shall be provided in accordance with DID Nos specified in the contract for the related end item technical manuals.

3.4.6 *Photographic manuals.* When specified in the Contract Data Requirements List DD Form 1423, photographic manuals clearly depicting each completed trainer, individual trainer panel, and set of trainers shall be provided and delivered concurrently with each trainer or set of trainers specified in the Detail Specification, in accordance with DID No. DI-H-6133.

3.4.7 *Reports.* When specified in the Contract Data Requirements List DD Form 1423, reports shall be submitted to provide management information covering the trainers, related items and services. Training equipment reports to be provided shall include, but not necessarily be limited to, those specified in 3.4.7.1 through 3.4.7.11.

3.4.7.1 *Maintenance training equipment progress report.* This monthly report shall indicate the previously scheduled and current actual completion percentage factor for each contract item or order for maintenance training equipment, related items, and services. This report shall be prepared in accordance with DID No. DI-H-6134. Revisions shall consist of complete superseding replacement/additional pages, with revisions appropriately identified, as necessary, to reflect changes, modifications, corrections, additions or deletions to the data contained in the report.

3.4.7.2 *Maintenance training equipment facilities report.* This report details the weight, size, power, cooling; and environmental requirements for each trainer, related items, and services specified in the Detail Specification. This report shall be prepared in accordance with DID No. DI-H-6135. Revisions or additions to the facilities report shall be prepared and delivered as contractually authorized by the Procuring Activity.

3.4.7.3 *Maintenance training equipment cost report.* This report provides the management information and historical cost data for maintenance training equipment cost reporting and procurement planning purposes. This report shall be prepared in accordance with DID No. DI-F-6125. Revisions or additions to the cost report shall be prepared and delivered as contractually authorized by the Procuring Activity.

3.4.7.4 *Maintenance training equipment material requirements/receipt report.* This report provides the management information for monitoring the receipt and progressing of government and contractor furnished equipment items required for the maintenance training equipment under procurement. This report shall be prepared in accordance with DID No. DI-A-6103.

MIL-T-81821

3.4.7.5 *Maintenance training equipment material shortage report.* This monthly report lists only those government furnished equipment/material items not received, and related end item contractor furnished equipment/material not available by the date required for the MTE use. This report shall be prepared in accordance with DID No. DI-P-6164.

3.4.7.6 *Maintenance training equipment "Make-or-Buy" program plan report.* This one time only report provides management information for maintenance training equipment under procurement to verify compliance with ASPR make-or-buy requirements. This report shall be prepared in accordance with DID No. DI-A-6100.

3.4.7.7 *Maintenance training equipment rejected/non-operable parts utilization report.* This one time only report provides management information to document the authorized use of rejected/non-operable parts in maintenance training equipment being procured and establish a basis for an appropriate schedule or price adjustment for their use. This report shall be prepared in accordance with DID No. DI-L-6139.

3.4.7.8 *Maintenance training equipment engineering changes status report.* This quarterly report provides management information necessary to monitor progress and status of the incorporation of authorized changes in maintenance training equipment procured and permit scheduling of training implementation. Revisions shall consist of complete superseding replacement/additional pages with revisions appropriately identified, as necessary, to reflect changes, modifications, corrections, additions or deletions to the data contained in the report. This report shall be prepared in accordance with DID No. DI-E-6118.

3.4.7.9 *Maintenance training equipment acceptance report.* This report for each contract item or order for maintenance training equipment reflects the acceptance status and condition of the MTE at the time of acceptance by the Procuring Activity. Revisions of the acceptance report shall be submitted monthly until all items and services under the appropriate item or order have been delivered to and finally accepted by the Government. This report shall be prepared in accordance with DID No. DI-H-6136.

3.4.7.10 *Maintenance training equipment configuration accountability report.* This report provides management information to document the current configuration of the maintenance training equipment procured and maintain accountability for modifications and configuration changes incorporated therein. Updating revisions and additions to this report shall be provided semiannually throughout the service life of the training equipment, related items, and services to reflect the current configuration thereof (including all modifications and changes incorporated therein) and to reflect additional trainers, panels or items subsequently added to a set of trainers and additional trainers and related items procured for separate training sites. This report shall be prepared in accordance with DID No. DI-E-6119.

3.4.7.11 Maintenance training equipment BOA (Basic Ordering Agreement) funding status report. This monthly report provides the management information necessary to maintain fiscal accountability of funding for the incorporation of related end item modifications, changes and retrofit kits in maintenance training equipment, training parts, related items and services as specified herein. This report shall be prepared in accordance" with DID No. DI-F-6203.

3.4.8 Acceptance test outlines. When specified in the Contract Data Requirements List DD Form 1423, individual engineering test outlines reflecting the MTS or individual trainer specification requirements, prepared in accordance with MIL-T-27615, shall be provided in accordance with DID No. DI-H-6129. These engineering test outlines shall define and describe the tests to be performed and data to be recorded, and shall be subject to review and approval by the Procuring Activity. These outlines shall be submitted to the Using Activity for formal approval a minimum of forty-five (45) days prior to the scheduled acceptance inspection for the related training equipment.

3.4.9 Audiovisual aids, general. All Audio/Visual aids (A/Vs) to be provided shall be completed and available for review and verification prior to the Acceptance Inspection for the maintenance training equipment, related items, and services specified in the Detail Specification. Symbols used on A/Vs shall be in accordance with the standards specified in MIL-STD--17 (Part II), AWS A2.0-58 and USAS Y32.2-1967.

3.4.9.1 Audiovisual aids coverage. A/Vs shall include coverage of the related series end item CFE and GFE systems, subsystems, equipment, and all applicable support equipment. The specific type, quantity, and coverage of the A/Vs to be provided shall be indicated in the Detail Specification and shall include all requirements necessary to supplement the maintenance training equipment and provide the specified scope of training capability.

3.4.9.2 Objectives of Audiovisuals. The objective of A/Vs is to supplement maintenance trainers, which are the primary training vehicles. A/Vs normally consist of the following objective categories: cutaway views (showing location of components), system/subsystems operational sequence, servicing, schematic wiring and block diagrams, component removal and installation, adjustment, and inspection. A/Vs shall supplement and not replace the spoken word. Aids designed for training purposes shall focus rather than divert attention, and shall aid the student in learning. The aids shall present one central idea with maximum clarity and simplicity. Every effort shall be made to avoid a cluttered view. Complex systems or adjustment procedures may, if necessary, be presented by using several illustrations.

3.4.9.3 Audio/Visual identification/configuration data code numbers. Each A/V shall be assigned an alpha-numeric identification/configuration data code number for reference purposes.

MIL-T-81821

This data code number shall be located on a single line centered under the title on the viewable surface of the A/V. The data code number, although located within the viewable surface of the aid need not be protectable. The A/V identification/configuration data code number shall be established as directed by the Procuring Activity and specified in the Detail Specification.

3.4.9.3.1 Identification details on Audio/Visuals. When an isolated unit or group of component parts is illustrated for reproduction as an A/V, and the unit or parts cannot be easily identified as to their location within the related series end items, some means of identifying this location shall be used (e.g., a small outline drawing of the related end item may be located in one corner of the A/V with a dot or directional arrow superimposed thereon, indicating the location or position of the unit or parts in the related series end items).

3.4.9.3.2 Part identification on Audiovisuals. Part identification shall be arranged to permit rapid identification of parts without cluttering the layout of the A/V, All parts identification callouts shall be located as near to the part as possible, but consistent with presentable layout. Legends or remote keying with numbered callouts shall not be used.

3.4.9.3.3 Adjustment details on Audio/Visuals. Adjustment details shall be prepared in accordance with MIL-T-4782, except that the view shall correspond to the view presented in the currently applicable official maintenance manuals.

3.4.9.4 Titling of Audio/Visuals. Each A/V shall be appropriately titled. The title shall be brief and descriptive, appearing preferably on the bottom-center in the viewed portion of each A/V as used for instructional purposes. If, due to layout problems, the title cannot be placed on the bottom-center, the title shall appear in the most suitable space, considering balance.

3.4.9.5 Abbreviations on Audio/Visuals. Abbreviations shall be used only where absolutely necessary to conserve space, but never in titles, except where the abbreviation has been standard terminology. In the event a word is abbreviated on any A/V due to space limitations, the same word must be abbreviated wherever else it appears on the same A/V. Abbreviations, when used, shall be in accordance with MIL-STD-12.

3.4.9.6 Art work, illustrations, and data for Audiovisuals. A/V development and preparation shall make maximum use of available illustrations and art work prepared for official Government manuals and related documentation, provided such art work is suitable for the preparation of a graphic aid in accordance with all requirements specified herein.

3.4.9.7 Security classification of Audiovisuals. Applicable security classification markings shall appear at the top and bottom of the art work within the viewable area of each A/V. The appropriate security classification group category statement, i.e., automatic time-phased downgrading notation and the date of the security classification of the aid (month and year) shall also be indicated on the A/V in a manner which does not clutter the viewable area of the A/V.

3.4.9.8 Workmanship of Audiovisuals. All A/Vs shall be free from blemish and defects. Particular attention shall be given to the accuracy of dimensions, markings, and location of parts.

3.4.9.9 Retention of art work for Audiovisuals. Unless otherwise directed by the Procuring Activity, all art work prepared for A/Vs procured hereunder shall be retained by the Contractor during the life of the applicable contracts. On the expiration of the applicable contracts, disposition instructions shall be requested from the Procuring Activity.

3.4.9.10 Schematic diagrams on Audiovisuals. Schematic diagrams shall be prepared in accordance with MIL-T-4782; however, when transparencies are not feasible, charts may be substituted.

3.4.9.11 Types of Audiovisuals, general. The primary types of A/Vs to be provided shall be transparencies and charts. The requirement for transparencies and charts is not intended to limit or preclude development of additional or different types of A/Vs such as photographs, illustrations, diagrams, thirty-five (35) mm slides, workbooks, handout materials, filmstrips, sixteen (16) mm training/introductory films, television kinescopes, audio tapes, or other means deemed suitable for the purpose. However, A/Vs other than transparencies and charts shall be provided only when specifically authorized by the Procuring Activity, and specified in the Detail Specification. Master reproducible for each A/V prepared in accordance with DID No. DI-E-6124, shall be provided.

3.4.9.11.1 Transparencies. A/Vs in the form of transparencies shall be prepared in accordance with MIL-T-4782 except where otherwise specified herein. One set of mounted projection ready transparencies shall be furnished with each trainer or MTS procured, and delivered prior to, or concurrently with, the related trainers.

3.4.9.11.1.1 Master reproducible transparencies, one set of unmounted master reproducible transparencies of the same size and content as the mounted transparencies shall be provided in suitable protective covers and delivered to the Using Activity or as otherwise directed by the Procuring Activity concurrently with the delivery of the first set of mounted transparencies.

MIL-T-81821

3.4.9.11.2 Charts. Where transparencies are not feasible, one (1) set of charts shall be provided for each trainer or MTS specified in the Detail Specification and delivered prior to, or concurrently with, the related trainers. The lettering on charts shall be at least one-half (%) inch in height except for titles which shall be at least one (1) inch in height.

3.4.9.11.2.1 Chart material. Charts shall be prepared on paper, plastic, cloth, or other material approved by the Procuring Activity. Electrical, electronic, and other schematic type charts shall be provided with a clear plastic overlay or be made of a suitable material which will facilitate temporary marking with a china marking pencil or equivalent.

3.4.9.11.2.2 Chart size. Charts shall be prepared to conform to one or more of the following four sizes:

thirty-six (36) inches by forty (40) inches;

thirty-six (36) inches by sixty (60) inches;

thirty-six (36) inches by ninety (90) inches;

thirty-six (36) inches by one hundred twenty (120) inches.

3.4.9.11.2.3 Master reproducible charts. One set of full size master reproducible charts shall be provided and delivered to the Using Activity or as otherwise directed by the Procuring Activity concurrently with the delivery of the first set of charts.

3.4.9.11.3 Slides 35 mm. When thirty-five (35) mm slides are authorized by the Procuring Activity and specified in the Detail Specification they shall conform to the requirements of 3.4.9.11.3.1 through 3.4.9.11.3.3 herein.

3.4.9.11.3.1 Slide mounting. A thirty-five (35) mm slide shall be a graphic presentation in the form of thirty-five (35) mm film mounted in a standard two (2) inch by two (2) inch rigid mount. Slides shall be prepared for either horizontal or vertical projection, depending on the material to be presented. However, horizontal projection is preferred. Slide mounts shall be appropriately marked to indicate top and front side to facilitate projector loading.

3.4.9.11.3.2 Slide type style. LeRoy, Wrico, Press-Type, DECA-DRY, or other mechanical lettering of similar size and style may be used where typeset is not practical. Typed copy on thirty-five (35) mm slides shall be either by typeset or office composing machines of like quality.

3.4.9.11.3.3 Slide type size. The smallest letter (or symbol) height shall be at least three percent (3%) of the shortest dimension of the artwork, photograph or other material prepared for thirty-five (35) mm photography. Example: Eight (8) inch by twelve (12) inch artwork requires one fourth ($\frac{1}{4}$) inch high letters. A single slide shall not contain more than fourteen (14) lines of type or an equivalent amount of other graphic material, plus a title.

3.4.9.11.4 Introductory motion picture film 16 mm. When directed by the Procuring Activity and specified in the Detail Specification, a sixteen (16) mm sound color motion picture film shall be prepared to present completely a new maintenance trainer to a viewing audience. The film will be used for introductory briefings and training. The film shall be a maximum of thirty (30) minutes duration and shall show the equipment in performance of its design mission; maintenance views as a part of the overall film are acceptable and desirable. The film should be so designed that the viewer will have a better understanding of the new item.

3.4.9.11.4.1 Film titles. Titles shall be composed within a standard ten (10) field frame size and a two (2) field allowance shall be made around all lettering within the field as a safety precaution.

3.4.9.11.4.2 Film type style and size. When considered essential for a more effective presentation and authorized by the Procuring Activity, style (type face) and size of lettering for main title, sub-titles, and end title may deviate from standard.

3.4.9.11.4.3 Film leaders. Each reel of film will have the film report number and title marked on the head and foot of the standard leaders.

3.4.9.12 Negatives and positives for Audiovisuals. Negatives and positives for all A/Vs shall be free of overall discoloration, local off-color areas, highlight areas, dark shadows, transparent streaks, reticulation, scratches, stains, surface deposits, mechanical defects, and injuries. Prints shall be sharp and provide good detail. Black and white reproductions shall be of even density and free of fog, spots, markings, stains, discolorations, surface deposits, mechanical defects, and injuries.

3.4.9.13 Color coding on Audio/Visuals. Color coding shall be in accordance with the color coding used in the applicable official technical manuals. Colored A/Vs shall be evenly illuminated in light of the correct color temperature for which the film is balanced. The color achieved shall closely duplicate that of the subject in hue and intensity. Color harmony shall be maintained by the use of various shades of neutral colors to complement the colors being used to show flow and component parts. Where dark colors are used to show flow and component parts, lighter neutral shades shall be used for background and fill-in to ensure the A/V will not be given a drab

MIL-T-81821

appearance. Color shall be used to clearly present flow patterns of liquids or gases, or operating conditions on an electrical schematic. In specific instances, color may be used for extreme emphasis or for separation of details for clarity. Special emphasis may be given to parts or units by reverse black silhouette treatment with white line detail, by a bold posterized treatment, or by color in conjunction with a simple line technique. Color shall be used only to serve as essential functional requirement, and shall not be used for decorative purposes. A legend on the A/V shall explain the significance of each color used.

3.4.9.14 Audio/Visual review and verification. Completed A/Vs shall be subject to review and verification by Using Activity instructors during the instructor training program and inspection by the Using Activity representative during the training equipment acceptance inspection. In the event A/Vs are not used in an instructor training program prior to acceptance thereof, the Contractor shall provide one (1) reproduced copy of such A/Vs to the Using Activity for review and verification a minimum of thirty (30) days prior to delivery and acceptance of the A/Vs. This review copy shall, if possible, be in the form of a commercial quality dry process paper reproduction of the master reproducible for each A/V. Using Activity review, verification and approval of A/Vs will be limited to determination of compliance with Detail Specification requirements (including the descriptive data therein) technical accuracy, validity of identification/applicability data code numbers assigned, and suitability of the A/V for the intended training purpose.

3.4.9.15 Index of Audiovisuals. When specified in the Contract Data Requirement List DD Form 1423, an index of A/Vs consisting of a consolidated listing of all A/Vs specified in the Detail Specification shall be provided concurrently with the delivery of the first set of A/Vs, in accordance with the requirements of DID No. DI-E-6123.

3.4.10 Symbols and reference designations on circuit diagrams

3.4.10.1 Circuit parts. Circuit parts shall be represented on circuit diagrams using symbols conforming to USAS Y32.2-1967.

3.4.10.2 Electronic parts. Electronic parts, such as capacitors, resistors, relays, transformers, and other miscellaneous circuit parts of the trainer shall be identified on the applicable circuit diagram by reference designations conforming to USAS Y32.16-1968 and by numerical designations assigned by the Contractor.

3.4.10.3 Fluid system components. Fluid system components shall be represented on schematic diagrams using symbols conforming to MIL-STD-17.

3.5 Logistics

3.5.1 *Maintenance*

3.5.1.1 *Repair parts.* Trainer peculiar equipment and material repair parts in the estimated quantities required to support the trainers and related items for a period of six (6) months shall be provided and delivered concurrently with the training equipment and related items. Spare bulbs and fuzes equivalent to twenty-five (25%) percent of the total trainer requirements for each type shall be furnished with each applicable trainer. A container for these spare bulbs and fuzes shall be mounted in a convenient location on the rear of each trainer panel and shall be appropriately labeled. Repair parts to be provided shall be specifically identified in the Detail Specification.

3.5.2 *Conferences.* Initial and follow-on conferences, as required to further define required Contractor support and technically approve the configuration and design of the trainers and related items, and services specified in the Detail Specification, shall be convened as required. When specified in the Contract Data Requirements List DD Form 1423, specific agenda and minutes for these conferences shall be prepared in accordance with DID Nos. DI-P-6201 and DI-P-6202—or as directed by the Procuring Activity. Technical data and administrative support, as required, shall be provided for each conference. Such conferences may include, but shall not necessarily be limited to the items listed in the following subparagraphs.

3.5.2.1 *Training equipment preliminary design review conferences.* A preliminary design review conference shall be convened for the purpose of reviewing the proposed Detail Specification or Detail Specification revision and other related data specified herein for the initial and subsequent procurements of training equipment, related items, and services required to provide the necessary training capability for the related series end items. The following items shall be provided for review by appropriate attendees on the convening date of the conference:

- a. A proposed Detail Specification or revision prepared in accordance with DID No. DI-E-6122.
- b. A proposed Make or Buy Program Plan prepared in accordance with DID No. DI-A-6100.
- c. A proposed detail Milestone Chart for the maintenance training equipment prepared in accordance with DID No. DI-H-6205.
- d. A preliminary MTE facilities report prepared in accordance with DID No. DI-H-6135.
- e. An MTE budgetary cost report prepared in accordance with DID No. DI-F-6125.

MIL-T-81821

3.5.2.2 *Training equipment general arrangement drawing and design review conference.* General arrangement drawing and design review conferences shall be convened throughout the detail engineering and design cycle of the trainers and related items procured under the Detail Specification, or revision thereto, to review and approve the general arrangement drawings of the trainers and related items prior to final approval by the Contractor and release for production and fabrication of the items.

3.5.2.3 *Audio/Visuals review and selection conferences.* An A/Vs review and selection conference shall be convened prior to the preparation of final layout or original art work for the A/Vs to be provided. This conference may be held concurrently with, or subsequently to, the preliminary design review conference specified in 3.5.2.1 herein, as necessary, to meet the applicable delivery schedules. Attendees of this conference shall review the Contractor's defined listing of proposed A/Vs, and select those to be specified in defined listing of A/Vs for inclusion in Appendix IV of the Detail Specification or revision thereto.

3.5.2.4 *Instructor training curriculum review conferences.* For each contract item or order for training equipment, related items, and services for which Using Activity instructor training is required, an instructor training schedule and curriculum review conference shall be convened. Attendees at this conference will review the Contractor's proposed training objectives, schedules, and curriculum outlines for all instructor training courses required for the training equipment, related items, and services specified in the Detail Specification or appropriate revision thereto.

3.5.2.5 *Training equipment status and progress review conferences.* Quarterly training equipment status and progress review conferences shall be convened throughout the detail engineering, design, and fabrication cycle of the trainers, related items and services provided in accordance with the approved basic Detail Specification or revision thereto. Attendees at these conferences will review the current status and progress of all maintenance training equipment, related items, data, documentation, and services currently under procurement to support the maintenance training requirements for the related series end items.

3.5.2.6 *Training equipment acceptance conference.* A training equipment acceptance conference shall be convened to accomplish the formal inspection and acceptance of the trainers, related items, and services specified in the Detail Specification. Attendees at this conference shall witness or perform the acceptance inspections and insure compliance with all applicable quality assurance provisions.

3.5.3 Required services. Services required in support of the trainers and related items specified in the Detail Specification shall be provided as specified therein. Such services may include, but shall not necessarily be limited to, those specified in 1.5, 3.5.2, 3.5.4, and 3.6 herein.

3.5.4 Refurbishment. The trainers and related items specified in the Detail Specification shall, upon completion of the Using Activity instructor training program and incorporation of authorized modifications and changes, be refurbished prior to delivery and acceptance by the Government. Refurbishment shall consist of the effort necessary to restore the trainers and related items specified in the Detail Specification to final delivery condition, and shall include touchup of paint and finish, correction of defects and malfunctions, recalibration of equipment as applicable, and repair of any discrepancies resulting from the use of these items during the instructor training program.

3.6 Instructor Training. A factory or on-site training program for Using Activity instructors in the operation, maintenance, and utilization of the training equipment and related items specified in the Detail Specification shall be provided under separate contracts or contract line items. The training program for Using Activity instructors shall use the applicable trainers, A/Vs, trainer MOM IS, technical manuals and other related items, equipment and materials specified herein and in the Detail Specification, and shall be completed prior to the refurbishment, acceptance and delivery of the trainers and related items to the Using Activity. Proposals for required training shall be prepared in accordance with DID No. DI-P-6200.

3.7 Major Components Characteristics. The components characteristics specified and defined herein are of a general nature. In the development of special major components, detail requirements will be specified by the Procuring Activity and specified in the Detail Specification. Systems depicted on maintenance trainers shall be arranged primarily to facilitate an understanding of the systems. Components shall be arranged so that the view of other components is not obstructed in normal classroom use. Provided these goals are not sacrifices, the systems and components shall also represent the relative location of the systems and components in the related end items.

3.7.1 Supporting structure (frame). Each trainer panel shall be supported by the necessary structure consisting of a metal frame and braces fabricated of materials in accordance with 3.3.1.2. The structure must be adequate for the conditions of operation, loading, unloading, storage, and transportation. In addition, the structure must be capable of distributing the weight to the proper reaction points, for example, to the casters when caster mounted, to the lifting device fork truck or pallette when being lifted, and to the platform of the transporting device when being transported. In addition to these requirements, the structure must be designed to optimum weight and size. The

MIL-T-81821

structure shall be designed and constructed in such a manner that its overturning moment is in accordance with 3.2.2.2.2. When specified in the Detail Specification clear hardwood skids shall be installed on selected trainer panels where required to facilitate handling. Materials used to fabricate the skids shall be in accordance with 3.3.1.2.1.

3.7.2 Casters and jacks. All panel assemblies weighing in excess of seventy-five (75) pounds in transportation configuration shall be equipped with casters as specified in 3.7.2.1. All panel assemblies which require leveling for proper operation, or which are equipped with casters shall also be reequipped with screw jacks as specified in 3.7.2.2.

3.7.2.1 Casters. Each trainer panel assembly requiring casters shall be equipped with a minimum of four (4) ball bearing, full swiveling, flat plate type casters which meet the requirements of FF-C-88. At least two (2) of the casters, one on each end of the trainer panel support frame, shall be the locking type. Casters shall be fabricated of high-strength aluminum alloy and shall be equipped with rubber or composition tread aluminum alloy wheels approximately six (6) inches in diameter and one and one-half (1-1/2) inches in width. Extruded aluminum alloy caster mounting plates, countersunk into the skid, or trainer base frame shall be provided on all trainers requiring casters. Provisions shall be made for removing the casters from the metal support frame for shipping purposes. The caster base plate shall be approximately five (5) inches wide, four (4) inches long, and one-half (1/2) inch thick and shall be fitted with a spring loaded pin to retain the casters in a caster storage rack on the trainer base or frame. The casters shall be capable of supporting the trainer panel while in use for extended periods of time. Each caster shall not impose a concentrated single point floor loading greater than 100 pounds-per-square-inch based on the following formula:

$$F = \frac{W}{C \times N}$$

- F** = Concentrated single point floor loading factor in psi
w = Total weight of trainer panel in pounds
c = Caster or jack pad foot print in square inches of floor area covered
N = Number of casters or jack pads on trainer panel

To determine floor loading without casters substitute square inches of trainer support structure in floor contact for C x N in this formula.

3.7.2.1.1 Special casters. Casters shall be provided on auxiliary power-plants, engines, and on trainers of special design, as directed by the Procuring Activity, and specified in the Detail Specification.

3.7.2.2 Screw jacks. When leveling is critical or the trainer panel requires casters, a minimum of four (4) screw type jacks, one each permanently mounted adjacent to each caster on the trainer base frame, shall be provided for retracting, leveling, removing, or installing the casters. The jacks shall be capable of supporting the trainer while in use for extended periods of time. Each jack shall not impose a concentrated single point floor loading greater than 100 pounds-per-square-inch based on the formula specified in 3.7.2.1.

3.7.3 Storage provisions. Storage provisions shall be provided in each trainer panel for all trainer peculiar items, such as, extension cords, leads, cables, removable casters, soft covers, publications, manuals and historical records.

3.7.4 Drip pans. Detachable drip pans with readily accessible low-point drain valves shall be located under all liquid systems. The drip pan shall be constructed of sheet metal or other equally durable material not less than forty thousandths (.040) of an inch thick.

3.7.5 Covers. Unless otherwise specified in the Detail Specification, covers of the types specified in 3.7.5.1 through 3.7.5.3 shall be provided for each individual trainer.

3.7.5.1 Waterproof soft covers. Waterproof soft covers shall be provided for protection against weather damage during shipment. These covers shall be fabricated of a coated waterproof fabric or equivalent and shall be designed to fit over individual trainer panels in the shipping configuration. All corners and points of stress shall be reinforced to assure maximum strength and durability. Covers shall be fitted with waterproof zippers where required to permit ease of installation and removal. Suitable fasteners shall be provided where required to assure a reasonably tight fit and secure cover. Fasteners provided for this cover shall be of a type which can be secured or unsecured quickly with no special tools.

3.7.5.2 Waterproof hard covers. Hard covers shall be provided for protection against weather and handling damage during shipment. Covers shall be collapsible and constructed of not less than one-half (1/2) inch-thick plywood conforming to NN-P-530 for type 1 exterior fully waterproof bond plywood. Stiffeners shall be provided on the inside surface of covers as required for rigidity and strength. Covers shall be attached to the trainer panel structure by high-strength! hexagonal, wrench-operated, rotary-type latches which engage with the base rail of the trainer panel frame or, alternatively, by link locks. When multiple panels are assembled on the trainer, they shall present a smooth and continuous exterior surface. An access door shall be provided in hard covers to facilitate removal of the trainer casters from the stored position. The access door lock shall be actuated by an ordinary screwdriver. An instruction decal in accordance with 3.3.3.7.2 shall be included.

MIL-T-81821

3.7.5.3 *Dust and security covers.* Dust and security covers shall be provided for each trainer panel requiring protection against damage due to collection of dust during periods of nonuse and for each trainer panel that contains classified components. These covers shall be fabricated of a suitable light-weight fabric material, conforming to MIL-C-10799 and shall be designed to fit the individual trainer panel in both the shipping and operating configuration. Corners and points of stress shall be reinforced to assure maximum strength and durability. Covers shall be fitted with zippers where required to permit ease of installation and removal. Suitable fasteners shall be provided where required to secure the cover to the trainer panel.

3.7.6 *Working platform.* Where support of personnel is required fourteen (14) inches or more above the floor, a built-on platform or appropriate workstand shall be provided 'which shall be safety-engineered for the planned loads. The procedures described in MIL-STD-882 shall be used to minimize potential hazards to reduce the possibility of personnel injury. Platforms or workstands shall include uniformly spaced nonslip surface steps with firmly anchored guard rails on both sides and along any perimeter of the platform not otherwise protected. The steps shall have from seven (7) to ten (10) inches rise with treads a minimum of eighteen (18) inches in width and four (4) inches in depth.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality Assurance Provisions, General. An organized quality assurance program shall be established in accordance with MIL-Q-9858. Certain requirements herein, such as testing, may be considered common to quality, reliability, and maintainability programs. The quality assurance program shall be planned and used in a manner to effectively support the Contractor's reliability and maintainability programs.

4.1.1 *Responsibility for inspection.* Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the purpose of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.2 *Examination of product.* Each trainer shall be inspected to determine compliance with the requirements specified in the Detail Specification with respect to materials, parts, design, construction, safety, workmanship, finish, interchangeability where applicable, nameplates, data plates and markings.

4.2 Quality Conformance Inspection. The examination and testing of trainers shall be classified as quality conformance inspection and shall consist of inspection methods specified under 4.2.4.

4.2.1 *In-process inspections.* In-process inspections shall include such visual, electrical, and mechanical examination and testing of materials, assemblies, parts, and accessories (including purchased items) during the manufacturing process of the trainers and related trainer peculiar items as may be required to assure conformance to all of the requirements of this specification.

4.2.2 *Acceptance inspection.* Individual engineering acceptance tests shall be performed in accordance with the Government approved test outlines specified in 3.4.8, describing the tests to be performed and the data to be recorded. Acceptance methods and procedures shall be as specified in these Government approved test outlines. The following instructions shall apply:

- a. All test and inspection records shall be subject to review by the *Procuring Activity*.

MIL-T-81821

b. Request for final acceptance inspection shall be made to the Procuring Activity after it has been established by the Government Quality Assurance representative that the trainer set or individual trainer complies with the applicable Detail Specification.

c. Unless otherwise directed, the Procuring Activity or designated representatives thereof will, in conjunction with the Using Activity, determine the date for and perform the final acceptance inspection with the QAR at the Contractor's plant. The inspection will follow the operational and functional tests, and inventory set forth herein.

d. Upon completion of the final acceptance inspection, the Using Activity will make recommendations to the Procuring Activity in regards to acceptance.

4.2.3 Failure logs. The Contractor shall maintain a log of all parts failure, in the equipment service/historical record specified in 3.4.3, including GFE which occur during the test calibration period. The log shall include the part number of the failed part, location of failed part, cause of failure if known, and number of cycles and hours on the trainer at the time of failure. This log shall be made available to the Procuring Activity at the beginning of inspection. This log shall also be maintained on total calibration and testing time and shall be authenticated by the quality assurance representative (QAR).

4.2.4 Test methods. The procedures and methods for conducting all tests specified herein shall be as stated in the trainer acceptance test outlines specified in 3.4.8.

4.2.4.1 Human-factor compliance tests. Each trainer panel shall be tested from a training effectiveness standpoint to demonstrate that training requirements are satisfied, and to insure compliance with the human-factor requirements of MIL-STD-1472.

4.2.4.2 Operating tests. The trainer panel or system shall be energized for a period of one (1) hour and subjected to an operating test in an ambient temperature of sixty-eight (68) degrees F \pm five (5) degrees F of not less than six (6) hours to insure the proper functioning of the panel, including all operating controls, supply line voltage, ranges and frequencies, conditions of extreme limits, and conformance to applicable safety requirements. During the operation period not less than three (3) complete cycles of operation shall be accomplished in the presence of the Government inspector to demonstrate compliance with the requirements of the applicable specifications. A cycle of operation is considered to be one complete end to end sequential operation of the trainer in accordance with the operating instructions contained in the trainer

MOMI, regardless of the time required. The trainer panel shall be capable of meeting the performance requirements without alignment or adjustment other than the accessible controls employed for operation of the panel. No repairs shall be permitted during the operational tests. If repairs are required, the test shall be repeated after the necessary repairs or replacements have been made. Trainers requiring interconnection for complete system demonstration shall be tested as a unit to insure proper operation of all components. Associated trainer power supply equipment, such as power conversion units, direct-current power units, cables and power distribution junction boxes, and also all applicable system Ground Support Equipment (GSE) and special tools shall be functionally tested in conjunction with applicable trainers prior to delivery.

4.2.4.3 *Electromagnetic interference suppression test.* The electronic trainer panels shall be tested to determine conformance to the electromagnetic interference suppression requirements of paragraph 3.3.2 herein, by means of the applicable test methods specified in MIL-STD-462, for Class 1D equipment, which are concerned with conducted and radiated electromagnetic emissions, and with degradation of performance of equipment due to susceptibility to electromagnetic interference.

4.2.4.4 *Reliability and maintainability demonstrations and tests.* Reliability and maintainability demonstrations and tests, if required by the contract or Detail Specification, shall be subject to the following criteria:

- a. Monitoring instruments shall be used to observe essential operating characteristics and to determine the time of failure.
- b. A failure will be considered to have occurred whenever the trainer panel requires corrective maintenance action in order to perform its function within specified limits.
- c. A pattern failure shall be considered to have occurred when two or more failures of the same part in its identical or equivalent application exceeds its combined predicted failure rate. Necessary corrective action, at no cost to the Government, shall be required for pattern failures.

These tests may be performed separately or in conjunction with any other tests to which the trainers are subjected at the discretion of the Government and as specified in the individual trainer reliability demonstration and test procedures. Equipment mission, failure, and accept/reject criteria shall also be defined in the reliability demonstration and test procedures for each trainer.

MIL-T-81821

4.2.4.4.1 Maintainability verification (applicable to Navy and Air Force). The Contractor shall verify that all parts and components are identifiable in the I Illustrated Parts Breakdown and are readily accessible for servicing and replacement, and that all maintenance repair and set-up instructions in the MOM I are complete and valid.

4.2.4.4.2 Maintainability verification (applicable to the Army). Verification of maintainability requirements shall be accomplished by the Contractor, who shall identify all maintenance tasks and perform time studies on them in accordance with the following:

a. These tasks shall be performed, in a manner representative of the normal equipment maintenance environment, by following written instructions prepared for operating personnel with a skill level equivalent to laboratory technicians or skilled mechanics. The time to accomplish each maintenance task shall include time for preparation, fault location, correction of fault, and adjustment, recalibration, and final test. Time shall be recorded in hours and decimal fractions thereof.

b. Maintainability shall be expressed in terms of mean active maintenance downtime as defined in MIL-STD-470, and as determined herein. A period representing the service life shall be expressed in hours of operation or cycles of operation, as appropriate. If service life is not specified, a period of 5,000 hours shall be used. Active maintenance downtime studies shall be made and recorded for each different maintenance task estimated to occur during this period. The number of times each task occurs during this period shall be recorded. This shall be done through use of factual failure rate (reliability) data. If this factual data is not available, estimated failure rate data shall be used. The mean active maintenance downtime shall then be computed by adding all of the downtimes for the period and dividing by the total number of tasks for the period.

4.2.4.5 Other tests. Other tests such as functional tests, structural tests, environmental tests, etc. will be performed as necessary to demonstrate compliance with applicable specifications cited herein. These tests shall be as described in the following subparagraphs.

4.2.4.5.1 Temperature measuring. Temperature measuring instruments shall be placed at critical points throughout the trainer panel, covering suspected high temperature areas. Data shall be recorded during each cycle at the end of the period of high voltage variation indicated under the power requirements of the related specification. The log of the data obtained should clearly identify

the location of the instrument in or on the trainer panel, the temperature recorded, and ambient temperature for which the trainer panel was designed.

4.2.4.5.2 Controls and control circuits. The trainer panels shall be tested to determine the suitability of controls and control circuits for satisfactory mechanical and electrical operation.

4.2.4.5.3 Functional tests. The functional tests shall consist of all tests necessary to substantiate compliance with the trainer panel performance requirements and the system operational interconnection capability, as stated in the Detail Specification.

4.2.4.5.4 Structural tests. Structural tests shall be as required by the applicable specifications cited in the Detail Specification.

4.2.4.5.5 Power tests. Power tests shall be performed as necessary to demonstrate compliance with the electrical, hydraulic, and pneumatic operational requirements of the Detail Specification.

4.2.4.5.6 Environmental tests. Environmental tests shall be performed in accordance with appropriate portions of MIL-STD-810 as necessary to establish durability and reliability of the trainer panel materials and components under the environmental conditions of service operation.

4.3 Test Records. The Contractor's records of all inspection work and tests, giving the results of tests required to determine compliance with the requirements and tests specified herein, shall be kept complete and available to Government representatives throughout the life of the contract. The record of report of inspection and tests shall be signed or approved by a responsible person specifically assigned by the Contractor. Contractors not having laboratory test facilities satisfactory to the Government shall engage the services of a commercial testing laboratory, capable of conducting tests and acceptable to the Government, to determine compliance with all the requirements and tests in the applicable specifications cited herein.

4.4 Inventory. Each trainer panel and related items specified in the Detail Specification shall be inventoried by representatives of the Procuring Activity, QAR, and the Using Activity as the last function of the final acceptance inspection.

4.5 Preparation for Delivery Inspection. Preparation for delivery provisions shall be examined for conformance to section 5 herein.

MIL-T-81821

4.6 Warranty. The training equipment, related items, and services specified in the Detail Specification shall be subject to the warranty provisions applicable to the related end items.

5. PREPARATION FOR DELIVERY

5.1 Preparation for Delivery, General. The requirements specified herein apply only to direct purchases for direct shipment to the Government. All items specified herein shall be shipped by carrier(s) specified by the Procuring Activity. If Government carriers are used, the Contractor shall load and secure the items at the Contractor's plant.

5.2 Packing. Unless otherwise specified, the trainer covers specified herein shall provide adequate protection to comply with the air transportability requirements of MIL-A-8421 for shipment by air. When other methods of shipment are required, packing shall be provided as directed by the mode of transportation.

5.2.1 Base. A pallet type base shall be secured to the bottom of trainer panels where necessary to facilitate general handling, fork lifting, or hoisting, during shipment and storage.

5.2.2 Preparation for shipping. All trainer panels containing liquid, except fuel system trainers, shall be drained, purged, and preserved only if required by the carrier or applicable regulations pertaining to the method of shipment. Fuel system trainers shall always be drained, purged and, if required, preserved prior to shipment. Containers, as required, shall be provided for shipping fluids used in the trainer panels. These containers shall be of anti-corrosive material, and shall be free of any materials which could cause contamination of fluids during shipment.

5.3 Marking. When additional packaging or packing is specified, interior or exterior containers shall be marked as specified in 3.3.3.23. The trainer nomenclature shall be as specified in the Detail Specification.

5.4 Delivery Date. The delivery date shall be the date on which the complete trainers, related items and services specified in the Detail Specification are inspected by representatives of the Using Activity, QAR and accepted by the Procuring Activity for shipment to the designated Government site.

MIL-T-81821

6. NOTES

6.1 Intended Use. The trainers and related items specified herein are intended for use by the students in the performance of maintenance tasks (i.e., repair servicing, adjustment, and troubleshooting of the various systems, subsystems, installations, components, and equipment of the related series end items and ground support equipment applicable thereto at the specified levels of maintenance).

6.2 Ordering Data. Procurement documents should specify:

(a) Title, number, and date of this specification.

(b) The proposal should contain a proposed Prime Item Development Specification/Detail Specification, Type B1 Form 1A, in accordance with MIL-STD-490 and DID No. DI-E-6122 for the Maintenance Trainer Set/Maintenance Training Equipment.

(c) Data requirements (as listed on the Contract Data Requirements List, DD Form 1423). Provisioning data and documentation for logistic support of the maintenance trainers as delivered should be as specified by the Logistic Support Agency on the appropriate DD Form 1423. The following data items shall be specified in the Contract Data Requirements List (DD Form 1423), and prepared in accordance with their corresponding DIDs as indicated:

Paragraph Number	Data Item Description Number
3.1.1	DI-E-6122
3.3.1.36	DI-E-6204
3.4.1	DI-E-6106
3.4.2	DI-M-6152
3.4.3	DI-H-6132
3.4.4	DI-P-6167
3.4.4	DI-H-6197
3.4.4	DI-H-6198
3.4.4	DI-H-6199
3.4.6	DI-H-6133
3.4.7.1	DI-H-6134
3.4.7.2	DI-H-6135
3.4.7.3	DI-F-6125
3.4.7.4	DI-A-6103
3.4.7.5	DI-P-6164

Paragraph Number	Dat Item Description Number
3.4.7.6	DI-A-6100
3.4.7.7	DI-L-6139
3.4.7.8	DI-E-6118
3.4.7.9	DI-H-6136
3.4.7.10	DI-E-6119
3.4.7.11	DI-F-6203
3.4.8	DI-H-6129
3.4.9.11	DI-E-6124
3.4.9.15	DI-E-6123
3.5.2	DI-P-6201
3.5.2	DI-P-6202
3.5.2.1	DI-H-6205
3.6	DI-P-6200

(d) That the distribution of data will be as specified in the Contract Data Requirements List (DD Form 1423) in accordance with DIDs requirements listed in 6.2(c).

(e) That when specified in the Detail Specification, Contractor-furnished tools necessary for maintenance or adjustment of the component on any panel will be furnished with each trainer. The special tools to be furnished should be listed on the trainer proposal drawings and should be the applicable ones selected from the Contractor's special tools exhibit and should be specified in the Detail Specification. Where duplicate tool requirements exist, only one set of tools should be provided.

6.3 Definitions. Throughout this specification, various phrases and terms are used which could be subject to varying definitions. These phrases and terms are therefore specifically defined as follows:

6.3.1 *Animated/simulation panels.* Animated/simulation panels are maintenance trainers consisting of simulated or animated components designed to provide capability for demonstration of systems operations, theory, and maintenance of systems which the use of actual equipment is not feasible or desirable, and cost effective training value can be attained.

6.3.2 *"As directed"*. This phrase indicates that the requirements of the paragraph in which the phrase appears are normally applicable to all procurements under this specification, and these requirements shall be specifically defined in the Detail Specification or other applicable contractual documentation. The Procuring Activity may provide specific direction concerning the means of

MIL-T-81821

fulfilling these requirements in the request for proposal or order, or by reference to other requirement documentation of the Using Activity or Procuring Activity. Such requirements may also, at the option of the Procuring Activity, be procured by separate contractual actions.

6.3.3 BOA (Basic Ordering Agreement). An instrument of understanding executed between a Procuring Activity and a Contractor which sets forth negotiated contract clauses which will be applicable to future procurements entered into between the parties during the term of the agreement. It includes as specific as possible a description of the supplies or services and a description of the method for determination of prices.

6.3.4 CFE – peculiar ground support equipment. CFE peculiar GSE consists of those peculiar GSE items and parts thereof that are identical to those approved by the Government for inclusion in the appropriate allowance lists or other support equipment documentation as Contractor furnished peculiar GSE for the specified level maintenance of the related series end items. Identical related end item Contractor furnished peculiar GSE which is modified for trainer use is also included in this category. Normally these Contractor furnished peculiar GSE items, (excluding any modification effort for trainer use) are procured separately under the appropriate support equipment procurement actions for the identical items to be provided for operational use.

6.3.5 CFE – related end item operational equipment. CFE related end item operational equipment consists of those related end item systems, subsystems, equipments, components, and major parts required (excluding ground support equipment) that are identical to items provided as Contractor furnished equipment for the related series end items. For example, when the related end item is an aircraft model, this category shall consist of those required items specified in the applicable aircraft equipment or configuration lists, aircraft Detail Specifications, or aircraft engineering drawings and associated lists as Contractor furnished equipment. Identical related end item Contractor furnished equipments which are modified for trainer use are also included in this category.

6.3.6 CFE – trainer peculiar equipment and materials. CFE trainer peculiar equipment and materials consist of those items and materials required for the fabrication, operation, and support of the trainers, related items, and services provided or supplied which are peculiar thereto and not required or supplied for the related end items. This category includes items such as: trainer signal simulation units; special trainer panel controls; trainer base frames; trainer shop type electronic benches, screw jacks, casters and covers; trainer power supplies; environmental control equipment required for trainer operation; simulated or mock-ups parts representing actual related end item equipment and parts; trainer power cables; built-in trainer panel work platforms; A/Vs; etc., and individual parts, components, or bits and pieces of GFE items (excluding spare and repair parts therefore) which are required in addition to, or in lieu of, the complete item.

6.3.7 CGPR/ACO (Cognizant Government Plant Representative/Administrative Contracting Officer). The CGPR/ACO is the resident Government representative at the Contractor's plant. The CGPR may be an AFPRO (Air Force Plant Representative Office), NPRO (Naval plant Representative Office), APRO (Army Plant Representative Office), DACSO (Defense Administrative Contract Services Office), or other Government activity designated by the Procuring Activity.

6.3.8 Cutaway component. A cutaway component shall be defined as one which has had a portion of the external housing removed to display the internal portion to the maximum extent possible for training purposes.

6.3.9 Electronic workbench panels. Electric workbench panels are maintenance trainers consisting of actual electronic system components mounted on electronic workbenches with all applicable GSE in a configuration that shall provide capabilities for demonstration and performance of all applicable maintenance tasks in the same manner as performed by the operational maintenance activities.

6.3.10 Equipment group panels. Equipment group panels are maintenance trainer panels consisting of actual related end item system, subsystem, or equipment components and related GSE provided in the same configuration as utilized by operational maintenance activities. These trainer panels shall provide the capability for trainees to practice actual performance of specific maintenance tasks in the same manner as they will be performed in the operational environment.

6.3.11 GFE – common ground support equipment. GFE common GSE consists of those complete items of common GSE that are specified in the applicable allowance lists or other appropriate Government approved support equipment documentation as Government furnished items required for the specified level maintenance support of the GFE and CFE systems, components, and equipment of the related series end items. The individual parts, components, bits and pieces of these complete items (excluding spares and repair parts therefore), which are required for the trainers, related items, and services provided or supplied herein, and are in addition to, or in lieu of, the complete item, are not considered GFE.

6.3.12 GFE – contractor installed operational equipment. GFE Contractor installed operational equipment consists of those complete items of required equipment provided to the Contractor as Government furnished equipment for installation in the related series end items. For example, when the related end item is an aircraft model, this category shall consist of those complete items required that are listed under separate identification numbers in the Government furnished equipment lists or aircraft Detail Specification for production or retrofit installation in

MIL-T-81821

the applicable aircraft model. The individual parts, components, bits and pieces of these complete items (excluding spares and repair parts therefore), which are required for the trainers and related items, and services provided or supplied herein, and are in addition to, or in lieu of, the complete item, are not considered GFE.

6.3.13 GFE – end item and support equipment technical manuals. GFE end item and support equipment manuals consist of official manual< identified by a Government publication number, which pertain to the maintenance and operation of the related series end item, Government installed and Government furnished equipment, and the related support equipment applicable thereto.

6.3.14 GFE – Government installed operational equipment. GFE Government installed operational equipment consists of those complete items of equipment required that are normally supplied direct to the Government operational sites for alternate or intermittent use on the related end item. These items are not included as Contractor installed equipment for the related series end items; however, space and wiring provisions for the equipment are required by the related series end items Detail Specification. These items that are Government installed for the related series end items, however, must be supplied to the Contractor for incorporation in, or support of, the maintenance trainers, related items and services specified herein. This category includes items such as electronic countermeasure pods, refueling stores, armament pods, pylon adapters, alternate launcher installations, inert armament stores, and other items of this type that are required but not listed in the Government furnished equipment list for the related series end items. The individual parts, components, bits and pieces of these complete items (excluding spares and repair parts therefore), which are required for the trainers, related items and services specified herein, and are in addition to, or in lieu of, the complete item, are not considered GFE.

6.3.15 GFE – peculiar ground support equipment. GFE peculiar GSE consists of those complete items of peculiar GSE required that are specified in the applicable allowance lists or other appropriate Government approved support equipment documentation as requirements for the specified level maintenance support of the Government furnished operational equipment supplied for either Government or Contractor installation in the related series end items. The individual parts, components, bits and pieces of these complete items (excluding spares and repair parts therefore), which are required for the trainers and related items and services specified herein, and are in addition to, or in lieu of, the complete item, are not considered GFE.

6.3.16 GSE (Ground Support Equipment). All equipment required on the ground to make a system, support system, or subsystem, or end item of equipment (GSE for GSE) operational in its intended environment. This includes all equipment required to install, launch, arrest (except

Navy shipboard and shorebased launching and arresting equipment), guide, control, direct, inspect, test, adjust, calibrate, appraise, gauge, measure, assemble, disassemble, handle, transport, safeguard, store, actuate, service, repair, overhaul, maintain, or operate the system, subsystem, end item, or component. This definition applies regardless of the method of development, funding, or procurement. GSE may be categorized as Common (General Purpose) and Peculiar (Special Purpose); within these categories may exist Developmental (no Government-approved specification/drawing). For the purpose of this document the following equipment is excluded from the definition of GSE:

- (1) Common powered and nonpowered hand tools.
- (2) Housekeeping items.
- (3) Office furniture and equipment, and items common to all activities defined in applicable tables of allowance, and which are required as indirect support.
- (4) Common production tools and tooling such as lathes, drills, presses, plating equipment, grinders, induction heaters, etc.
- (5) Items which are used only by the Contractor.
- (6) Personal equipment (head sets, microphones, etc.).

6.3.16.1 GSE, common. Common GSE is comprised of only those general purpose items supplying or measuring broad parameters of physical properties such as ground electrical, pneumatic, and hydraulic power units; towing, hoisting, and fueling devices; etc., that are known to be established in the Using Service's inventory. The application of GSE items to other end items, systems, or components does not in itself categorize the items as common GSE.

6.3.16.2 GSE, developmental. Developmental GSE is an item of GSE for which no Government approved specification or drawing exists. This includes:

- a. GSE items to be or being designed and developed.
- b. Commercial items being introduced into the Government inventory.

6.3.16.3 GSE – peculiar. That GSE which must be designed and developed in conjunction with the development of an end item and which does not meet the criteria of common GSE.

6.3.16.4 GSE – standard. Standard GSE is an item of GSE defined by a current Government approved specification or drawing of "off-the-shelf" commercial equipment currently in the Government inventory for which procurement data is available.

MIL-T-81821

6.3.17 *Integrated trainer panels.* Integrated trainer panels are composite maintenance trainers containing several related end item systems mounted on a combination of open frame, workbench, and equipment groups. These trainers shall provide capabilities for overall system operation and demonstration, and for the performance of maintenance tasks for several interconnected and interfaced systems and subsystems contained in the related series end items.

6.3.18 *Intermediate and direct/general.* Intermediate and direct/general level maintenance training includes operation, servicing, adjustment, calibration, troubleshooting, repair, disassembly, reassembly, etc., of end item systems, subsystems, parts, and GSE as defined in the appropriate maintenance concept for the related series end item.

6.3.19 *MT (Maintenance Trainer).* A Maintenance Trainer is a single trainer portion of the MTS and consists of one or more maintenance trainer panels. A Maintenance Trainer contains actual related series end item equipment hardware, simulated malfunctions, the requisite related ground support equipment and equipment groups. A Maintenance Trainer shall provide organizational, intermediate and direct/general levels of maintenance training capability and support for a single system, subsystem, or related group of components within the related series end items that the MTS represents.

6.3.20 *Maintenance trainer panel.* A maintenance trainer panel is a single trainer panel portion of a maintenance trainer that is normally used in conjunction with other related trainer panels to provide the complete training capability required for the systems, subsystem, or equipment represented by a maintenance trainer. Individual trainer panels may be independently operable, may require mechanical assembly into a panel group in the operating condition, or may require power and signal interconnection with other panels of the trainer and related trainers. A maintenance trainer may consist of separate trainer panels due to space, size, weight, shipping, transportability, and convenience considerations. A single panel of one of the styles specified in 1.2 which will provide the complete training capability required for the represented system or equipment may also be considered a complete maintenance trainer.

6.3.21 *MTS (Maintenance Trainer Set).* A Maintenance Trainer Set is an instructional hardware set with related items and materials consisting of displays, actual systems, subsystems and equipment hardware items, parts and materials, equipment groups, cutaway components, mock-ups, related ground support equipment, Audio/Visual aids, publications, data, and other items necessary to provide training capability for organizational, intermediate and direct/general level maintenance, operation and special techniques for an aircraft, missile, specific equipment, related equipments, or other item series designated as the related series end items.

6.3.22 MTE (Maintenance Training Equipment). The hardware or software in the form of equipment, devices, system or subsystems, parts or components (actual, duplicated, simulated or otherwise represented) and supporting materials, to be used by student/instructor personnel to achieve required skill levels appropriate to the performance of maintenance tasks such as repair, servicing, adjustment, and troubleshooting various systems, subsystems, installation, components, and equipment of operational related end items or ground support equipment applicable thereto.

6.3.23 Open frame panels. Open frame panels are maintenance trainer panels utilizing an open frame workstand to simulate related end item structure and containing a major system or subsystems of the end item, such as main landing gear, flight controls, or arresting gear systems. These trainer panels shall contain actual operational end item components that duplicate the operation and relative location of components on the related end item and shall provide capabilities for demonstration of system operation and actual performance of applicable maintenance tasks in the classroom environment.

6.3.24 Organizational. Organizational maintenance level training includes operation, location, inspection, testing, troubleshooting, removal, installation, and checkout of end item system, subsystems, parts, and GSE as defined in the appropriate maintenance concept for the related "series end item.

6.3.25 Panel group. This term is defined as two or more trainer panels which require mechanical assembly into a single unit in the operating condition. Individual panels of the panel group are not independently operable, and the panel group is disassembled into individual panels only-for repair, relocation or shipping purposes.

6.3.26 Plasticized component. A plasticized component is defined as one which has all or a portion of its external housing removed and replaced with a transparent plastic composition allowing visual inspection of the component internal mechanism.

6.3.27 Procuring activity. The Procuring Activity, is assigned the responsibility for procuring or providing the supplies or services.

6.3.28 Related end item. A related end item consists of a specific model aircraft, missile, system, subsystem, or equipment for which the trainer set or individual trainers and related items and services provide the required maintenance training capability. For example, the model F-15 aircraft is considered the related end item for the maintenance training equipment representing that aircraft model.

MIL-T-81821

6.3.29 *Related series end items.* Related series end items consist of the complete series, including all models and configurations of the related end item to be included in the operational inventory of a specific Using Service. For example, the F-15A, F-15B, and F-15E aircraft models in the Using Activity's operational inventory are all considered to be the same related series end items.

6.3.30 *Reliability, maintainability, human factors and safety.* Reliability, maintainability, human factors, and safety definitions are as defined in MIL-STD-721.

6.3.31 *'Shall'.* The word 'shall' indicates a mandatory requirement with which the Contractor must comply.

6.3.32 *'Shall be provided:'* Except where otherwise qualified herein or by the Procuring Activity, this phrase or word indicates that the requirements of the sentence and paragraph in which the phrase or word appears are the responsibility of the Contractor to provide as Contractor furnished equipment/material or services under this specification and the specific contract item or order referencing this specification.

6.3.33 *SE (Support Equipment).* Support equipment consists of all equipment (including ground support equipment) required to perform support functions at specified maintenance levels in support of the related series end items in any maintenance environment. For example, support equipment includes in-flight maintenance support equipment (excluding common handtools) when in-flight maintenance is required by the approved maintenance concept for the related series end items.

6.3.34 *'Unless otherwise directed.'* This phrase indicates that the requirements of the paragraph in which the phrase appears are applicable to all procurements under this specification except where specific deviations thereto are indicated in the request for proposal or invitation for bid, or are reflected in the Government approved Detailed Specification for the maintenance training equipment, related items, and services.

6.3.35 *Using activity.* The Using Activity is the specific component or command within one of the military services designated by the Procuring Activity.

6.3.36 *Vertical display panels.* Vertical display panels are maintenance trainer panels containing major related end item system, subsystem, or equipment components mounted on vertical display panels in such a way as to show function, relative location, interface, maintenance

requirements, and physical characteristics of the individual components of the system. Use of actual components is preferred but consideration shall be given to the use of simulated components when greater economy, reliability, or training value can be achieved. Systems may be static or operational with simulated malfunctions incorporated as required to provide the trainee with an understanding of system operation and maintenance.

Custodian:

Army - AV
Air Force - 11
Navy - AS

Preparing Activity:

Navy - AS

Project No. 6900 - 0011

Review Activities:

Army - TM
Air Force - 70
Navy -

User Activities:

Army - WC
Air Force -
Navy -

MIL-T-81821

FIGURES

		Page
Figure 1	Typical Vertical Display Style Trainer	76
Figure 2	Typical Vertical Display Style Trainer	77
Figure 3	Typical Equipment Group Style Trainer	78
Figure 5	Typical Open Frame Style Trainer	80
Figure 6	Typical Open Frame Style Trainer	81
Figure 7	Typical Electronic Workbench Style Trainer	82
Figure 8	Typical Electronic Workbench Style Trainer	83
Figure 9	Typical Animated/Simulation Style Trainer	84
Figure 10	Typical Animated/Simulation Style Trainer	85
Figure 11	Typical Integrated Style Trainer	86
Figure 12	Typical Integrated Style Trainer	87

MIL-T-81821

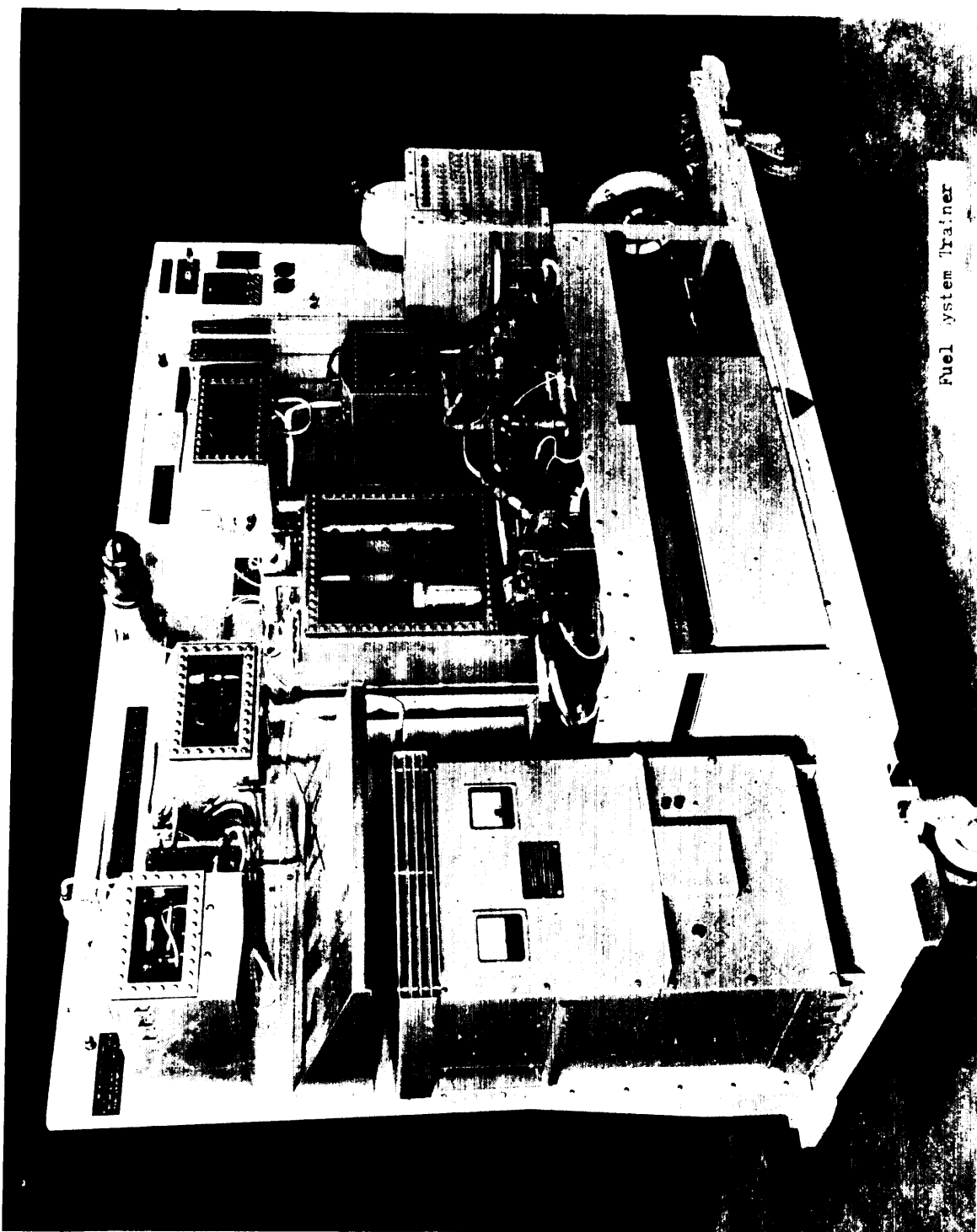


FIGURE 1. Typical Vertical Display Style Trainer

MIL-T-81821

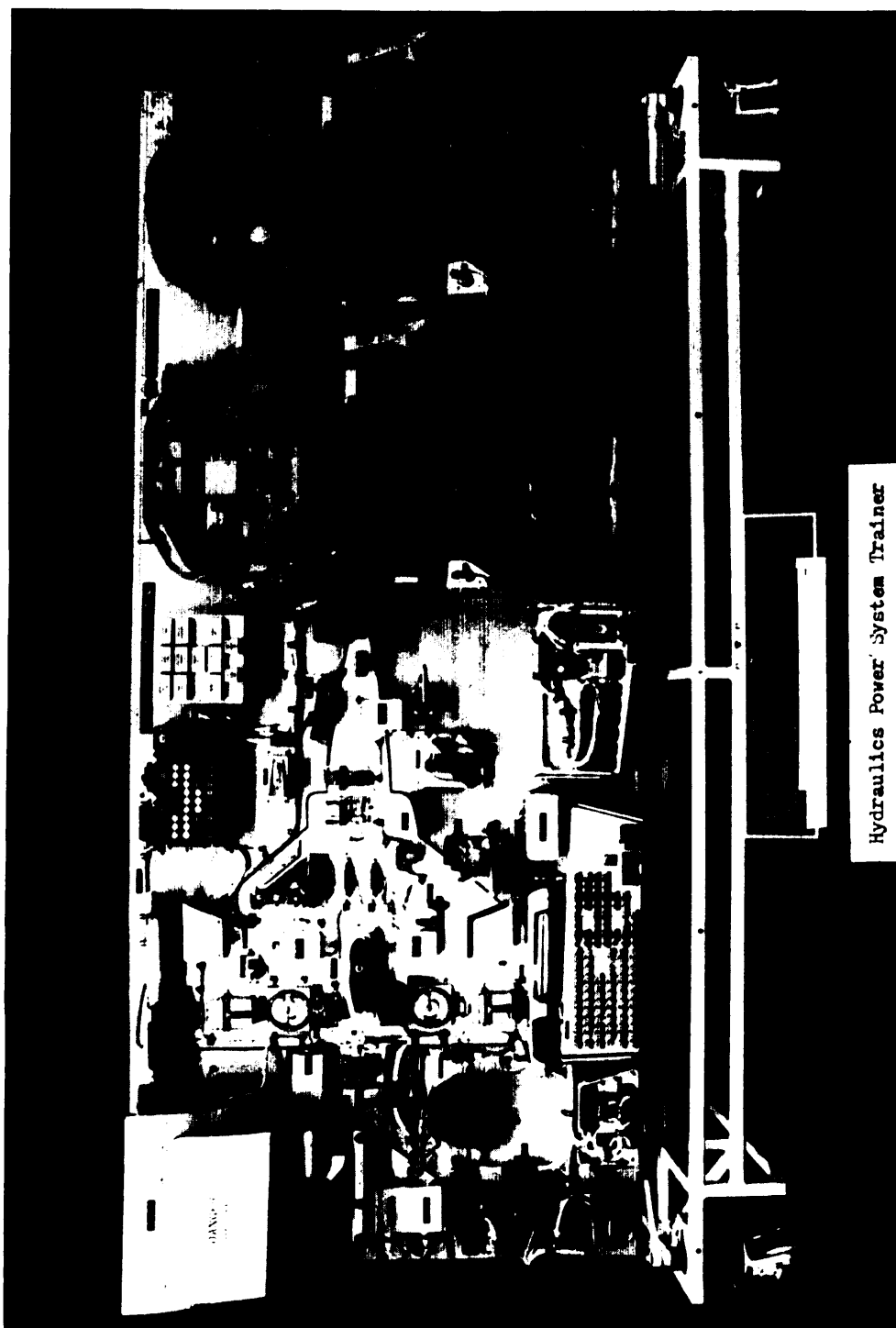


FIGURE 2. Typical Vertical Display Style Trainer

MIL-T-81821



Engine Equipment Group

FIGURE 3. Typical Equipment Group Style Trainer

MIL-T-81821

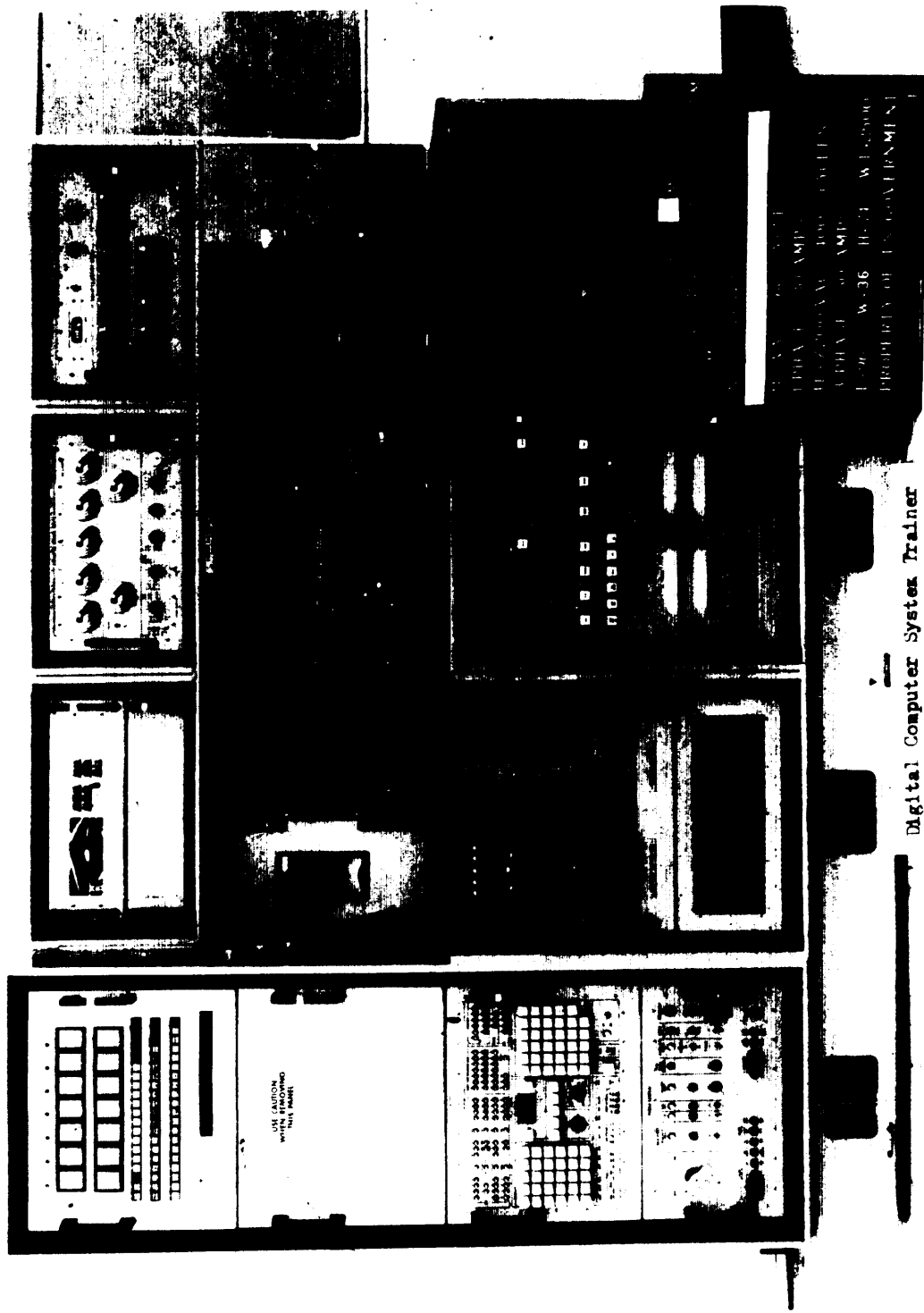


FIGURE 4. Typical Equipment Group Style Trainer

MIL-T-81821

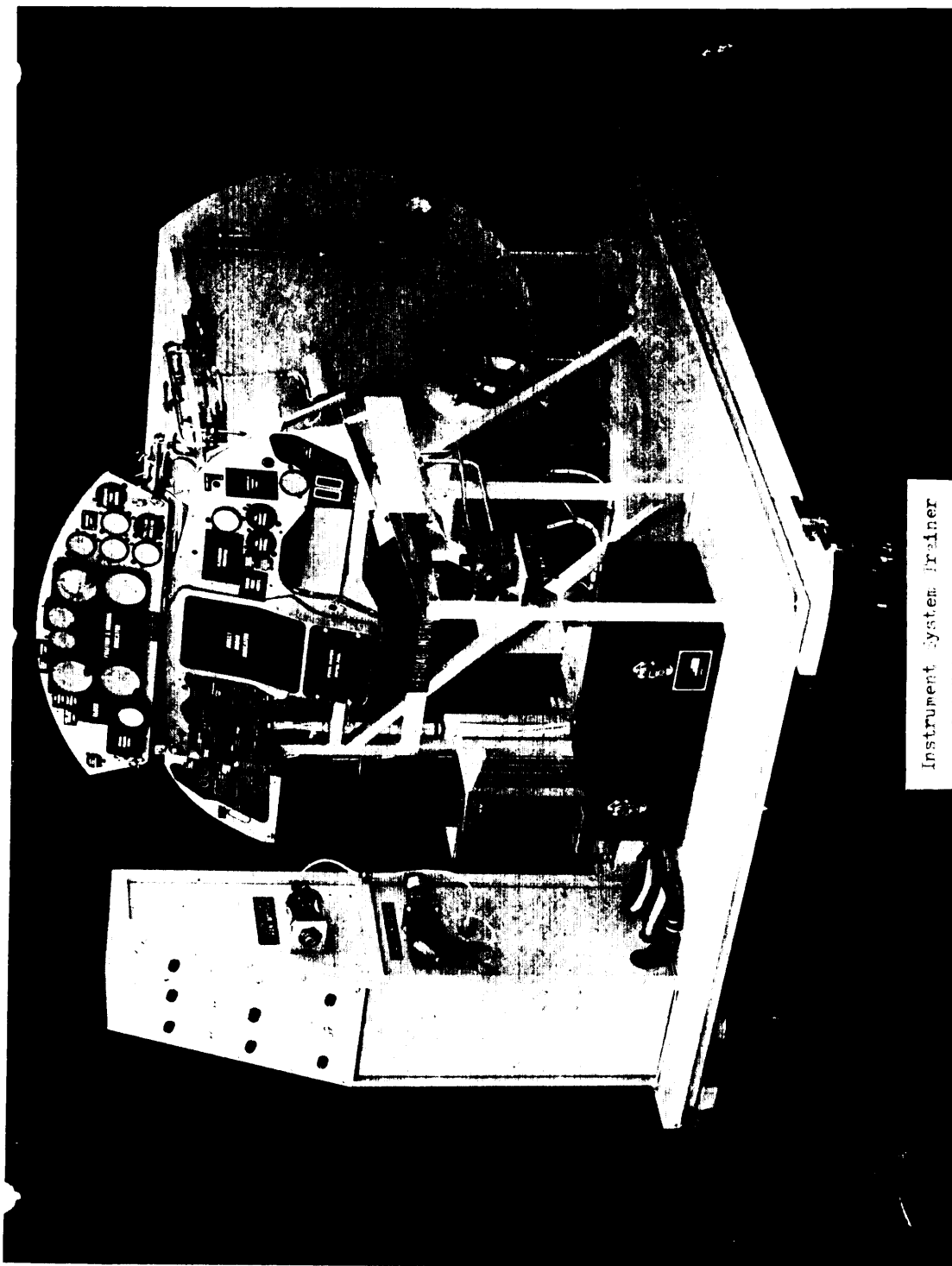


FIGURE 5. Typical Open Frame Style Trainer

MIL-T-81821

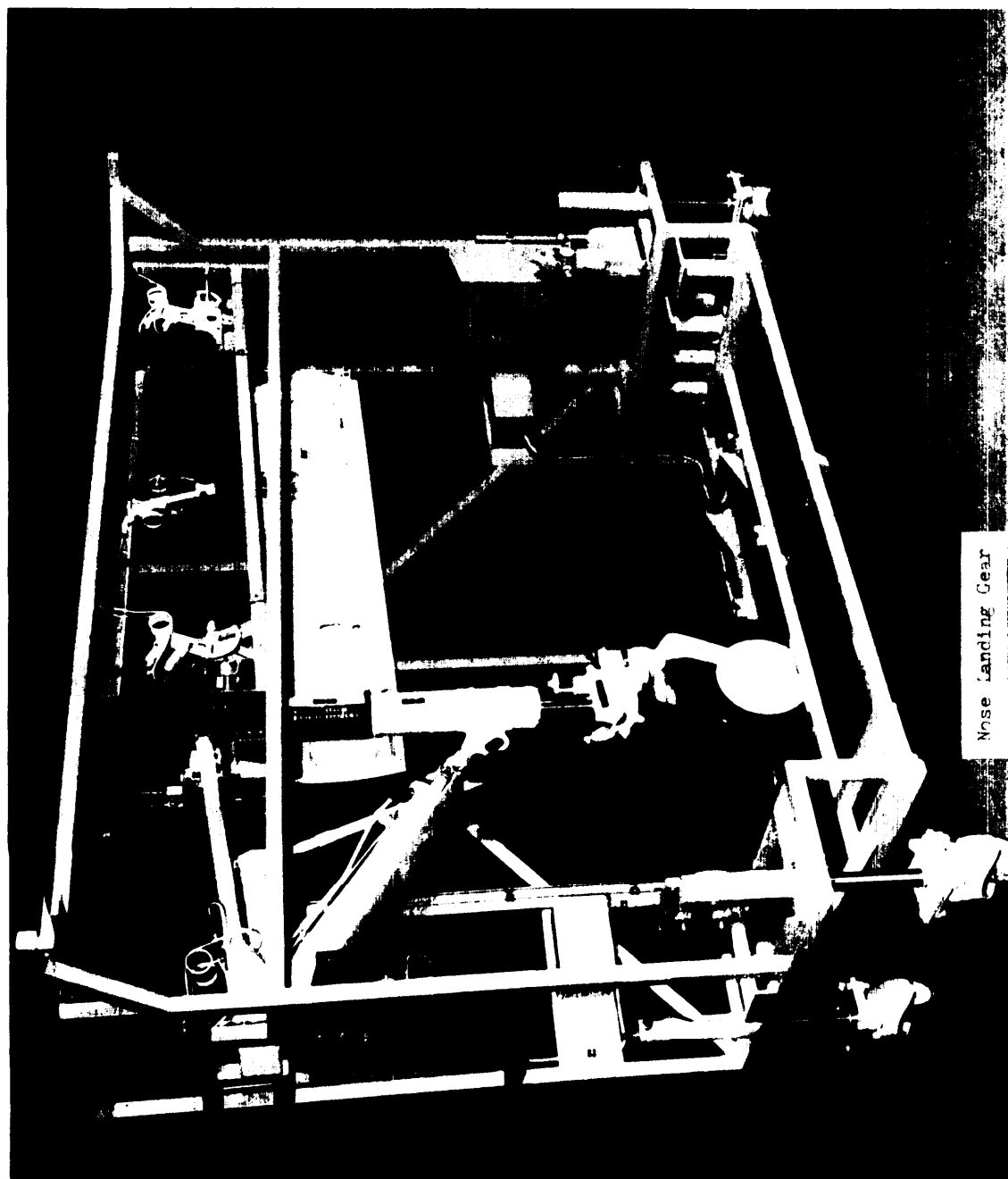


FIGURE 6. Typical Open Frame Style Trainer

MIL-T-81821

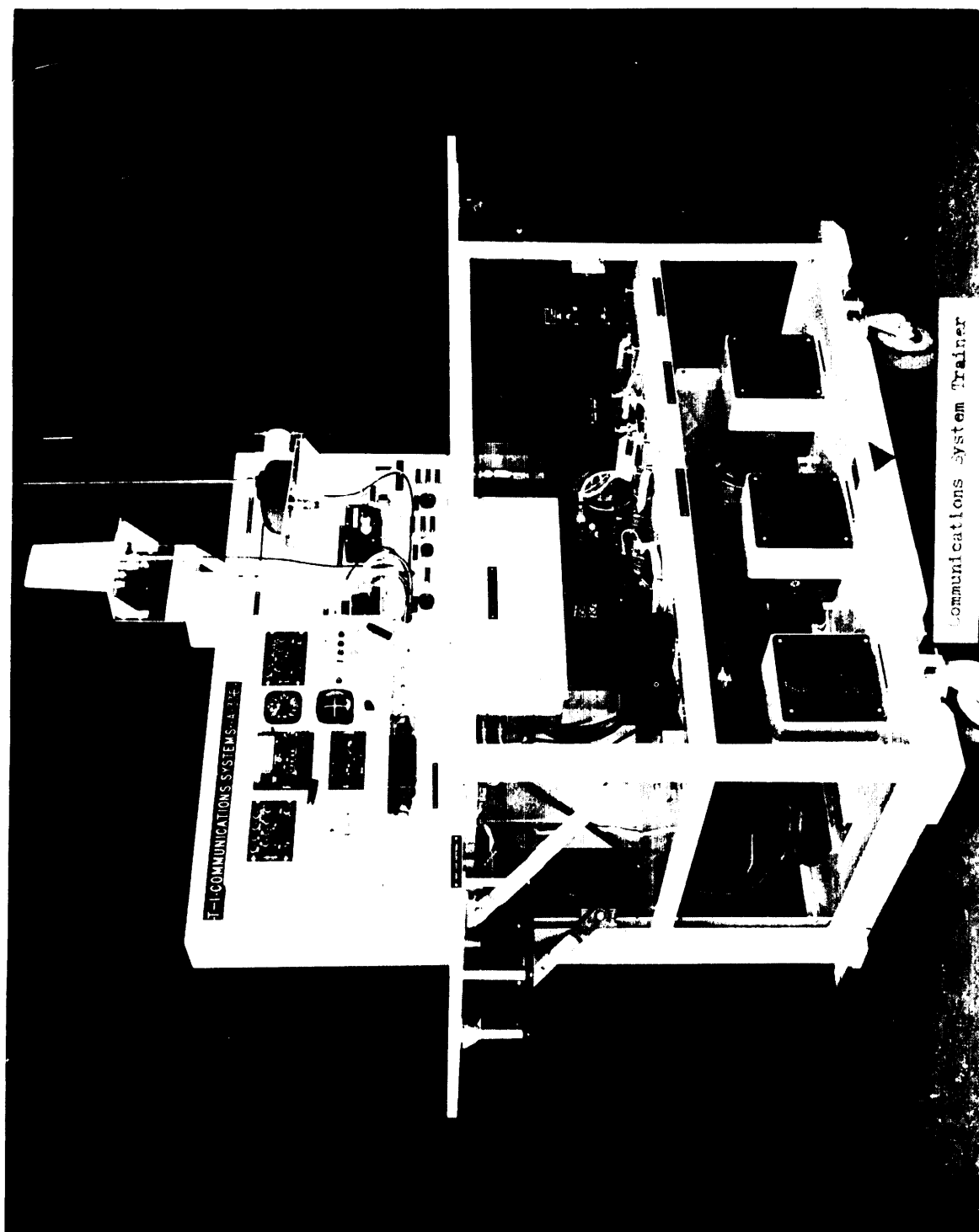
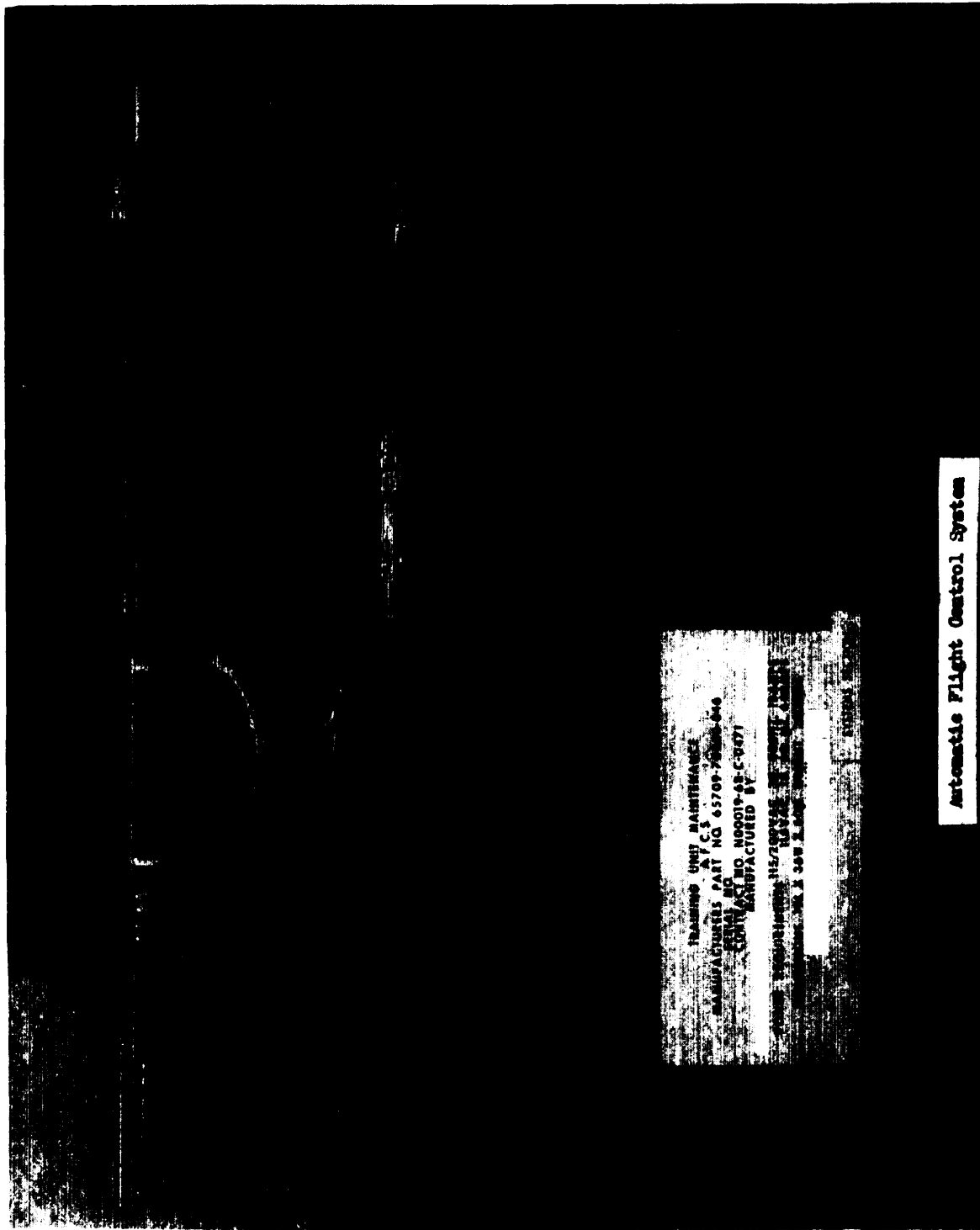


FIGURE 7. Typical Electronic Workbench Style Trainer

MIL-T-81821



Automatic Flight Control System

TRAINING UNIT MAINTENANCE
MANUFACTURER'S PART NO. 65709-7000-000
UNIT NO. N00019-00-C-0071
UNIT MANUFACTURED BY

FIGURE 8. Typical Electronic Workbench Style Trainer

MIL-T-81821

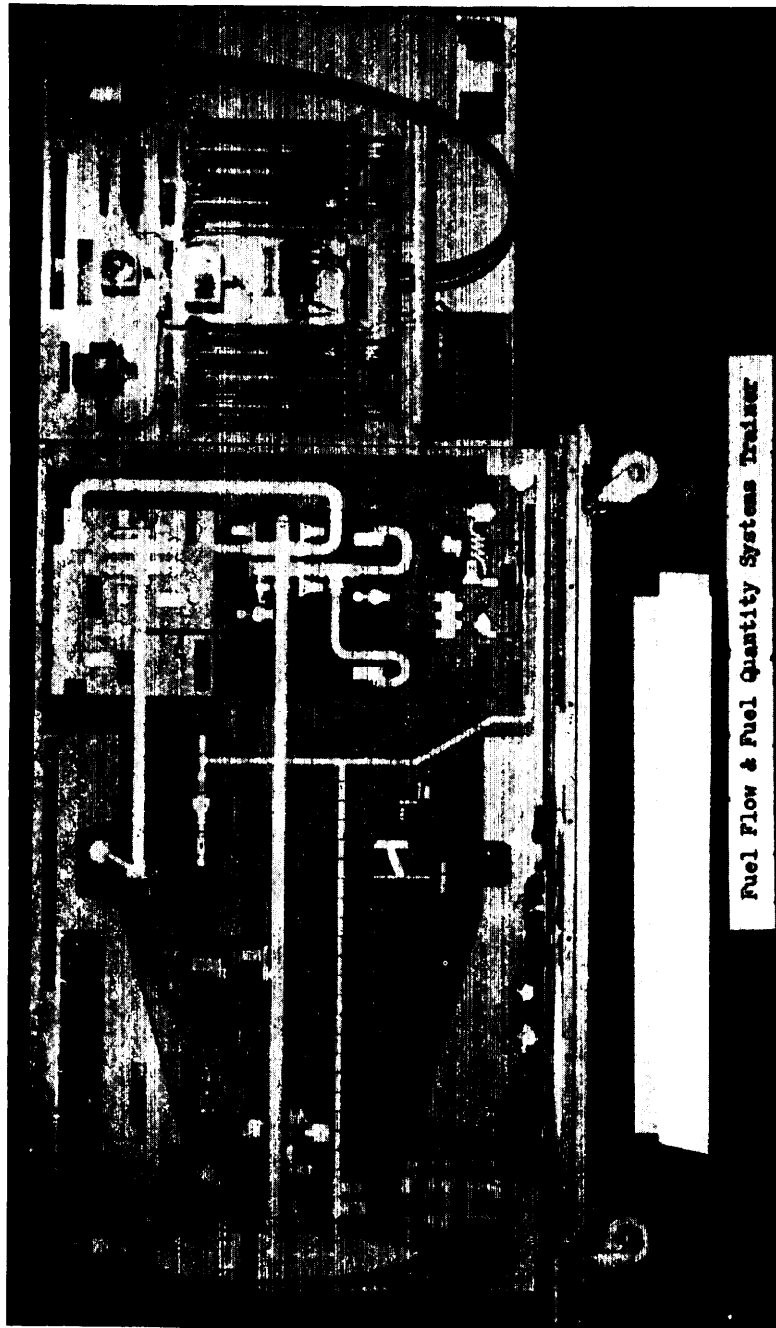


FIGURE 9. Typical Animated/simulation Style Trainer

MIL-T-81821

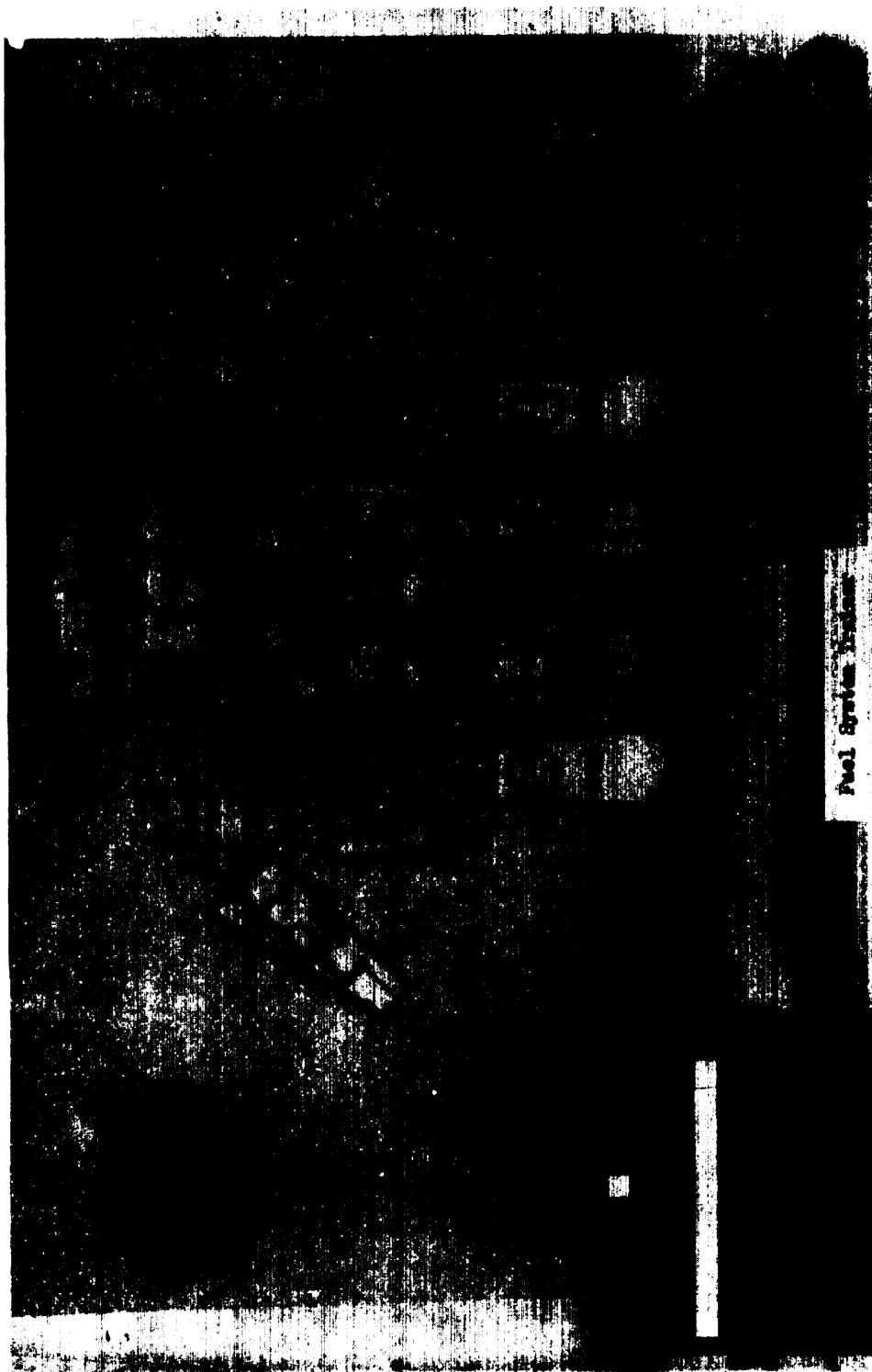


FIGURE 10. Typical Animated/simulation Style Trainer

MIL-T-81821

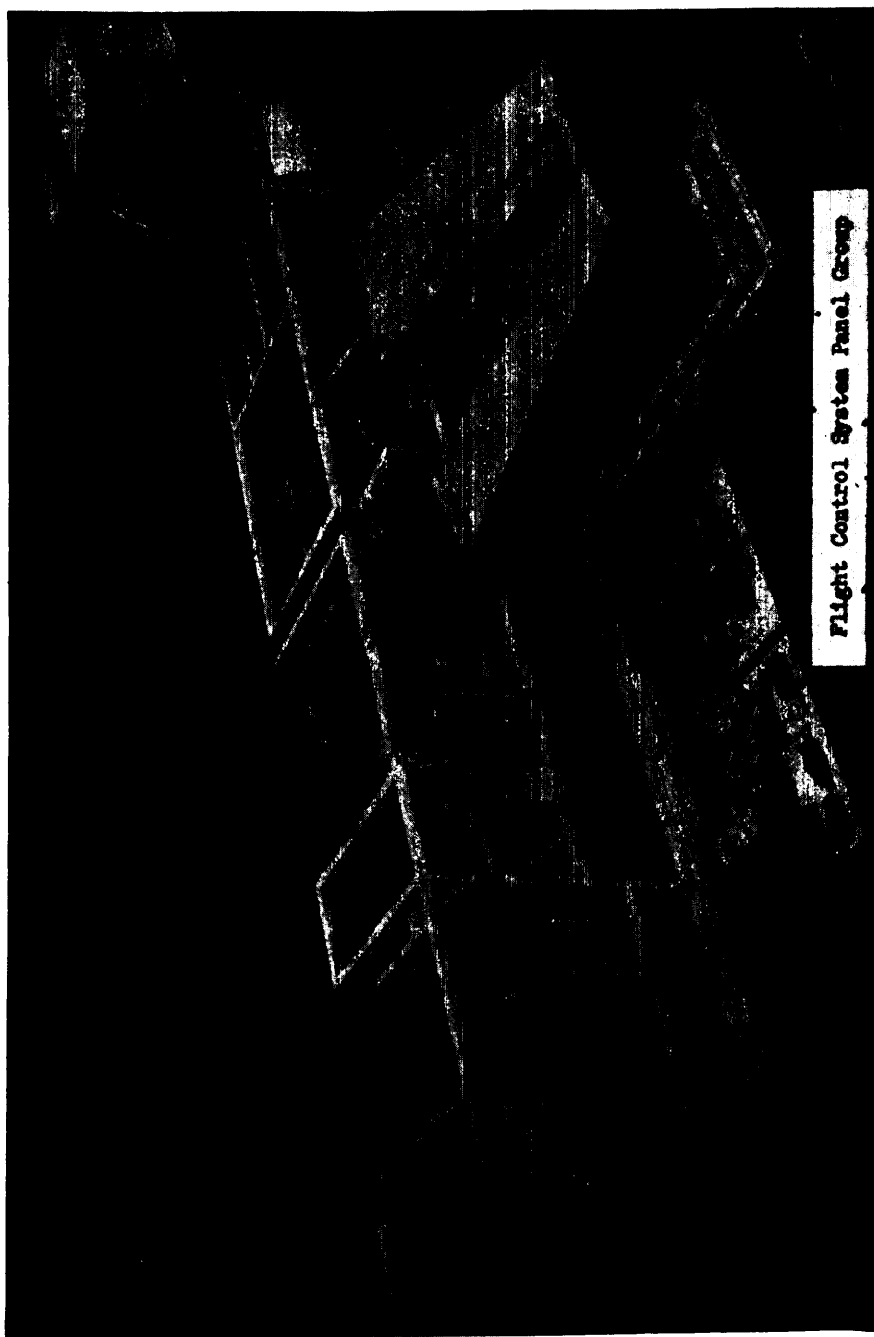


FIGURE 11. Typical Integrated Style Trainer

MIL-T-81821



FIGURE 12. Typical Integrated Style Trainer

MIL-T-81821

INDEX

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Abbreviations on Audio/Visuals	3.4.9.5	48
Acceptance inspection	4.2.2	59
Acceptance test outlines	3.4.8	47
Accessibility	3.3.1.24.3	32
Adjustment details on Audio/Visuals	3.4.9.3.3	48
Air transportability	3.2.6.1	21
Alteration of operable system components	3.3.1.15	25
Animated parts	3.3.1 .6.5	24
Animated/simulation panels	6.3.1	67
Animated trainer lines	3.3.1 .6.6	24
Animation	3.3.1.35	35
Animation capability	3.2.1.3	11
Animation techniques	3.3.135.1	35
Antennas, dummy loads, and absorption enclosures	3.2.2.6	19
Applicable Documents	2.	3
Applicable Documents, General	2.1	3
Arc suppression (relay contacts)	3.3.1 .25.4	33
Art work, illustrations, and data for Audio/Visuals	3.4.9.6	48
“As directed”	6.3.2	67
Attachment of components	3.2.2.4	18
Audio/Visual aids, general	3.4.9	47
Audio/Visual aids coverage	3.4.9.1	47
Audio/Visual identification/configuration data code numbers	3.4.9.3	47
Audio/Visual review and verification	3.4.9.14	52
Audio/Visuals review and selection conference	3.5.2.3	54
Authentic operation	3.2.1.2	11
Availability	3.2.1.7	13
Base	5.2.1	65
Bench top construction	3.2.2.3	18
BOA (Basic Ordering Agreement)	6.3.3	68
Casters	3.7.2.1	56
Casters and jacks	3.7.2	56
Central power conversion and environmental control units	3.2.1.11.5	15
Center of balance	3.3.3.8	39

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
CFE – peculiar ground support equipment	6.3.4	68
CFE – related end item operational equipment	6.3.5	68
CFE – trainer peculiar equipment and materials	6.3.6	68
CGPR/ACO (Cognizant Government Plant Representative Administrative Contracting Officer)	6.3.7	69
Characteristics	3.2	10
Chart material	3.4.9.11.2.1	50
Charts	3.4.9.11.2	50
Chart size	3.4.9.11.2.2	50
Chromate primer and lacquer coating	3.3.1.6.1	23
Circuit parts	3.4.10.1	52
Circuit protective devices	3.3.1 .21.7	30
Cleaning of lacquered surfaces	3.3.1.6.7	24
Cleaning, painting, plating, anodic films, and chemical treatments	3.3.1.6	23
Color-coded legend	3.3.1.35.7.2	36
Color coding	3.3.1 .35.7	36
Color coding on Audio/Visuals	3.4.9.13	51
Color material	3.3.1.35.7.1	36
Compatibility	3.3.1.28	33
Component relocation	3.3.1 .24.4	32
Components requirements, general	3.3.1.8	24
Conferences	3.5.2	53
Construction	3.2.2.1	17
Contractor furnished equipment	3.1.4.1	9
Controls and control circuits	4.2.4.5.2	63
Cover assembly installation	3.3.3.17	40
Cover handles	3.3.3.18	41
Cover marking requirements	3.3.3.7	38
Covers	3.7.5	57
Cutaway and plasticized parts, general	3.3.1.16	26
Cutaway component	6.3.8	69
Data	1.4	2
Data case	3.4.3.1	44
Data plate	3.3.3.2	37

MIL-T-81821

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Data plates and product marking	3.3.3	36
Definitions	6.3	67
Delivery Date	5.4	65
Design and Construction	3.3	22
Detail Specification	3.1.1	8
Dimensions and tolerances	3.2.2.2.3	18
Disassembly for shipment	3.2.6.2	21
Dissimilar metals	3.3.1.7.1	24
Documentation and Supplemental Materials	3.4	43
Drawing identification	3.3.1.32	34
Drawings and microfilm	3.4.1	43
Drip pans	3.7.4	57
Dual maintenance level electronics trainers	3.2.1.5.3	13
Duplication of equipment	3.3.1.18	27
Dust and security covers	3.7.5.3	58
Elapsed time meters	3.3.1.22	31
Electrical circuits	3.3.1.35.6	35
Electrical power cable connectors	3.3.1.21.2.2	28
Electrical power cable pigtails	3.3.1.21.2.1	28
Electrical power cables	3.3.1.21.2	28
Electrical power interconnection	3.3.1.21.3	29
Electrical power receptacles	3.3.1.21.4	29
Electrical requirements	3.3.3.13	40
Electric motors	3.3.3.11	39
Electromagnetic interference suppression test	4.2.4.3	61
Electromagnetic radiation	3.3.2	36
Electronic failures	3.2.1.4.1	11
Electronic parts	3.4.10.2	52
Electronics trainer panels, general	3.2.1.5	12
Electronic workbench panels	6.3.9	69
Emergency power control switch	3.3.1.21.8	30
Emergency power control switch marking	3.3.3.21	41
Environmental conditions	3.2.5	21
Environmental tests	4.2.4.5.6	63

INDEX (Cont'd)

Title	Paragraph No.	Page No.
Equipment group panels	6.3.10	69
Equipment service/historical record	3.4.3	44
Examination of product	4.1.2	59
Failure logs	4.2.3	60
Fasteners	3.3.1.13	25
Federal stock number	3.3.3.4	38
Film leaders	3.4.9.11.4.3	51
Film titles	3.4.9.11.4.1	51
Film type style and size	3.4.9.11.4.2	51
Finish	3.3.1.5	23
Finish and protective coatings	3.3.1.3	22
Fluids	3.2.1.13	17
Fluid system components	3.4.10.3	52
Fluid tank or reservoir	3.3.3.16	40
Fluid/gaseous transmission lines	3.3.3.12	40
Frame materials	3.3.1.2	22
Functional tests	4.2.4.5.3	63
Fungus inert materials	3.3.1.4	23
GFE – common ground support equipment	6.3.11	69
GFE – contractor installed operational equipment	6.3.12	69
GFE – end item and support equipment technical manuals	6.3.13	70
GFE – Government installed operational equipment	6.3.14	70
GFE – peculiar ground support equipment	6.3.15	70
Government and Contractor furnished equipment quantities and limitations	3.1.4.2	9
Government furnished equipment	3.1.4	8
Grounding	3.3.1.24.2	32
GSE (Ground Support Equipment)	6.3.16	70
GSE, common	6.3.16.1	71
GSE, developmental	6.3.16.2	71
GSE, peculiar	6.3.16.3	71
GSE, standard	6.3.16.4	71
Heat dissipation and cooling	3.2.1.8	14
Hoisting instructions for heavy trainers	3.3.3.19	41

MIL-T-81821

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Human-factor compliance tests	4.2.4.1	60
Human performance/engineering	3.3.7	42
Hydraulic and pneumatic interconnection	3.3.1.34	34
Hydraulic and pneumatic power hoses	3.3.1.33	34
Hydraulic and pneumatic power units	3.2.1.12	16
Identification details on Audio/Visuals	3.4.9.3.1	48
Identification of parts	3.3.3.6	38
Identification of product	3.3.3.5	38
Illustrated parts breakdown	3.4.2.1	44
Index of Audio/Visuals	3.4.9.15	52
Individual trainer power conversion units	3.2.1.11.6	16
In-process inspections	4.2.1	59
Input signals	3.2.1.9	14
Instructor Training	3.6	55
Instructor training curriculum review conferences	3.5.2.4	54
Instructor training material	3.4.4	44
Insulation protection	3.3.1.24.5	32
Integrated trainer panels	6.3.17	72
Intended Use	6.1	66
Interchangeability	3.3.5	42
Interface definition	3.1.3	8
Intermediate and direct/general	6.3.18	72
intermediate and direct/general level electronics maintenance trainers	3.2.1.5.2	12
Introductory motion picture film 16mm	3.4.9.11.4	51
Inventory	4.4	63
Item definition	3.1.2	8
Items	1.3	2
Lighted line widths	3.3.1.35.5	35
Logistics	3.5	53
Major Components Characteristics	3.7	55
“Make or Buy” program	3.1.4.3	10
“Make or Buy” program plan	1.4	2
Maintainability	3.2.4	20

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Maintainability verification (applicable to Navy and Air Force)	4.2.4.4.1.	62
Maintainability verification (applicable to the Army)	4.2.4.4.2	62
Maintenance	3.5.1	53
Maintenance trainer panel	6.3.20	72
Maintenance training equipment acceptance report	3.4.7.9	46
Maintenance training equipment BOA (Basic Ordering Agreement) funding status report	3.4.7.11	47
Maintenance training equipment configuration accountability report	3.4.7.10	46
Maintenance training equipment cost report	3.4.7.3	45
Maintenance training equipment engineering changes status report	3.4.7.8	46
Maintenance training equipment facilities report	3.4.7.2	45
Maintenance training equipment "Make or Buy" program plan report	3.4.7.6	46
Maintenance training equipment material requirement/receipt report	3.4.7.4	45
Maintenance training equipment progress report	3.4.7.1	45
Maintenance training equipment rejected/nonoperable parts utilization report	3.4.7.7	46
Maintenance training equipment material shortage report	3.4.7.5	46
Malfunction control panel	3.3.1.23	31
Marking	5.3	65
Marking for shipment and storage	3.3.3.23	41
Marking, general	3.3.3.1	36
Marking of modified, rejected and nonoperable parts	3.3.3.10	39
Marking of trainer with modified, rejected or nonoperable parts	3.3.3.9	39
Master keyed lock switch	3.3.1.21.6.1	30
Master reproducible charts	3.4.9.11.2.3	50
Master reproducible transparencies	3.4.9.11.1.1	49
Materials, processes, and parts	3.3.1	22
Metal	3.3.1.7	24
Methods of construction	3.3.1.35.3	35

MIL-T-81821

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Micro electronic and thin film devices	3.3.1.26	33
Modification of Government furnished property	3.3.1.14	25
Modifications, changes and configuration control	3.3.1.36	36
Moment	3.2.2.2.2	18
Motor control relays	3.3.1.25.3	33
Mounting	3.3.1.29	33
Mounting of cutaway and plasticized parts	3.3.1.16.2	26
Mounting of identification plates for sectionalized components	3.3.3.14	40
Mounting of sensitive relays	3.3.1.25.1	33
MT (Maintenance Trainer)	6.3.19	72
MTE (Maintenance Training Equipment)	6.3.22	73
MTS (Maintenance Trainer Set)	6.3.21	72
Negatives and positives for Audio/Visuals	3.4.9.12	51
Noise level	3.2.1.6	13
Notes	6.	66
Objectives of Audio/Visuals	3.4.9.2	47
Open frame panels	6.3.23	73
Operating controls	3.3.1.35.2	35
Operating tests	4.2.4.2	60
Ordering Data	6.2	66
Organizational	6.3.24	73
Organizational level electronics maintenance trainers	3.2.1.5.1	12
Other physical properties	3.2.2.7	19
Other tests	4.2.4.5	62
Output signals	3.2.1.10	14
Packing	5.2	65
Panel group	6.3.25	73
Panel materials	3.3.1.1	22
Part identification on Audio/Visuals	3.4.9.3.2	48
Performance	3.2.1	10
Permanent power distribution systems	3.2.1.11.1	14
Phase sequence indicating light	3.3.1.21.6.3	30
Photographic manuals	3.4.6	45
Physical characteristics	3.2.2	17

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Plasticized component	6.3.26	73
Plug-in modules	3.3.1.31	34
Potting	3.3.1.24.7	33
Power connections	3.3.1.21.1	28
Power control panel	3.3.1.21.6	30
Power design for foreign military sales	3.2.1.11.3	15
Power distribution cables and junction boxes	3.3.1.21.5	29
Power distribution	3.3.1.21	28
Power from overseas sources	3.2.1.11.2	15
Power on light	3.3.1.21.6.2	30
Power requirements, general	3.2.1.11	14
Power supply and environmental control equipment	3.2.1.11.4	15
Power supply 28 VDC	3.2.1.11.8	16
Power switch warning plates	3.3.3.15	40
Power tests	4.2.4.5.5	63
Precedence of Documents	2.2	7
Preparation for Delivery	5.	65
Preparation for Delivery, General	5.1	65
Preparation for Delivery Inspection	4.5	63
Preparation for shipping	5.2.2	65
Presentation of identical units	3.3.1.17	27
Priority for the use of Government and Contractor furnished equipment	3.1.4.4	10
Procuring Activity	6.3.27	73
Prototype of preproduction equipments	3.3.1.10	25
Provision of cutaway components	3.3.1.16.1	26
Quality Assurance Provisions	4.	59
Quality Assurance Provisions, General	4.1	59
Quality Conformance Inspection	4.2	59
Reduction of component size and weight	3.2.2.2.1	17
Refurbishment	3.5.4	55
Rejected/nonoperable parts, general	3.3.1.11	25
Rejected/nonoperable parts, Government approval.	3.3.1.12	25
Related end item	6.3.28	73

MIL-T-81821

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Related series end items	6.3.29	74
Relays	3.3.1.25	33
Reliability	3.2.3	19
Reliability and maintainability demonstrations and tests	4.2.4.4	61
Reliability, maintainability, human factors, and safety	6.3.30	74
Removal of hard cover	3.3.3.7.2	39
Repair parts	3.5.1.1	53
Reports	3.4.7	45
Required services	3.5.3	55
Requirements	3.	8
Responsibility for inspection	4.1.1	59
Retention of art work for Audio/Visuals	3.4.9.9	49
Safety	3.3.6	42
Safety marking	3.3.3.20	41
Schematic diagrams on Audio/Visuals	3.4.9.10	49
Scope	1.	1
Scope, General	1.1	1
Scope of items and services	1.1.1	1
Screw assemblies	3.3.4.1	42
Screw jacks	3.7.2.2	57
Security cover	3.3.3.7.1	39
SE (Support Equipment)	6.3.33	74
Sealing of Plywood panel surfaces and edges	3.3.1 .6.3	23
Sectionalized components	3.3.1 .6.4	23
Security classification of Audio/Visuals	3.4.9.7	49
Selection of micro electronic devices	3.3.1.27	33
Separate procurement	1.1.2	1
Serial number	3.3.3.3	37
Services	1.5	2
“Shall”	6.3.31	74
“Shall be provided”	6.3.32	74
Shielding	3.3.1.30	34
Simulated failure of systems	3.2.1.4	11
Skid materials	3.3.1.2.1	22

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Slide mounting	3.4.9.11.3.1	50
Slide type size	3.4.9.11.3.3	51
Slide type style	3.4.9.11.3.2	50
Slides 35mm	3.4.9.11.3	50
Special casters	3.7.2.1.1	56
Special control marking	3.3.3.22	41
Special controls	3.3.1.19	27
Standard parts	3.3.1.9	24
Standard power supply	3.2.1.11.7	16
Stepping relays	3.3.1.25.2	33
Storage provisions	3.7.3	57
Structural tests	4.2.4.5.4	63
Style Classification	1.2	1
Support equipment	3.1.4.5	10
Supporting structure (frame)	3.7.1	55
Symbols and reference designations on circuit diagrams	3.4.10	52
System and Item Definitions	3.1	8
Technical manuals	3.4.5	44
Temperature measuring	4.2.4.5.1	62
Terminal strips	3.3.1.24.6	32
Test equipment power receptacles	3.3.1.21.4.2	29
Test methods	4.2.4	60
Test Records	4.3	63
Titling of Audio/Visuals	3.4.9.4	48
Trainer Manuals of Operation and Maintenance Instructions (MOMI)	3.4.2	43
Trainer plumbing	3.2.2.5	19
Trainer power and signal distribution	3.3.1.20	27
Training capability	3.2.1.1	11
Training equipment acceptance conference	3.5.2.6	54
Training equipment general arrangement drawing and design review conference	3.5.2.2	54
Training equipment preliminary design review conferences	3.5.2.1	53
Training equipment status and progress review conferences	3.5.2.5	54

INDEX (Cont'd)

<u>Title</u>	<u>Paragraph No.</u>	<u>Page No.</u>
Transparencies	3.4.9 .11.1	49
Transportability	3.2.6	21
Treatment of display panel surfaces	3.3.1.6.2	23
Types of Audio/Visuals, general	3.4.9.11	49
“Unless otherwise directed”	6.3.34	74
Using activity	6.3.35	74
Utility receptacles	3.3.1.21.4.1	29
Ventilation or cooling	3.3.1.35.4	35
Vertical display panels	6.3.36	74
Warning lights	3.3.6.2	42
Warning sign	3.3.6.1	42
Warranty	4.6	64
Waterproof hard covers	3.7.5.2	57
Waterproof soft covers	3.7.5.1	57
Weights, dimensions and moments	3.2.2.2	17
Wire bundling	3.3.1.24.1	31
Wiring, general	3.3.1.24	31
Working platform	3.7.6	58
Workmanship	3.3.4	41
Workmanship of Audio/Visuals	3.4.9.8	49

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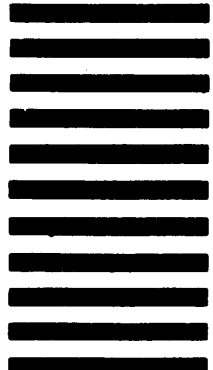
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