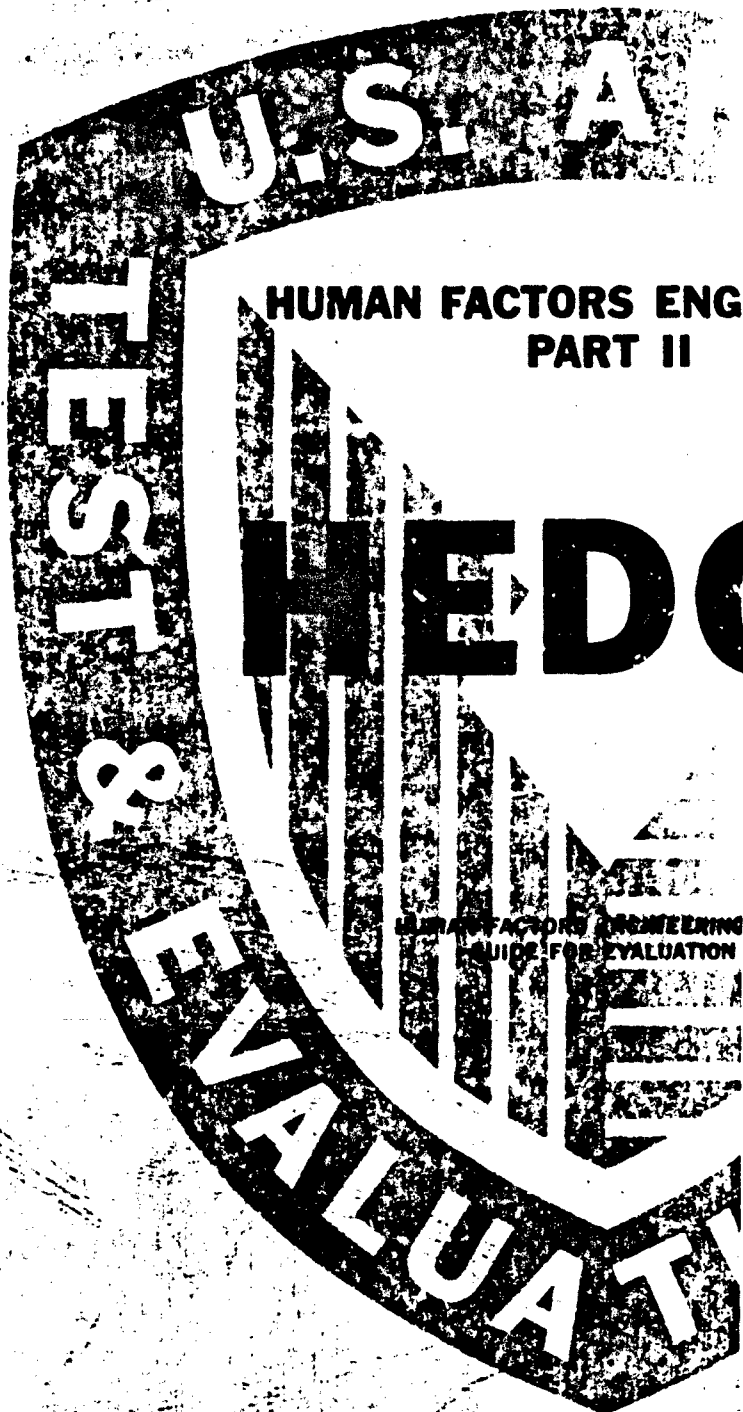


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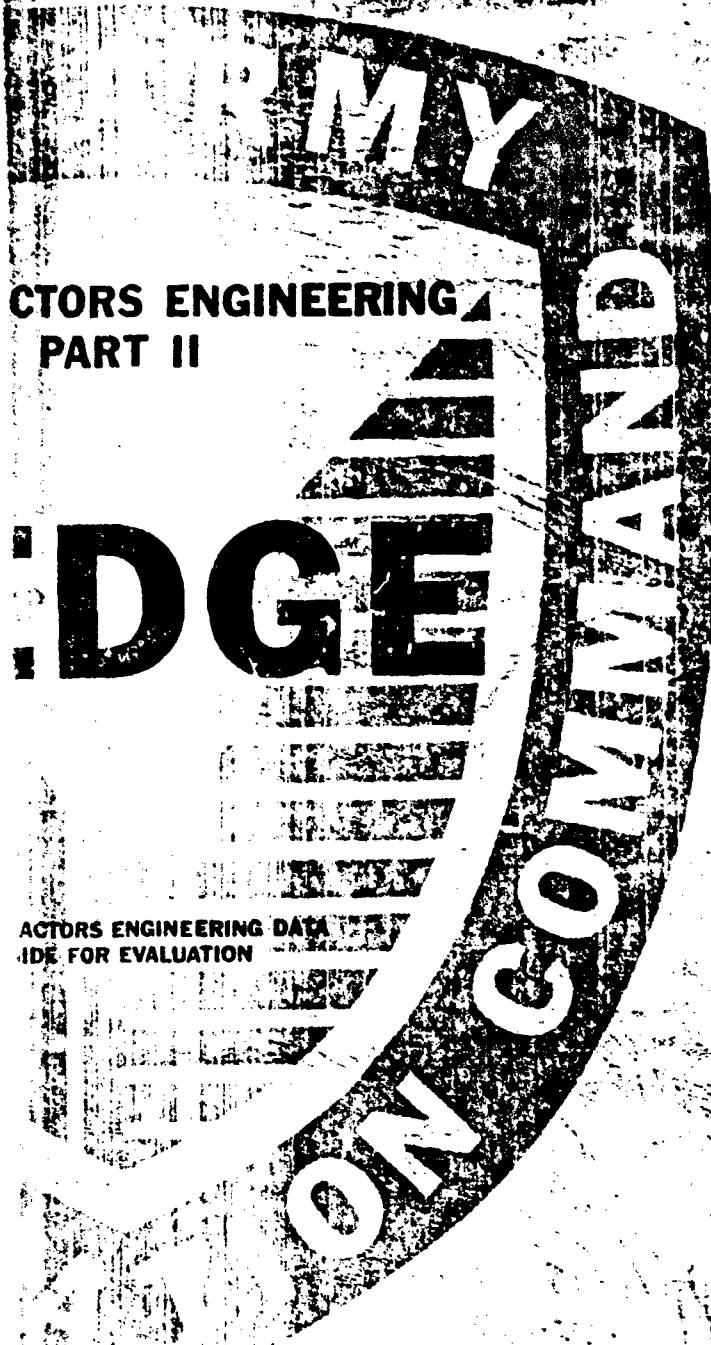
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30 November 1983



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The criteria herein reflects that in effect on the date of this document. Test requirements and criteria referred to as Design Requirements are contained in the current issue of MIL-STD-1472 which shall have precedence in case of conflict

STEP 1

Enter the Index

Test Functions	
Test Item Classes	

THE INDEX

STEP 2

Identify Use Conditions and Tasks

Test Item Function Class & Subclass	
Use Conditions	
Task Categories	
Purposes	
Man/Item Tasks	

MAN/ITEM TASK SHEET

STEP 3

Identify relevant Test Item Components & Human Factors Considerations

Test Item Components	
Human Factors Considerations	

INDEX TO DETAILED DESIGN CONSIDERATIONS

The purpose of the information in HEDGE is to enable you to expand your test capabilities in considering the human element. They will provide you with a strategy for viewing an item which is undergoing testing from the standpoint of the soldier who must ultimately operate, maintain, or otherwise utilize it. The use of these materials, in addition to standard Task and Design Checklists and Questionnaires, will enable you to tailor your HFE subtest to a specific item.

These materials have been prepared especially for you:

1. They are intended to support test engineers not design engineers.
2. They were designed with your specific tasks in mind, i.e., preparing a Test Plan, conducting a test, analyzing and interpreting test data, and generating the test report.
3. They were prepared under the cognizance of the TECOM Human Factors Engineering Directorate and will enable you to perform your job or to seek their guidance and assistance in a more efficient manner.

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The diagram above illustrates the steps necessary to use HEDGE. The paragraphs which follow will detail each step in turn. The Human Factors Engineering Directorate at TECOM stands ready to assist or advise you.

STEP 1 Enter the Index

STEP

A. How to Use the Index

1. Identify the Test Item Class which best defines the item you are going to test.
2. Select the Subclass which most closely identifies the item. You may find it useful to refer to the Definitions (Page 4) for assistance.
3. Determine which Test Function(s) you are concerned with (test of item operability, maintainability, etc.).
4. Note the page number(s) for the data sheets you will be utilizing.

- B.** How to Classify an Unlisted Item Some items may be particularly difficult to classify because of their unusual characteristics. However, if you carefully study the definitions provided you should be able to place any item of equipment under one of the subclasses presented in the Index. If in doubt, consult the Human Factors Engineering Directorate.

STEP

STEP 2 Identify User Functions and Tasks

Each reference in the Index will locate a set of two detailed data sheets. The left-hand page of each set of detailed data sheets, the Man/Item Task Sheet, is designed to aid you in the selection of what to test. The right-hand page, the Detailed Design Considerations, is designed to aid you in the selection of criteria to be used in the tests.

The left-hand page of each set of detailed data sheets presents the Man/Item Tasks. The Man/Item Tasks describe the way in which the soldier and his equipment will interact to form a system. They provide the framework for the human factors test and analysis. The performance of an individual and the performance of the item cannot be analyzed separately. You should keep this concept in mind as you plan and conduct your test. The actual formulation of a human factors Task Checklist can be very simply derived by utilizing the Man/Item Task Sheet (left-hand page). You need merely transcribe the material going down the sheet from the general functions to the Man/Item Tasks, adding qualifiers and specifics as necessary for the item under test. A Task Checklist form is provided in Appendix A of the Test Procedures. Sample Task Checklists are provided in Appendix B of the Test Procedures.

STEP 3 Identify Relevant Item Components and Human Factors Considerations

At the bottom of each left-hand page is a matrix of human factors considerations and item components. The test engineer should review the Task Checklist and the test item design description to identify which of the Test Item Components presented in the matrix apply to the item under test, and which Human Factors Considerations are important.

STEP 4 Locate Criteria

Each cell in the matrix at the bottom of the left-hand page associated with specific Test Item Components and Human Factors Considerations also has criteria information in the associated cell of the right-hand page. The test engineer therefore only needs to go from cells of the left-hand matrix, which he has identified as important for his test, to cells containing the criteria data on the Detailed Design Considerations (right-hand page). A Design Checklist is made up by listing all the detailed design considerations appropriate to the item under test. A Design Checklist form is provided in Appendix A of the Test Procedures. Sample Design Checklists are provided in Appendix C of the Test Procedures.

STEP 5 Prepare Human Factors Engineering Subtest Plan

Based on the outputs of the above steps the test engineer is ready to prepare his test plan. The format of the test plan should follow that established in TECOM Regulation 70-24. The sections of the plan includes:

1. Objective

The statement of objectives is taken directly from the Objective at the top of the left-hand page of HEDGE.

2. Criteria

The criteria for Design Tests are derived from the right-hand pages of HEDGE and from the Figures (pages 48-66) referenced by these right-hand pages. Other criteria are noted in paragraph 5.X.2 of Part I of this TOP, Test Procedures, where "X" represents the Specific Test Procedure under consideration.

3. Facilities and Instrumentation

Facilities and instrumentation are given in paragraph 5.X.3 of Part I, Test Procedures.

4. Method

Guidance for test and analysis is provided in paragraph 5.X.4 of Part I, Test Procedures.

5. Data Required

Guidance for data required is obtained from paragraph 6.0 of Part I, Test Procedures, and is modified by the appropriate Specific Test Procedure (5.X.6).

6. Data Reduction and Presentation

Guidance for data presentation is obtained from paragraph 7.0 of Part I, Test Procedures, and is modified by the appropriate Specific Test Procedure (5.X.7).

TEST ITEM CLASSES	TEST FUNCTIONS (PAGES AS NOTED)	OPERABILITY	MAINTAIN- ABILITY	TRANSPORT- ABILITY 40-41	PORTABILITY/ USABILITY 42-43	ERECTABILITY 44-45	HABITABILITY 46-47
I. VEHICLES		30-31					
A. MANEUVERING Trucks, Boats, Landing Craft, Tanks, Aircraft, Self Propelled Guns	6-7	●	●				
B. AIR Airplanes, Gliders, Helicopters	8-9	●	●				
C. NON-MANEUVERING Vans, Railroad Cars, Barges, Cargo Trailers	10-11	●	●				
II. WEAPONS		32-33					
A. INDIVIDUAL Rifles, Sidearms, Aircraft Mounted Weapons, Hand Grenades	12-13	●		●			
B. CREW SERVED Howitzers, Mortars, Missile Sites, Anti-Aircraft Guns, Tank Mounted Guns	14-15	●	●	●	●		
C. AMMUNITION Bombs, Artillery Rounds, Mines, Missiles, Dem- olition Explosives, Clip & Belt Ammunition			●	●			
III. MATERIEL HANDLERS		34-35					
A. MAN-OPERATED Cranes, Booms, Winches, Power Shovels, Hand Trucks, Fork Lifts, Sleds	16-17	●	●		●		
B. MAN-MONITORED Conveyor Belts, Chutes, Hoses, POL Storage & Distribution, Liquid Loaders, Pressure Cylinders	18-19	●	●				
IV. ELECTRONICS/SIGNALS		36-37					
A. SENSORS Radars, Mine Detectors, Range Finders, Prox- imity Warners, Radiation & Chemical Sensors	20-21	●	●	●			
B. INFORMATION COMMAND-CONTROL SYSTEMS Recorders, Information Retrieval & Optical Systems, Amplifiers, Avionics, Data Processers	22-23	●	●	●			
V. OPERATIONAL SUPPORT		38-39					
A. MAINTENANCE & REPAIR EQUIPMENT Hand Tools, Service and Lubrication Equipment, Inspection Devices, Pipeline Cleaners	24-25	●	●				
B. MATERIEL PRODUCTION & ENVIRONMENT CONTROL Printing Presses, Bakeries, Machine Tools, Dust Controllers, Dehumidifiers, Noise Attenuators	26-27	●	●				
C. MAJOR CONSTRUCTION ITEMS Erection Kits, Portable Shelters, Prefabricated Buildings, Towers, Antennas			●		●		
VI. TROOP SUPPORT							
A. CONSUMABLES Foods, Medical Supplies, Skin Ointments	28-29		●				
B. CLOTHING Protective, Regular				●			
C. PERSONAL EQUIPMENT Protective Equipment, Mess Gear, Back Packs, Sleeping Gear, Entrenching Tools, Skis				●			
D. LIVING & WORKING AREAS Tents, Shelters, Vans							●

TEST

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II.

III.

IV.

V.

VI.

TEST ITEM CLASSES

- I. VEHICLES - Items that move personnel or materiel from place to place.
 - A. MANEUVERING - Items that use their own power on the surface of land or water.
 - B. AIR - Items that move through the air.
 - C. NON-MANEUVERING - Items that use a prime mover.
- II. WEAPONS - Items that are used in offensive or defensive combat.
 - A. INDIVIDUAL - Items that are used by a single person.
 - B. CREW SERVED - Items that are operated by two or more people.
 - C. AMMUNITION - Explosive items used in weapons as well as those that are complete weapons within themselves.
- III. MATERIEL HANDLERS - Items that distribute or move materiel.
 - A. MAN-OPERATED - Items requiring direct action by an individual for loading, distributing or moving materiel.
 - B. MAN-MONITORED - Items in which the personnel function is limited to initiating, monitoring, and terminating the loading, distributing or moving of materiel. The monitoring function will include verification and such corrective action as may be required.
- IV. ELECTRONICS SIGNALS - Items used for the transmitting, receiving, disseminating and storing of information.
 - A. SENSORS - Items that detect the presence of metals, electromagnetic and nuclear radiation, noxious gases and other objects.
 - B. INFORMATION/COMMAND-CONTROL SYSTEMS - Items used in the collection, processing and presentation of data.
- V. OPERATIONAL SUPPORT - Items used in construction, production and maintenance of materiel, control of environment, and performance of various troop and unit support services.
 - A. MAINTENANCE & REPAIR EQUIPMENT - Items used to assemble, maintain and repair equipment.
 - B. MATERIAL PRODUCTION & ENVIRONMENT CONTROL - Items used to control or modify the environment, produce materials, or to supply support services to troop units.
 - C. MAJOR CONSTRUCTION ITEMS - Oversized items requiring major assembly.
- VI. TROOP SUPPORT EQUIPMENT - Items primarily used for individual troop support and subsistence.
 - A. CONSUMABLES - Items eaten, drunk or medically used.
 - B. CLOTHING - Items protecting the body under normal or emergency conditions.
 - C. PERSONAL EQUIPMENT - Items carried and/or used by an individual.
 - D. LIVING & WORKING AREAS - Items used by personnel while working or relaxing.

TEST FUNCTIONS

OPERABILITY - The purpose of this test function is to determine the adequacy of the man/machine combination to perform in conformance with the requirements delineated in the military and technical characteristics and standard military specifications.

This test function includes, but is not limited to, test item components and procedures required for:

1. Item set-up
2. Connection with other items
3. Operational check-out
4. Adjustments, calibrations, and tightening
5. Gaining access and egress
6. Activation and deactivation of item
7. Performance of required function
8. Accommodation of item and operator to various operating conditions

MAINTAINABILITY - The purpose of this test function is to determine if the item can be maintained under field conditions at the level specified by the directive. In some cases the maintenance requirements will be precisely defined. In others, you will have to make this determination based on your experience with similar items.

This test function includes, but is not limited to, the components and procedures required for:

1. Routine operator-performed preventive maintenance checks and tasks (scheduled maintenance)
2. Contingency tasks, field-operator level (non-scheduled maintenance)
3. Detection of malfunctions
4. Troubleshooting
5. Removal, repair, and replacement of components

TRANSPORTABILITY - The purpose of this test function is to evaluate the test item for adequacy of the human factors aspects of moving the item by rail, air, water, or land. Many of the items sent to TECOM are tested for this aspect only (i.e., missile trailers, weapons, various types of electronic gear, etc.). Some of the items which seem to be clearly within this function, however, may include man/item interactions other than those involved in transportability. A line-haul test of a vehicle for example, may involve the engineering testing of operating components, but also requires that it can be driven and maintained during the test. If you wish to evaluate the item for the ability of operators to drive it, consult the "Operability" test function for detailed guidance. By the same token, if you wish to evaluate the item for maintenance design, consult the "Maintainability" test function.

When the test is limited to those aspects of the item which pertain to transporting it by means other than its own power, the human factors portion of your evaluation should include, as a minimum, the testing of components and procedures for:

1. Preparation of item for transfer (crating, removal of projections, fastening down of loose elements)

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2. Attaching of cables, hooks, etc. to item
3. Pushing, sliding, or lifting the item
4. Tying down of the item in the carrier vehicle

PORTABILITY/USABILITY - The purpose of this function is to determine whether the item can be carried and used as designed by a fully encumbered combat soldier and also to ascertain if it will interfere with the performance of other tasks required of the man.

The testing for this function includes, but is not limited to, consideration of components and procedures involved in:

1. Preparing item for carrying (place in carrying case, disassemble, etc.)
2. Loading item on body (in pack or carrying case)
3. Lifting and transporting item
4. Performing required functions with item loaded on body
5. Unloading item
6. Use of item in a combat situation

ERECTABILITY - The purpose of this test function is to determine the adequacy of a test item for assembly under field conditions, where the assembly function is considered to be of primary importance, as it is with certain bridges, pipelines, prefabricated buildings, plugging in of power sources. These types of tasks should be considered under the operability test function relevant to the item.

The erectability test function includes, but is not limited to, the test item components and procedures required for:

1. Pre-erection alignment of parts
2. Connection of components
3. Sealing of joints
4. Testing of item integrity after erection
5. Disassembly of item after use

HABITABILITY - The purpose of this type of test is to determine whether the design of the tent, shelter, or building allows the using personnel to live, work, and move about the inhabited space.

This test includes the equipment components and activities required for:

1. Moving about and carrying materiel
2. Performing duties
3. Resting, relaxing, eating and taking care of personal hygiene
4. Life support and sustaining environment

Test Item	Labels Manuals Markings (1)	Steps Ladders Platforms (2)	Handholds Railings (3)	Head- holds Railings (3)	Doors Hatches Passages (6)
A. LITIGATION & ARRANGEMENT	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B
C. DIRECTION & FORCE		C		C	C
D. CLEARANCE	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F
G. SAFETY	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H

MANEUVERING

Operational conditions - time critical operations (emergency egress) and combat conditions (blackout, butted up, alternate tactical situations, etc.).

PREPARE FOR OPERATIONS		OPERATE	
	TAKE/LEAVE POSITION	START/MONITOR/STOP	CONTROL/DIRECTION/SPEED
the design of instruments, displays, providing cues of a state of	PURPOSE: To evaluate the design of the entryway and workspace for ease of getting into the normal working position and preparing or ceasing operation, including donning and doffing as well as stowing and unstowing personal gear and encumbrances, and emergency egress.	PURPOSE: Evaluate the design of controls and displays as they relate to normal work position for starting and stopping engine, for monitoring engine functions, and for detecting possible engine malfunctions.	PURPOSE: Evaluate the design of the total item, and specifically of controls, displays and workspace under operational conditions including backing and turning for ground vehicles and boats.
steering control	MAN/ITEM TASKS Step through entry.	MAN/ITEM TASKS Remove restraints (wheel chocks/dock lines/etc.).	MAN/ITEM TASKS View external conditions by means of mirrors/ windows.
of integrity/	Take/leave seat.	Read labels.	Check maps/charts.
where appli-	Doff/don clothing items.	Preset operating controls (choke/throttle/gearshift/etc.).	Identify destination/route.
are read and	Place clothing/tools/weapons/etc. into storage area.	Activate vehicle.	Operate steering control.
	Adjust seats/windows/belts/mirrors.	Check displays.	Operate directional control.
	Adjust seat belts/shoulder harness.	Manipulate controls.	Operate speed control.
		Communicate with crew members and/or passengers.	Operate environment controls.
		Perform post operational check (follow procedures if applicable).	Operate lighting controls.
			Operate visibility controls.
			Avoid obstacles.
			Communicate with crew/other vehicles/command post.

DETAILED DESIGN CONSIDERATIONS

[illegible]

DESIGN COMPONENTS

HUMAN FACTORS CONSIDERATIONS

A. LOCATION & ARRANGEMENT

The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of openings (access, cover or door openings, location of components (knobs, levers, etc.) as well as its relationship to other components.

B. SIZE & SHAPE

The maximum and/or minimum dimensions of components that are required for adequate man use, including the effects of anthropometric and special clothing (arctic, NBC) considerations, and the shape and contour of handles, knobs and other controls to enhance both the identification and use of the component.

C. DIRECTION & FORCE

The movement and/or force required to operate or generally manipulate a component (knobs, controls, fasteners, etc.) with emphasis on the direction of motion corresponding to the display, component, total item reaction or standard practice as well as the minimum strength required.

D. CLEARANCE

The unobstructed area surrounding a component which allows the operator to perform required actions, the adequacy of which varies as a function of the amount of body involved (hand, fingers, arm, torso, etc.) and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E. VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F. USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace area.

G. SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventive aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H. OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design handbooks as well as job aids, checklists, training tests, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1. LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates.
Make operator aware of hazards.
Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- ID labels not obscured by components on flattest surfaces on main chassis; min coverage by grimes not easily removed.

- Character height determined by distance read, luminance FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 1.B.2-4.
- Height/width ratio = 5/3; "a" is 1 stroke width wider; "m" & "n" are 5/4 "l" & "i" are 1 stroke width.
- Stroke width for black (white) characters on light (black) backgrounds 1/6 (1/7-1/8) of height.

- Spacing between characters (words) one stroke (character) width min.
- Line spacing = character height.
- Counter numeral two ratios = 1:1 (except 1) separation = 5 to 6.
- Optical projections all caps, stroke width 1/6 to 1/8; exceeds 15 minutes visual angle.
- Thumbwheel numeral line ratio = 3/2; h = 1/2 stroke width internally (externally) illuminated = 10:1 (5:1).
- Abbreviations all caps, no periods.
- Extended copy use lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environmental conditions.
- Labels are sharp with high or color contrast.
- With illumination above 1 f-c: black letters, light background.
- Dark adaptation letters visible, do not interfere with night vision.
- Chart readings FIG 1.E.3.
- Label characteristics accurate, required line available; distance light level, color criticality of function consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for parts - equipment easily affixed, or removed.
- Labels not obscured by other units near obscured by paint, dirt.
- Markings, tags are as permanent, readable as equipment.
- Remove materials avoided.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Electrical receptacles marked with voltage phase frequency.
- Pipes, hoses, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Character height determined by distance read, luminance FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 1.B.2-4.
- Height/width ratio = 5/3; "a" is 1 stroke width wider; "m" & "n" are 5/4 "l" & "i" are 1 stroke width.
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- Stroke width for black (white) characters on light (black) backgrounds 1/6 (1/7-1/8) of height.

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- Line spacing = character height.
- Counter numeral two ratios = 1:1 (except 1) separation = 5 to 6.
- Optical projections all caps, stroke width 1/6 to 1/8; exceeds 15 minutes visual angle.
- Thumbwheel numeral line ratio = 3/2; h = 1/2 stroke width internally (externally) illuminated = 10:1 (5:1).
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- Labels on production equipment are as durable as the equipment.
- Labels for parts - equipment easily affixed, or removed.
- Labels not obscured by other units near obscured by paint, dirt.
- Markings, tags are as permanent, readable as equipment.
- Remove materials avoided.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Electrical receptacles marked with voltage phase frequency.
- Pipes, hoses, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Character height determined by distance read, luminance FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 1.B.2-4.
- Height/width ratio = 5/3; "a" is 1 stroke width wider; "m" & "n" are 5/4 "l" & "i" are 1 stroke width.
- Stroke width for black (white) characters on light (black) backgrounds 1/6 (1/7-1/8) of height.

- Spacing between characters (words) one stroke (character) width min.
- Line spacing = character height.
- Counter numeral two ratios = 1:1 (except 1) separation = 5 to 6.
- Optical projections all caps, stroke width 1/6 to 1/8; exceeds 15 minutes visual angle.
- Thumbwheel numeral line ratio = 3/2; h = 1/2 stroke width internally (externally) illuminated = 10:1 (5:1).
- Abbreviations all caps, no periods.
- Extended copy use lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environmental conditions.
- Labels are sharp with high or color contrast.
- With illumination above 1 f-c: black letters, light background.
- Dark adaptation letters visible, do not interfere with night vision.
- Chart readings FIG 1.E.3.
- Label characteristics accurate, required line available; distance light level, color criticality of function consistency of design.
- Labels on production equipment are as durable as the equipment.
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- Labels not obscured by other units near obscured by paint, dirt.
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2. STEPS, LADDERS, PLATFORMS

Provide a surface to accommodate user's feet while climbing or conducting routine checks and for the temporary placement of loads.
Wheels, hubs and structural members used for climbing are evaluated as ladders.
Angle of ascent: defensible ladders, 75°-90°; steep ladders, 50°-75°; steep, 20°-50°; ramps, 0°-20°; platforms, 0°.

- Adequate footholds provided for crew to reach hatches from ground.
- Sequence of stepping points and with proper man orientation to door or entryways.
- Step surfaces within, without work-space easily reached from either direction.

- Clear (limited) dimensions based on 95th (5th) body dimensions of users FIG 2.B.1-7.
- Stair, stair-ladder, fixed-ladder dimensions do not exceed the max. min dimensions FIG 2.B.1-3.
- Stairs, ladders accommodate 5th - 95th % user wearing arctic clothing FIG 2.B.8.

- Folding ladder lift height 7' max.
- One man limits to lift, shore ladders 9' for 20 lb 6' for 25 lb.
- Stairs, ladders, platforms, ramps without heaviest combined weight of user plus equipment plus safety factor.

- Finger clearance to be provided in folding steps, ladders.
- Step width, spacing accommodate lower FIG 2.B.8.
- Folding ladder catches, ladders operable with cold-wet arctic mittens FIG 2.B.11.

- Visual obstructions, blind footholds avoided.
- Tools contrast with structure, conspicuous in dim light.
- For reduced lighting reflective materials used.

- Stair-ladders are of metal with the tread rise open at rear.
- Exterior personnel platforms, work areas: Open metal grating or mesh shield surface.
- Steps visible if wet, icy.

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3. HANDLES, GRIPS

Assist users to mount and enter the item and to maintain balance.
Supply leverage and support to a climbing or working man.
Door handles, structural members, etc., used for gripping or balance, are evaluated as handholds.

- Adequate hand grips provided for crew to reach hatch from ground.
- Handholds furnished where needed within easy reach.
- Handholds integrated with doors, entry ways for stability.
- Adequate handholds for balance while moving.

- Handhold dimensions FIG 2.B.1-3.
- Handhold length: 6" min.
- Handhold opening: 6" x 4" min.
- Shaped handholds improve grip.

- Design Requirements (MIL-STD-1472)
- User-Computer Interface Data (MIL-STD-1472C)
- Guidance Data (MIL-HDBK-759, Etc.)

- Handholds do not intrude into work-space.
- Handhold accommodates arctic gloves FIG 2.B.11.

- Handholds clearly visible from inside and out prior to grasping.
- Color coded to enhance visibility, prevent grasping errors.

- Handholds visible if wet, icy.
- Handgrip usable with bare hands in hot climates, high temp.
- Collapsible handholds overtable while wearing arctic mittens.

- Handgrip cross over from cables, lines, hot pipes, other hazards.
- Inappropriate structures, wires cannot be used as handholds.
- Railings no projections, snags.

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4. DOORS, HATCHES, PASSAGES

Provide a means for entering and leaving the workspace.
Provide openings for loading or unloading material.
Components are evaluated for both normal and emergency use.
Some doors serve dual purposes and must also be evaluated as steps, ramps or platforms.

- Wall hatches flush with floor where structurally possible.
- Latch handles can be reached from normal approach positions.
- Door, hatch lock, latch is easily reached from seated positions.
- Handgrips, footpads help user reach hatch easily.
- Overhead hatches: latch to hold open inside provided 1 hand operation.

- Rectangular hatch also FIG 4.B.1.
- Circular hatch: 30" min dia.
- Oval hatch: 17" x 20" min.
- Trailer vans, portable shelters with one ft min user 76", 30" x min.

- Hatch handle unlatching forces: 20 lb max.
- Overhead hatch: opening forces, 30 lb max operable by user with 5th % arm, hand strength FIG 4.C.1.
- Hatch opening forces: 30 lb max.
- Handles operable with gloves.

- Fixed equipment is located 3' min from swept area of doors.
- Clear (limited) dimensions based on 95th (5th) body dimensions of users FIG 2.B.1-7.
- Floor escape hatch: 22" min dia, 10" above ground.
- Handles, handgrips usable with arctic mittens FIG 2.B.11.
- Entry, egress possible wearing boots.

- Latch control visible initially.
- Door jamb or opening height allows full view of step point.
- "See thru" on vis possible.

- Hatches open with a single motion of hand, foot.
- If "step down" through a top access exceeds 27", appropriate foot rests.
- Trailer hatches do not freeze up.
- Locks lockable from inside.
- Handles uniform in operation.

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- Handles uniform in operation.

5. EXTERNAL COW

Components outside and serving as part of the external cow, including, loading, fire, tires, lights, pipes, test points, sticks, wrenches, start keys, internal handles or platforms.

- Drain valves: run accessible, reliable.
- Filters accessible for
- Components require are readily accessible
- Drain valves: either is to be checked, initial
- Spare tire can be c when stored.
- Special tools for repair must mounted nearby
- Fuel fill-pipe outside

- Clear (limited) dimensions based on 95th (5th) body dimensions of users
- Drain plugs, valve
- Number of sizes min
- Carburetor fuel
- over (under) 50 gph
- at 50 gph/min (with
- Components can removed, installed u
- Small parts handle
- mitts are captive.

- Mixed access cover
- Drain valves: either is to be checked, initial
- Spare tire can be c when stored.
- Special tools for repair must mounted nearby
- Fuel fill-pipe outside

- Size of access large hand, arm, head, in
- One large access in
- Safety chains do not connect air, hydraulic
- ble.

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Components outside of cab or normal working position involved in checkout and which are necessary for operation, landing, tie-down, etc.

Tires, tracks, lights, batteries, ventilators, test panels, indicators, dipsticks, sensors, starter cranks, pulleys, master/slave handles, etc.

Handles, grips, knobs, switches, triggers, levers, wheels, pedals and other man operated items as applicable.
Controls are associated only with the item under test, not with equipment placed on it.

Components that provide visual and auditory information
Provide positive indication of developing or current malfunctions
Displays are associated only with the item under test, not

Your slave
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FIGURE 1.
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- Drain valves: man, number, readily accessible, reliable, hand operated.
- Drain covers: easily removable.
- Components requiring adjustment are readily accessible.
- Dual wheels allow inner, outer tire to be checked, inflated.
- Spare tire can be checked, inflated when stowed.
- Special tools for operational adjustment mounted nearby.
- Fuel fill cap: outside cab, body.
- Gross (forming) dimensions based on 95%th (5th%): see FIG 25.B.1-7.
- Drain plugs, valves same size or larger than hose mounting.
- Carrier vehicle to fuel tanks which are over (under) 50 gal. can be refueled at 50 gal/min (under 1 min fuel).
- Components can be handled, removed, installed using only the materials.
- Small parts handled with metric mulls are captive.
- Hinged access covers open down.
- Battery removable by one man.
- Spare tire easily removed, replaced in carrier with vehicle fully loaded.
- Jacking operation feasible.

- Size of access large enough to insert hand, arm, tool, test equipment.
- One large access preferred over two smaller ones.
- Safety chains do not damage, disconnect air, hydraulic, electrical cable.

- Trucks have glass-proof, steel canopy type & weather mirror on each side of the cab.
- Watch operation observable from both within, cab locations.
- Timing marks, other indicators minimum parallax, readily visible.
- Mirrors bracket against vibration.
- Components which must be visible are color-coded, contrast with background.

- Windshield wipers, weather provided.
- Weather blades returned to stored position when turned off.
- Windshield wipers must be within reach when positioning tractor manually; not exposed to traffic.
- Manual to-down facilities easily maintained, removed.
- Windshield wiper vehicle must operate of simultaneous operation.
- Wiper cable must payed out 1 run.
- Wiper controls available from cab as well as from wiper.
- Windshield wipers can be operated manually if power fails.
- Fuel tank, lines are not within vehicle body.
- Dust exhaust pipe extends beyond rear body.
- Exhaust system located, protected as from contact; hot surfaces.
- Fasteners well ventilated.
- Use separate ways to apply brakes.

- Battery terminals of different size, marked "+", "-".
- Which instrument visible.
- Weight capacity indicated on stands, lifts, hoists, jacks.
- Dip sticks color coded.
- Airbrake, hydraulic hoses identifiable at each end.
- Fuel tank capacity labeled.
- Tire pressure labeled.
- Special handling, assembly, operating procedures, precautions for cold weather in company store.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Controls are sequenced appropriately. There have to be sequential order from left-to-right or vice versa.
- Controls or functional groups are located in accordance with operational sequence and/or function.
- Controls oriented to operator.
- Can not accidentally be moved.
- Recurring groups similar throughout system.
- Rotary knob, shape: FIG 6.8.1-4.
- Linear slide, shape: FIG 6.8.1-13.
- Linear slider, shape: FIG 6.8.1-13.
- Cross (bimetric) (bimetric) dimensions based on 75MM (50MM) (85-95MM) operator.
- Size ratings 3 sizes max.
- Linear knob, shape: FIG 6.8.1-18.
- Isometric joystick: shaft length = 3", 7/16" or diameter = 2".
- Isometric joystick: hand-grip for integral switching otherwise finger-grip.
- Adequate control response feedback.
- Display interface controllers force, displacements: FIG 6.8.19-21.
- Switches: no snap between positions, resistance increases until snap into position.
- Flarey valves open CCM.
- Force, displacements (including miniature controls): FIG 6.8.1-21.
- High force controls: FIG 6.8.1-2.

- Control spacing min. FIG 6.D.1;
- blind operation, 5" min.
- Rotary separations FIG 6.B.1-8.
- Linear separations FIG 6.B.9-18.
- Compatible with handwear used.
- Foot switches separated 3" horizontal; 6" vertical minimum.
- Display interface controllers clearances FIG 6.B.19-21.
- Range of control action does not interfere with other controls.

- Shape defined curvilinear viscosity, flexibility identical
- Control contrast with background
- Ambient light color determines usable contrast colors
- Reference line has 50% min contrast with control color
- Pulse rate varies over exposure period
- Threshold adjustable 25% min
- Threshold adjustable internally light if ambient illumination below 1 ft.-c.
- Threshold repeatable 30° off-axis
- Layered switch layout is legible
- Precision of control manipulation is consistent with that of system
- Subsequent vibration, noise of user's limbs are over bordered
- Cooling system throughout system
- Usable in time required despite inadvertent operation production
- Controls not adversely affected by vibration, vibration
- Minimum use ratio of horizontal to 3-position toggle switches
- System response time FIG F.6-F.2.

- Steps calling for sharp stops.
- Critical controls are not susceptible to accidental movement.
- Good "push" control used when inappropriate for critical conditions.
- Controls that initiate hazardous operations require prior operation of a latching control.
- Power steering failure does not incapacitate steering.
- Forward controls located near center warning display/rearview heart.
- Minimum deceleration required.
- Control color related to display.
- Operating instructions provided except where use is obvious.
- Discrimination of controls.
- Maximum speed in gear shown.
- Positions of shift handles shown.
- Control movements shown parallel to actual control movements.
- Information entries are easily recalled.

Intercept software checks minimize user error.

- Standardization of keyboards within system.
- Keyboard arrangement, number of keys compatible with info to be entered.
- How fast provided for partial angle over 20°.
- Power reached easily.
- Keyboards conform to MIL-STD-1700.

- Only 1 switch per font (preferred).
- Display interface controllers size, shape: FIG 6.8, 19-21.
- Manipulator controls size, unit under space consistently size & separation requirement.
- Rotary size, shape: 1 N. 6.H.1-R.

- Avoids the requirement of constant force on joystick.
- Isometric joysticks: deflection minimal, perceptible.
- Isometric joysticks: max. force for full output not to exceed 26.7 lbs.
- C/D ratios: large (small) for small (large) range of display movement.
- High force controls provide limb/body support; 3 sec. sustained operation max.
- Free from backlash.

- Pointers differentiated for each knob of gauged set.
- Interface controllers: in rate control applications, indicators provided to facilitate returning followers to display.

Isometric joystick uses visual feedback, minimal delays tight coupling of input/output; return to center after entry requirement. Variable function keys have a visual signal if standard function unavailable. Fixed function keys used for critical or frequent inputs. Cursor control is consistent with speed and accuracy requirements.

Fast-operated switches located away from obstructions.
Data manipulated without concern for internal storage.

Control inputs result in positive responses displayed to indicate performance. User chooses sequence of transaction.

Data entry requires explicit completion actions paced by user.

Critical entries require user acknowledgment, can be edited.

Fast-operated control uses force needed greater than upper bath noncritical, frequent operation alternative shutdown control. Steps at beginning and end of control active positions. Extended maximum force applications avoided. Controller/follower maximum ratio, displacement proportional. Conventional control movement FIG 6.C.1.

humatic joystick delay between control movement and display response, .1 sec. max. Recommended manual control FIG 6.F.1.

- Display relationship to control is approximately horizontal; control used, e.g., *display, display*.
- Functionally related units grouped.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Displays limited as they can be read to the right of the control.
- Lighted control indicators are unambiguously associated with controls.
- Emergency, critical, important displays located in 30° cone about line of sight.
- Display viewing distances 13-20".
- Power controls to be read not obscure or second index mark width.
- Functions are close to dial to eliminate parallax, shadows.
- Numbers, flags, pointer, *plotters* F.B.I.B.1.
- CRT *display* viewed angle exceeds 2.0 minutes, 10 lines of resolution distance 16" (10") read.
- Numbers, flags, pointers, *plotters* F.W.B.A.X.

- Display clear to line of sight enough to 45° min. parallel, reflection.
- Frequency of light emission constant in operation and zero F.G.B.I.
- Illumination unit form: F.G.B.I. sparingly, visible.
- Contrast, luminance exceeds 50%.
- Flashing lights 3-3 flashes/sec.
- Color coding used where possible; unaided color covered.
- Indicators of status illuminated, standard, 0.82-1.0 ft-L.
- Flashing lights synchronized.
- Display precision, response is consistent with that of system.
- Information display: Clear, specific, precise, unambiguous not redundant, degraded by vibration or shock.
- Location of display F.G.B.I.
- Symbols: linear, width of 6, use whole numbers, 2 pointers max, numerals or coded symbols.
- Mechanical type FIG.B.F.2.
- Audio signal evolutions F.G.B.F.3.
- Audio, useful warnings 20 db min. over background.
- Frequency, 1000 Hz approx.
- Signal duration does not mean "up".
- Indicator light color coding for emergency, warning, attention, etc. F.G.B.F.3; master lights not apart.
- Audio warnings transmitted to both emphasis and work area.
- Audio signal action against specific action or problem.
- Pushbutton master signals are not used F.G.B.I.
- Audio warning duration min of 1 sec. until corrective action taken.
- Minimum decoding required.
- Touchmarks, irrelevant information, etc. do not appear on panel face.
- Coding techniques utilizing facilities for identification, identification, relationship, critically.
- Auditory displays used where vision overloaded, degraded, redundant; desirable warning, cue needed.
- Verbal warnings intelligible, opt.
- Audio warnings use standard signals.
- Labels functionally basic well located.

- Display pointer common stable
- Circular dials
- Recurring tabular located.
- Tabular data right, top-to-bottom
- All data needed is grouped together
- Simple menus fit on 1 page
- For hierarchical function call

- Illumination bar
- Display pointer
- Data entry by touch
- Groups of info. distinctive
- Display frames identified
- Text contained paragraphs separate blank line
- Prompts provisions explicit consistent technique
- Inserted items for, displayed in correct situation
- Data entered as shown, at least mechanical display are available
- Displays are expected operation
- Need for manual
- Auditory display
- Operator and then not combine for both uses
- Operator allowed visual
- Splitting and produce valid

- Auditory displayable.
- Display freeze mode feedback.
- Information generation of like c
- Data presented readable format
- Internally detected explicit, neutral
- Prompts and available for
- and error locati

8 DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation. Displays provide indication of developing or current malfunctions. Displays are designated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Functionally related units grouped.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Displays located so they can be read in the required degree of accuracy.
- Limited control indicators are unambiguously associated with controls.
- Emergency, critical, important displays located in 90° cone about line of sight.
- Display viewing distance: 13-20".
- Pointer extends to but does not obscure or exceed index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- Displays, flags, pointers, plotters: FIG. 8.B.1.
- CRT target visual angle exceeds 2.0 minutes, 10 lines of resolution distance 16" (10° min).
- Displays, flags, pointers, plotters: FIG. 8.B.1.

- Display pointers are aligned for common scale values.
- Circular dials: FIG. 8.F.X.
- Recurring tabular data is similarly located.
- Tabular data is displayed left-to-right, top-to-bottom.
- All data needed to support activity is grouped together.
- Simple menus used when all selections fit on 1 page.
- For hierarchical menus a direct function call capability is provided.

- Tabular displays used to present raw or data.
- Information necessary for selection of control action available when needed.
- Information density held to minimum on critical task displays.
- Standardized data fields used.
- Information displayed limited to that necessary to make decisions.
- Location and presence of control input data clearly indicated.

- Display face to line of sight exceeds 45° min parallax, reflection.
- Frequently used displays grouped in optimal visual zones: FIG. 8.F.1.
- Illumination uniform: FIG. 8.E.3, conspicuously visible.
- Contrast, luminance exceeds 50%.
- Flashing lights: 3-5 flashes/sec.
- Color coding used where possible; unused scales covered.
- Indicators used at night illuminated, dimmable: 0.02-1.0 (1:1).
- Flashing lights synchronized.
- Display precision, response is consistent with that of system.
- Information displayed: Clear, specific, precise, unambiguous; not redundant, degraded by vibrations, timely.
- Lights show functions: FIG. 8.F.1.
- Scales: linear, short of 0, use whole numbers, 2 pointers max, numerals oriented upright.
- Mechanical types: FIG. 8.F.2.
- Audio signal evaluations: FIG. 8.F.3.
- Audio, verbal warnings: 20 dB min over background.
- Failure immediately apparent.
- Signal absence does not mean "go".
- Indicator light color coding for emergency, warning, summation, etc: FIG. 8.F.1; master lights set apart.
- Audio warnings transmitted to both earphones and work area.
- Audio signal action apparent specifies nature of problem.
- Prohibited persistent signals are not used: FIG. 8.G.1.
- Audio warning durations min of 1 sec; until corrective action taken.
- Minimum decoding required.
- Trademarks, irrelevant information, etc do not appear on panel face.
- Coding techniques uniform facilitate discrimination, identification, relationships, criticality.
- Auditory displays used where vision overburdened, degraded redundancy desirable; warnings, cues needed.
- Verbal warnings: intelligible, apt.
- Audio warnings use standard signals.
- Labels: functional; basic; well located; graduated in size.

- Illumination balanced full on to off.
- Display pointer tip same color as marks.
- Date entry by overwriting is not used.
- Groups of information, commands distinctive.
- Display frames and pages uniquely identified.
- Text conforms to MIL-STD-490; paragraphs separated by min. of 1 blank line.
- Prompts provide data and explanations explicitly understandable; use consistent technology.
- Inserted items are collected in buffer, displayed in insert area, and inserted simultaneously.
- Data entered via keyboard are displayed, as keyed, on the screen.
- Mechanical overlays for keyboards, displays are avoided.
- Displays are designed for the expected operational environment.
- Alert for memorization minimized.
- Auditory displays have test device.
- Operator and maintenance information not combined unless compatible for both uses.
- Operator presumption in a crew system allowed only for mission survival.
- Prompting and command errors don't produce valid commands.

- Auditory displays: volume adjustable.
- Display freeze made provided has mode feedback.
- Information grouped to permit association of like classes.
- Data presented in readily usable and readable format.
- Internally detected error messages explicit, neutral in tone.
- Prompts and structuring features available for interactive sessions and error location.

- Digital values requiring reliable reading updated 1 per second or less.
- Gross or rate of change values updated between 2 and 5 per second.
- Graphic displays requiring integration of rapidly changing patterns updated consistent with the user's information handling rate.
- Display formats designed to optimize information transfer.
- Stacked, alternately presented legends visible.
- Display changes represent functional state.
- Priority information obvious.
- Transilluminated displays: FIG. 8.F.A-1.
- Transilluminated indicators display system status, immediate actions, adjustment functions.
- Software minimizes operator task complexity.
- Display indicates acceptance and unavailability of input and delay.
- Expected use of information determines update rates.

- Nomenclature approved by procuring agency.
- Abbreviations from MIL-STD-12, MIL-STD-411, and MIL-STD-783.
- Feedback provided to indicate system status.
- Command lang. as reflects user's point of view.
- Multiple level systems have minimum levels, priority access to critical levels, indicate current position.
- Aided for entry of already available information minimized.

10 WORKSPACE

The area within which the user operates the equipment.

Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, consoles and seats.

Provides storage for excess clothing, personal gear, weapons and tools.

Protects operator from adverse environment, when applicable.

- Display placement above standing (seated) surfaces normal, 41-70° (6-16°) precisely, frequently read, 50-65° (14-35°), ± 21° from centerline.
- Controls on vertical surfaces above floor (seated normal, 34-70° (8-30°) precisely, frequently read, 34-57° (8-27°), ± 21° from centerline.
- With vision over console top critical warning display 27° min above seat.
- Display reading location identified.
- Equipment designed, installed with workspace requirements in mind.
- Seats fit suitably clothed 5-95th percentile without degrading performance.
- Arm rests 24" min.
- Back, seat have 7° min padding.
- Lateral work (writing) space 30" (24" 6") min.
- Standard consoles: FIG. 10.B.1-3.
- Gross (limiting) dimensions based on 5th & 95th fully equipped users: FIG. 10.B.1-1, Arctic: FIG. 10.B.1-2.
- Adjustable dimensions fit 5-95th percentile.
- Vehicle operator's seat: FIG. 10.D.4.
- Vertical seat adjustments 15-27" in 1" min increments.
- Seat lumbar sections 103-105°, supports form as operator's eyes are within 3" of "eye-line".
- Nerve adjust 76-11" above seat.
- Seat adjust fore, aft 4" min.
- Operator does not have to lift seat to adjust seat.
- Padding does not restrict entry.

- Cabinet kick space: 44" min.
- Console front floor space: 8" min.
- Knee room 25x26x18" min.
- Unusual positions: FIG. 10.D.1-2.
- Allowances made for heavy clothing, protective equipment.
- Vehicle seat: FIG. 10.D.5.
- Workspace anthropometrics: FIG. 10.D.1-2.
- Seat adjustment overhead clearance from seat pan 40" min.
- Overhead clearance takes into account seat stiffening in cold.
- Reflection of instruments, consoles in windows, windshields avoided.
- Right-left viewing angle for wrap-around consoles 190° max.
- Dimensions: FIG. 10.E.1.
- Forward field of view 40° min.
- Trunk forward visibility ground beyond 10° to 15° above horizon.
- Vision, etc reduce external glare.
- Reflections: FIG. 10.E.3.
- No bright work in user's view.
- Door push, other motions do not cause vision.
- Acoustical environment does not degrade system effectiveness.
- Noise levels: FIG. 10.F.2-4.
- Whole body vibration limits X, Y, Z, times: FIG. 10.F.5.
- Vehicle temps 68°F min.
- Fresh air exceeds 20 cfm/min/man hot climate, 150-200 cfm/min/man.
- Windshield defrostable.
- Arctic clothed man not exposed to temp above 60°F; 35-45°F optimal.

- Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES.
- Legible noise: FIG. 10.G.1.
- Aural non-detection: FIG. 10.G.2.
- Noise duration limits: FIG. 10.G.3.
- Cars have seat belts.
- Windshields, windows are shatter-resistant, don't distort vision.
- Handed alerting device provided.
- Illumination adequate.
- Exposed edges (forward) rounded 0.08" (0.5") min radius.
- Motion sickness limits: FIG. 10.G.4.
- Adequate, suitable storage for manuals, worksheets, etc.
- Consoles, equipment adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.
- Instructions kept simple.
- Seat adjustment diagrammed.
- Pushed access motions marked.
- Messages, warnings include warnings on their, thermal hazards of hot/cold, exhaust gas.

11 COMMUNICATIONS

Devices and techniques for communicating information among crew members within the workspace, between the crew and externally located individuals, and between the crew and remotely located persons.

Includes antennas, where applicable.

- Microphones, headphones, headsets permit hands-free operation.
- Accessible volumes, gain controls are provided for each channel.
- Fast operated "Send-Receive" control when both hands busy.
- Radios, telephones are located for easy emergency access, time critical communications.
- Communication devices are located within easy reach of operator.

- Earphones, headsets easily adjusted, accommodates 5th-95th users: FIG. 11.B.4.
- Reach to communication controls is unobstructed.
- Workspace accommodates operators wearing earphones, headsets.
- Radio antenna located to minimize radio-frequency hazards.

- Microphones, headphones, single (multi-tilt) speakers: 200-6100 Hz (100-4000 Hz) dynamic range 50 dB min.
- Microphones noise cancelling in 100 dB range 10 dB rms min.
- Filtering, clipping is used to improve intelligibility.
- Discrete headsets used when ambient noise exceeds 85 dBA.
- Volume, gain audible range 110 dB max squarish.
- Volume/power control has delay between min volume, off.
- Communication equipment worn by operator is comfortable; metal parts do not contact user's skin.
- Headsets worn in high ambient noise provide attenuation equal to ear protective devices.
- Exposed metal parts grounded.
- System allows emergency message top priority, does not interfere with their transmission, reception.
- Antennas, waveguides grounded.

- Speaker hears own voice in his headset in phase with his speech.
- Voice communication intelligibility criteria: FIG. 11.H.1.
- Audio signals coded as to maintenance, emergency, health hazard, etc to minimize operator's visual display search.
- Instructions provided for use and fault detection for communications equipment.

SUBCLASS 8B

The

1. User
2. Envl
3. Open

INDEX TO DETAILED[illegible]

AIR

The conditions applicable to this class includes

1. User conditions - body size, clothing and encumbrances (flight suit, helmet, gloves);
2. Environmental conditions - weather, lighting and climate;
3. Operational conditions - time critical operations (emergency egress).

PERFORM FLIGHT OPERATIONS			
POSITION	CHECKOUT/FLY	INTERCEPT TARGETS	PERFORM IN-FLIGHT MISSIONS
design of the rator to access/ ing ejection.	PURPOSE: Evaluate the design of aircraft to enable completion of checkout and flight functions. MAN/ITEM TASKS Perform static check. Perform dynamic check. Taxi. Takeoff. Read displays. Cruise. Approach. Land.	PURPOSE: Evaluate the design of aircraft subsystems for enabling completion of target intercept tasks. MAN/ITEM TASKS Detect target. Locate target. Track target. Monitor spatial relationships. Identify target. Perform intercept. Read weapon display. Select weapon.	PURPOSE: Evaluate the design of aircraft subsystems for enabling completion of in-flight missions. MAN/ITEM TASKS Remain on station. Perform ELINT. Perform ECM/ECCM. Attack. Evaluate effects of attack Communicate. (See Operability IV B)

INDEX TO DETAILED DESIGN CONSIDERATIONS

[illegible]

TEST ITEM COMPONENTS

HUMAN FACTORS CONSULTATIONS

A LOCATION & ARRANGEMENT

The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of openings (accesses), cover or door operation, location of components (knobs, levers, etc.) as well as its relationship to other components.

B SIZE & SHAPE

The maximum and/or minimum dimensions of components that are required for adequate man use, including the effects of anthropometric and special clothing (arctic, NBC) considerations, and the shape and contour of handles, knobs and other controls to enhance both the identification and use of the component.

C DIRECTION & FORCE

The movement and/or force required to operate or generally manipulate a component (handle, control, fastener, etc.), with emphasis on the direction of motion corresponding to the display, component, total item reaction or standard practice as well as the minimum strength required.

D CLEARANCE

The unobstructed space surrounding a component which allows the operator to perform required actions, the adequacy of which varies as a function of the amount of body involved (hand, fingers, arm, torso, etc.) and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventive aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design handbooks as well as job aids, checklists, training texts, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1 LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates.
Make operator aware of hazards.
Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- ID labels not obscured by components on flat surfaces on main chassis; min coverage by grime; not easily removed.
- Data groups have the content designated by a title.
- Character height determined by distance read, luminance: FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles: FIG 1.B.2-4.
- Height/width ratio: $5/3$; h/w is 1 stroke width wider; "M" & "W" h/w is $5/4$; "I" & "l" are 1 stroke width.
- Stroke width for black (white) characters on light (black) background: $1/6$ (1/7-1/8) of height.

- Spacing between characters (word) one stroke (character) width min.
- Line spacings & character height.
- Counter numeral h/w ratio = 1:1 (except 1); separation = $5/8$ to 1 .
- Optical projections all caps, stroke width $1/6$ to $1/8$ h/w exceeds 15 minutes visual angle.
- Thumbwheel numeral h/w ratio = $3/2$; h/w is $5/4$; stroke width internally (externally) illuminated = 1:1 (5:1).
- Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environmental conditions.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-cd black letters, light background.
- Dark adaptation letters visible, do not interfere with night vision.
- Chart readings: FIG 1.B.3.
- Label characteristics accuracy required: time available; distances; light level; color; criticality of function; consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.
- Human numerals avoided.
- Vertical labels used only when labels are not critical for personnel safety performance.
- Electrical receptacles marked with voltage, phase, frequency.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-121) new OK if obvious.
- Aircraft station labeling legends: FIG 1.H.1-3.
- Trade names, irrelevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand grasp areas identified.
- Axes of graphs labeled and graduated appropriately.

2 STEPS, LADDERS, PLATFORMS

Provide a surface to accommodate user's feet while climbing or conducting routine checks and for the temporary placement of loads.
Wheels, hubs and structural members used for climbing are evaluated as ladders.
Angle of ascent definitions: ladders, 75° - 90° ; stair ladders, 50° - 75° ; stairs, 20° - 50° ; ramps, 0° - 20° ; platforms, 0° .

- Adequate footholds provided for crew to reach hatches from ground.
- Sequence of stepping points ends with proper man orientation to door or entryways.
- Step surfaces within, without workspace easily reached from either direction.
- Gross (limiting) dimensions based on 95th% (5th%) body dimensions of users: FIG 2.B.1-7.
- Stair, stair-ladder, fixed-ladder dimensions do not exceed the max. min dimensions: FIG 2.B.1-3.
- Stairs, ladders accommodate 5th-95th% user wearing arctic clothing: FIG 2.B.8.

- Folding ladder lift heights 9' max.
- One man limits to lift, store ladders 9' for 20 lb & for 25 lb.
- Stairs, ladders, platforms, ramps withstand heaviest combined weight of user plus equipment plus safety factor.
- Finger clearance is provided in folding steps, ladders.
- Step width, spacing accommodate boots: FIG 2.B.8.
- Folding ladder catches, locks operable with cold/wet arctic mittens: FIG 2.B.11.

- Visual obstructions, blind footholds avoided.
- Treads contrast with structure, conspicuous in dim light.

- Stair-ladders are of metal with the tread rise open at rear.
- Suitable footholds supplied.

- Ladders are not provided when equipment is to be hand carried.
- Ladders, stairs non-slip surface.
- Step openings safety bars, chains.
- Obstructions, sharp edges are ped-

- Footholds marked, identified.
- "No Step" markings if applicable.
- Warnings labels for hazards.
- Procedures listed for stowing, emptying ladders, ramps.

3 HANDHOLDS, HANDLES

Assist users to mount and enter the item and to maintain balance.
Supply leverage and support to a climbing or working man.
Door handles, structural members, etc., used for gripping or balance, are evaluated as handholds.

- Adequate hand grips provided for crew to reach hatch from ground.
- Handholds furnished where needed within easy reach.
- Handholds integrated with doors, entry ways for stability.
- Adequate handholds for balance while moving.
- Handrail dimensions: FIG 2.B.1-3.
- Handhold lengths: 6" min.
- Handhold openings: 6" x 4" min.
- Shaped handholds improve grip.

- Handholds do not intrude into workspace.
- Handhold accommodations: arctic gloves: FIG 2.B.11.
- Handholds clearly visible from inside and out prior to grasping.
- Color coded to enhance visibility, prevent grasping error.

- Suitable handholds supplied.
- Handholds provided to aid escape.
- Handholds useable with gloves.
- Handgrip useable with bare hands in hot climates, high temps.
- Collapsible handholds useable while wearing arctic mittens.

- Handholds have non-slip surfaces.
- Handrail height: 36" above walking surface.
- Handgrip areas away from cables, lines, hot pipes, other hazards.
- Inappropriate structures, wires cannot be used as handholds.

- Handholds marked, identified.

4 DOORS, HATCHES, PASSAGES

Provide a means for entering and leaving the enclosure.
Provide openings for loading or unloading material.
Components are evaluated for both normal and emergency use.
Some doors serve dual purposes and must also be evaluated as steps, ramps or platforms.

- Wall hatches flush with floor where structurally possible.
- Latch handle placement is uniform throughout vehicle.
- Latch handles can be reached from normal approach positions.
- Handgrips, footsteps help user reach hatch easily.
- Overhead hatches latch to hold open inside readily 1 hand operation.
- Handles can be reached, operated by troops in bulk clothing.
- Rectangular hatch, passageways: 26" x 30" min.
- Circular hatch, tunnels: 30" dia min.

- Hatch handle unlatching forces: 20 lb max.
- Overhead hatch opening force, 50 lb max operable by user with 5th% arm, hand strength: FIG 6.C.1.
- Emergency exit release handles: 30lb max force; 2 separate motions max.
- Hatch opening forces: 50 lb max.
- Handles operable with gloves.

- Fixed equipment is located 3" min from exact area of doors.
- Gross (limiting) dimensions based on 95th% (5th%) fully equipped users: FIG 2.B.1-7.
- Tunnels permit passage of user with equipment, clothing.
- Handles, handgrips useable with arctic mittens: FIG 2.B.11.
- Entry, egress possible wearing boots.

- Exits identifiable in dim light.
- Emergency lights at each exit, self contained power, automatic & commander operated, removable for emergencies.
- Latch control visible initially.
- Door jamb or opening height allows full view of step point.
- "See thru" where possible.

- Doors: minimum jamming.
- Doors, hatches: quick opening, easily opened, standard latch handle operation throughout.
- Escape exits do not open inadvertently, handles are not lock-wired.
- Passage flares non-slip.
- Latch handles do not freeze up.

- Doors, emergency exits are easily reached, unobstructed, quick opening: 3 sec max.
- Hatches over 72" above ground have evacuation slide slides, poles, ladders, ropes.
- Ropes at evacuation slide stand off from structure to permit use by more than one person at a time.
- Escape openings smooth-edged, no obstructions, permit passage with survival equipment.
- Glass in doors shatterproof.
- Exit instructions are legible, brief, clearly worded.
- Latch handle motion marked.
- Emergency evacuation: completed within 60 seconds using 1/2 exits.

6 CONTROLS

Components used to effect actions.
Handles, grips, knobs.
Controls are evaluated as:

- Control relationship: apparent, compatible.
- Functionally related grouped together.
- Control groups, sections have left-to-right to bottom order of use.
- Controls in function located in accordance with sequence and order.
- Controls oriented to a.
- Can not accidentally be.
- Recurring groups similar.
- Rotary size, shape: 1:1.
- Linear size, shape: 1:1.
- Controls have non-slip.
- Gross (limiting) dimensions based on 95th% (5th%) operator.
- Size coding: 3 sizes min.

- Isometric joystick: 4.2 - 7.1 grip diameter.
- Isometric joystick: for integral switches finger-actuated.
- Adequate control response.
- Conventional control: FIG 6.C.3.
- Isometric joystick: full output not to exert.
- Peaks return to off use.

- Rotary valves open: 1:1.
- Forces, displacement: mechanical controls: 1:1.
- Free from backlash.
- Avoid the requirement force on joystick.
- Control spacing: min. blind operation: 5" min.
- Rotary operation: 1:1.
- Linear operation: 1:1.
- Compatible with hand.
- Foot switches: separate.
- Display interface: 1:1.
- Range of control: no interference with other controls.
- Larger diameter controls used for the fine adj.
- Shape coded controls: easily identifiable.
- Color coding: 5, 10, 15.
- Ambient light color: de-able control colors.
- Reference line has 50% with control color.
- Pointer parallel error: 25% max.
- Thumbwheel: interval: ambient illumination: 1:1.
- Thumbwheel: readable: 1:1.
- Legend switch legend: 1:1.
- Precision of control consistent with that of selected, distributed user's limbs are over 1:1.
- Variable g-loading: 1:1.
- Coding uniform: 1:1.
- Useable in time: no inadvertent operation.
- Controls not adverse: distraction, shock, vibration.
- Movement oriented: 1:1.
- Several sections are use: System response times.
- Shape coding free of: to accidental movement.
- Controls that initiate operations require: a locking control.
- Main power ON-OFF: power to equipment.
- Emergency controls: related warning of hand.
- Compatible with hand.

- Minimum decoding: 1:1.
- Control color related: 1:1.
- Operating instruction: concept where use is obvious.
- Diagrams used where: 1:1.
- Main power switch: 1:1.
- If red lighting is used: for coding: use black striping instead.
- Emergency (noncritical) groups outlined with (1/16" black) border.

4 DOORS, HATCHES, PASSAGES

- Provide a means for entering and leaving the workspace.
- Provide openings for loading or unloading material.
- Components are evaluated for both normal and emergency use.
- Some doors serve dual purposes and must also be evaluated as steps, ramps or platforms.

6 CONTROLS

Components used to activate, deactivate and modify the equipment power and to modulate the operating elements.

Handles, grips, levers, switches, triggers, levers, wheels, pedals and other man-operated items as applicable.

Controls are associated only with the item under test, not with equipment placed on it.

7 SPECIAL CONTROLS

Particular components, used only on specific equipment, which are in addition to the normal complement of controls or controllers.

8 DISPLAYS

Components that provide position information. Displays are associated with controls.

- Wall hatches flush with floor where structurally possible.
- Latch handle placement is uniform throughout vehicle.
- Latch handles can be reached from normal approach positions.
- Handgrips, footsteps help user reach latch easily.
- Overhead hatches latch to hold open inside packing hand operation.
- Handles can be reached, operated by troops in bulky clothing.
- Rectangular hatch, passageway: 26" w, 30" h min.
- Circular hatch, tunnel: 30" dia min.

- Hatch handle unlatching force: 20 lb max.
- Overhead hatch opening force, 50 lb max; operable by user with 50% arm, hand strength FIG 6.B.1-8.
- Emergency exit release handles: 30 lb max force; 2 separate motions max.
- Hatch opening force: 50 lb max.
- Handles operable with gloves.

- Fixed equipment is located 3" min from panel area of doors.
- Gross (limiting) dimensions based on 50th (50th) fully equipped user FIG 7.D.1-7.
- Tunnels permit passage of user with equipment, clothing.
- Handles, handgrips useable with arctic mitts FIG 7.B.1-1.
- Entry, egress possible wearing boots.

- Exists identifiable in dim light.
- Emergency light: at each exit, self contained power, automatic & commander operated, removable for emergencies.
- Latch control visible initially.
- Door jamb or coming height allows full view of step point.
- "See thru" where possible.

- Doors: minimum jamming.
- Doors, hatches: quick opening, easily operated, standard latch handle operation throughout.
- Escape exits: do not open inadvertently, handles are not lock-wired.
- Passage floors non-slip.
- Latch handles do not freeze up.

- Doors, emergency exits are easily reached, unobstructed, quick opening, 3 sec max.
- Hatches over 72" above ground have evacuation aids: slides, poles, ladders, ropes.
- Ropes as evacuation aids stand off from structure to permit use by more than one person at a time.
- Escape openings smooth-edged, no obstructions, permit passage with survival equipment.
- Glass in doors shatterproof.
- Exit instructions are legible, brief, clearly worded.
- Latch handle motion marked.
- Emergency evacuation completed within 60 seconds using 1/2 exits.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
- Controls in functional groups are located in accordance with operational sequence and/or function.
- Controls oriented to operator.
- Can not accidentally be moved.
- Recurring groups similar thru system.
- Rotary size, shape: 1 1/2" 6.A.1-8.
- Linear size, shape: FIG 6.B.5-18.
- Controls have non-slip surfaces.
- Gross (limiting) (adjustable) dimensions based on 95th% (5th%) (5-75th%) operator.
- Size coding: 3 sizes max.

- Isometric joystick: shaft length: 4.3-7.1", grip diameter: 2".
- Isometric joystick: hand-grip for integral switching otherwise finger-grip.
- Only 1 switch per foot (preferred).
- Display interface: controllers size, shape: FIG 6.B.17-19.
- Mixture controls used only under space constraint; size and separation maximum.

- Fast-operated control use force needed greater than upper body muscularity, frequent operations; alternative shutdown control.
- F/D ratios: large (small) for small (large) range of display movement.
- Switches: No stop between positions; resistance increases until snap into position.
- Display interface controllers force, displacements: FIG 6.B.19-21.

- Rotary separations: FIG 6.B.1-8.
- Rotary separations: FIG 6.B.1-8.
- Linear separations: FIG 6.B.5-18.
- Compatible with handwear used.
- Control switches separated 3" horizontally, 1" vertically minimum.
- Display interface controllers clearance: FIG 6.B.17-19.
- Range of control action does not interfere with other controls.
- Larger diameter concentric control is used for the fine adjustment.
- Shape coded controls visually, tactually identifiable.
- Color contrasts with background.
- Ambient light color determines useable control colors.
- Reference line has 50% min contrast with control color.
- Pointer parallel error between reference marker 25% min.
- Threshold: Internally lighted if ambient illumination below 1 ft-c.
- Threshold: externally lighted 30" off-axis.
- Legend switch legend is legible.
- Precision of control manipulation is consistent with that of system.
- Selected, distributed so none of user's limbs are over burdened.
- Variable g-loading considered.
- Coding uniform throughout system.
- Usable in time required despite inoperative operation protection.
- Controls not adversely affected by vibration, shock, vibration.
- Movement oriented to operator if several stations are used.
- System response times: FIG 6.F.2.

- Shape coding free of sharp edges.
- Critical controls are not susceptible to accidental movement.
- Controls that initiate hazardous operations require prior operation of a locking control.
- Main power ON-OFF switch out of view to equipment.
- Emergency controls located near related warning display/nearest hand.
- Compatible with handwear used.

- Minimum decoding required.
- Control color related to display.
- Operating instructions provided except where use is obvious.
- Diagrams used where possible.
- Main power switch labeled.
- If red lighting is used, red is not used for coding use yellow and black striping instead.
- Emergency (noncritical) functional groups outlined with 3/16" red (11/16" black) border.

- Keyboard arrangement, number of keys compatible with info to be entered.
- Feet rest provided for pedal angle over 20°.
- Pedals reached easily.
- Standardization of keyboard's within system.
- Keyboards conform to MIL-STD-128B.

- Isometric joystick: shaft length: 4.3-7.1", grip diameter: 2".
- Isometric joystick: hand-grip for integral switching otherwise finger-grip.
- Only 1 switch per foot (preferred).
- Display interface: controllers size, shape: FIG 6.B.17-19.
- Mixture controls used only under space constraint; size and separation maximum.

- Fast-operated control use force needed greater than upper body muscularity, frequent operations; alternative shutdown control.
- F/D ratios: large (small) for small (large) range of display movement.
- Switches: No stop between positions; resistance increases until snap into position.
- Display interface controllers force, displacements: FIG 6.B.19-21.

- Rotary separations: FIG 6.B.1-8.
- Rotary separations: FIG 6.B.1-8.
- Linear separations: FIG 6.B.5-18.
- Display interface controllers clearance: FIG 6.B.17-19.

- Pointers differentiated for each level of ganged set.
- Interface controllers: in case control applications, indicators provided to facilitate returning followers to display.
- Display frames and pages uniquely identified.

- Isometric joystick use visual feedback, minimal delay tight coupling of input/output; return to center after use requirement.
- Isometric joystick define between control movement and display response: 1 sec max.
- In bracketing, knobs swing thru 10-70° are around target value.
- Lighters have feedback of placement, actuation, and input reception.

- Emergency controls located near related warning display/nearest hand.
- Fast-operated switches located away from obstructions.
- Recommended manual controls: FIG 6.F.1.
- Data manipulated without concern for internal storage.

- Erroneous entries are easily corrected.
- Internal software checks minimize user errors.
- Critical entries require user acknowledgment; can be edited.
- Control inputs result in positive response displayed to indicate performance.
- User chooses sequence of transaction.
- Data entry requires explicit completion action; requires pace by user.

- Forces, displacements (including miniature controls): FIG 6.B.1-21.
- Stops at beginning and end of control active positions.
- Avoid the requirement of constant force on joystick.
- Isometric joystick: deflection minimal, perceptible.

- Recommended manual controls: FIG 6.F.1.
- Lightpad have discrete activating mechanism.
- Variable function keys have a visual signal if standard function unavailable.
- Fixed function keys used for critical or frequent inputs.
- Cursor control is consistent with speed and accuracy requirements.

- Fixed wing cockpit control locations: FIG 7.A.1-2.
- Rotary wing cockpit control locations: FIG 7.A.3-5.
- Aircraft controls are operable with shoulder harness locked.

- Gross, (limiting) (adjustable) dimensions based on 95th% (5th%) (5-75th%) operator: FIG 7.D.1-7.

- Overhead switches are actuated upward (forward) for increased performance if overhead panel is in an angle of 0-30° (30-90°) to vertical axis.
- Fixed wing control actuations: FIG 7.C.1.
- Rotary wing control actuations: FIG 7.C.2.
- Primary, curtain (alternat., D-ring) ejection control force extract, 20-40 (15-25) lbs for 30-40 (30-40) lbs.

- Pitch, roll control clearances: FIG 7.D.1-2.
- Yaw control clearances: FIG 7.D.3.
- Single, multiple throttle controls: FIG 7.D.4; except multiple is based on forward most position of throttle.
- Collective controls: FIG 7.D.5.
- Controls, switches, control guards & covers operable by gloved hand.

- Emergency controls have yellow & black stripes or background.
- Emergency control colors limited to grey, black, white, yellow.

- Landing gear lock, release is operable by hand or foot.
- Firing mechanism for ejection seats is located, protected to preclude inadvertent actuation.

- Rotary wing aircraft have no emergency control that requires the removal of the pilot's right hand from the cyclic stick.
- Actuation of controls, switches involving flight safety are consistent with previous models of the particular aircraft.
- Ejection controls do not jeopardize user's safety nor hinder emergency escape.
- Ejection controls operable by 3rd - 90th% crewman.
- Printed instructions in the cockpit are minimized, legible.
- Cockpit information displays: Lettering, numbering, markings, symbols on displays, controls, control panels; emergency procedures for exiting, ditching flight, operational procedures; radio call signs.

- Display relationship to parent; determines control equipment displayed.
- Displays, groups have and/or top-to-bottom or left-to-right order.
- Displays located so they are in the required degree of view.
- Positions of related displays on separate panels.
- Display positions correct relative to equipment motion.
- Lighted control indicators unambiguously associated with equipment.
- Display viewing distance: Pointer extends to but is secure or exceed index mark.
- Pointers are close to a note parallel, shadows.
- CRT target visual angle: minutes, 10 lines of resolution: 16" (10" min).
- Counters, flags, printers: FIG 8.B.1.
- Circular dials: FIG 8.B.1.

- Design Requirements (MIL-STD-172)
- User-Computer Interface (MIL-STD-172)
- Guidance Data (MIL-HDBK-759)

- Display face to line of sight: 45° min parallel, reflex.
- Frequently used displays optimal visual zones: FIG 8.B.1.
- Illumination uniform: FIG 8.B.1.
- Indicator lights show no springing, visible.
- Contrast, luminance: FIG 8.B.1.
- Flashing lights: 3-5 Hz.
- Color coding used with unaltered scales covered.
- Flashing lights synchro: LED's red only dimming.
- Display precision, consistent with that of system.
- Information displayed: fig, precise, usable; not degraded by vibration.
- Lights show functions: FIG 8.B.1.
- Scales: linear, start at numbers, 2 pointers oriented upright.
- Mechanical types: FIG 8.B.1.
- Audio signal evaluation: FIG 8.B.1.
- Audio, verbal warnings: FIG 8.B.1.
- Failure immediately on: FIG 8.B.1.
- Signal absence does not: FIG 8.B.1.
- Indicator light color: FIG 8.B.1.
- Emergency, warning, master light: FIG 8.B.1.
- Audio warnings: transmitters and work are: FIG 8.B.1.
- Audio signal action: FIG 8.B.1.
- Prohibited, persistent: FIG 8.B.1.
- Audio warning duration: FIG 8.B.1.
- Minimum decoding required: FIG 8.B.1.
- Trademarks, irrelevants: FIG 8.B.1.
- Coding techniques: FIG 8.B.1.
- Relationship, criticality: FIG 8.B.1.
- Auxiliary displays: FIG 8.B.1.
- Overburdened, degraded: FIG 8.B.1.
- Verbal warnings: FIG 8.B.1.
- Audio warnings: FIG 8.B.1.
- Labels: FIG 8.B.1.
- Labels: FIG 8.B.1.

DETAILED DESIGN CONSIDERATIONS

10 WEEKS!

- The area within which the user operates the equipment.
- Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, consoles and seats.
- Provides storage for excess clothing, personal gear, weapons and tools.
- Protects operator from adverse environment, when applicable.

- Display placement above stordious location; surface: normal, 41-70° (16-46°); precarity, frequently read, 50-65° (16-35°), +21° from centerline.
- Controls on vertical surface above floor (width): normal, 30-70° (8-34°); precarity, frequently used, 30-53° (8-27°), +21° from user centerline.
- Seated operator has free access, equipment cost points.
- Control panel design allows equipment sharing, good communication.
- User oriented to work site.
- Arm rests 20° FH.
- Standard consoles FH, IGB.1-3.
- Gases (livings) dimensions based on 95th % (5th %) fully equipped users: FIG.25A.1-7. Airties: FIG.25A.1-7. Adjustable dimensions fit 5-95th%.
- Adjustable precision seat geometry FIG.10B.3-5.
- Armrests don't interfere with work, egress, emergency procedures.
- Seats: mass protection under g-h-d.
- Aircrew seating, ejection seat geometry: FIG.10B.4.
- Vertical seat adjustment: 15-2P in 1" mass increments.
- Reclining seats & latching positions limit, support 750 lb mass inverted. Secs, adjust, sec, alt: 4° min.
- Operator seat not have to lift off to vertical seat.

- Humane: FIG I&E-1.
- Transparent: crew free from color, distortion, etc.
- Multireflections from multiple-angle viewing minimized.
- Windowpan angle of incidence 60° max for undistorted view.
- Windows: crew have optimum unobstructed vision.
- Pilot vision plots FIG I&E-2.
- Inflight reticles: pilot able to see tender, signals, beam, probe.
- Instrument refraction avoided.
- Acoustic: system not degrading system effectiveness.
- Noise levels: FIG I&F-2,8.
- Whole body vibration limits: X, Y, Z, time FIG I&F-3.
- Crew ops in variable g: restrained, acceleration aids staying limited.
- Ejection: FIG I&F-10.
- Ejection astronaut controls accessible; limbs held; restraint adequate; life support provided.
- Comfort: man adapted to crew use.

- Exposure to gases, fumes, vapors, toxicity and THRESHOLD LIMIT VALUES.
- Noise duration limits FFG 100.0.
- Hazard alerting device provided.
- Exposed edges (corners) rounded: 0.04" (0.57) min radius.
- Vehicle escape simple, effective within 30-60 sec.
- Control system usable throughout flight envelope.
- Accidental action minimized.
- Motion sickness limits: FFG 100.0.
- Adequate, suitable storage for manuals, worksheets, etc.
- Conspicuous placards adjacent to equipment hazardous to user.
- All required PPE, equipment, clothing are specifically identified.
- Structure which can be chipped thru in emergencies is clearly marked: areas provided, labeled.
- Emergency procedures detailed, instructions kept simple.
- Seat equipment disarmed.
- Push-out escape windows marked.

TEST FUNCTION

TEST ITEM CLASS I

SUBCLASS C

OBJECTIVE: Evaluate the effectiveness and safety of the design of non-maneuvering vehicles for enabling the user to prepare them for use, connect and disconnect them, and use them as intended. The MFE subtest should give consideration to the evaluation of user performance and safety in conducting these functions with the item under conditions which are representative of those expected in actual use.

The conditions applicable to this class are:

1. User conditions - level of training and encumbrances, and conditions of the user which degrade soldier performance (such as noise levels impairing hearing, affecting his night vision).
2. Environmental conditions - weather, illumination, etc.
3. Operational conditions - time critical conditions (blackout, noise suppression) or

PREPARE FOR USE		CONNECT/DISCONNECT	
LOAD/UNLOAD MATERIALS	SET UP FOR USE	ENGAGE PRIME MOVER	VERIFY OPERATION
PURPOSE: Evaluate the design of the test item for adaptability to cargo loading facilities and practices. This function will deal with general types of cargo, as well as special equipment, such as would be subsequently employed in a shop van or other stationary work van. MAN/ITEM TASKS Mate loading position with loading device. Open/close cargo doors. Lower/raise platform/ramp. Mount steps/etc. with load. Pass load up to platform/entryway. Transfer load to storage area. Secure load in/en item.	PURPOSE: Evaluate the design of the item for ease of setting up as a temporary working station. MAN/ITEM TASKS Transfer item to destination with prime mover. Install permanent equipment. Block/lock wheels. Level item. Attach temporary steps/stairs. Connect powerlines/cables/hoses. Deploy expendable units.	PURPOSE: Evaluate the design of the item for ease of fastening to prime mover, including hitches, tow lines, hydraulic, air and electrical connections, alignment aids, retracting wheels, and other components used in the task of connecting to the prime mover. MAN/ITEM TASKS Connect lines/hoses from mover to item. Prepare hitch/connection. Align/mate prime mover and item. Fasten/connect prime mover and item.	PURPOSE: Evaluate the design of the item for ease of fastening to prime mover, including hitches, tow lines, hydraulic, air and electrical connections, alignment aids, retracting wheels, and other components used in the task of connecting to the prime mover. MAN/ITEM TASKS Inspect hose/cable. Manually/visually check tightness. Tighten/adjust connections. Inspect external components. Read labels.

INDEX TO DETAILED-DESIGN CONSIDERATIONS

Test Item Components HUMAN FACTORS CONSIDERATIONS	Steps Ladders Platform (7)	Doors Hatches Passages (4)	External Components (5)	Work- space (10)	Fastener Connect- ors (13)	External Components (5)	Communi- cations (11)	Lines Hoses Cables (12)	External Components (5)	Lines Hoses Cables (12)	Fasteners Connectors (15)	Labels Markings (1)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B	B	B	B	B	B
C. DIRECTION & FORCE	C	C	C	C	C	C	C	C	C	C	C	C
D. CLEARANCE	D	D	D	D	D	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H	H	H	H	H	H

NON-MANEUVERING

Operational conditions - time critical operations (emergency access/egress), combat conditions (blackout, noise suppression) and use conditions (duration of use).

DETAILED DESIGN CONSIDERATIONS

[illegible]

TEST ITEM COMMENTS

HUMAN FACTORS

A. LOCATION, ARRANGEMENT

The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of openings (for control, cover or door operation, location of components (knobs, levers, etc.) as well as its relationship to other components.

B. SIZE & SHAPE

The maximum and/or minimum dimensions of a component that are required for adequate man use, including the effects of anthropometric and space of clearing (e.g., 24 in. clearance), and the shape and contour of handles, knobs and other controls to ensure both the user form and use of the component.

C. DIRECTIONAL FORCE

The movement and/or force required to operate or manipulate a component (knobs, control, fastener, etc.) with emphasis on the direction of motion corresponding to the display, component, total environment or standard, as well as the maximum strength required.

D. DISPLAY

The visual characteristics pertaining to a component which allows the operator to perform required actions, the display of information as a function of the amount of body movement, force, speed, time, force, etc., and where display is, will also include considerations such as display, text, symbols, pictorial, etc.

E. VISIBILITY

Visual quality of a component that contributes to the operator's ability to use it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflection, and illumination.

F. FUNCTIONALITY

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the associated areas.

G. SAFETY

Those aspects of a component that contribute to the operator's safety or other personnel, including prevention of injury to the user, electrical contact with electrical components, chemical, radiation and pressure hazards, and danger to sight and hearing particularly under the conditions of alert or battle stress.

H. OPERATING PROCEDURES

Those operating and informational aspects affecting or improving the performance of a component, including design characteristics, as well as ability, checklist, training, testing, troubleshooting guides, and repair manuals with special attention to the safety aspects of the component.

1. LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates.

Make operator aware of hazards.

Give special guidance or instructions.

Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.

Labels placed on or near items they identify.

Do not cover other information.

Label is not behind control.

Label is not constant.

ID labels not obscured by component on flat surfaces on main chassis; not covered by grilles not easily removed.

Character height determined by distance read, luminance FIG 1.B.1.

Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.

Letter, numeral stroke FIG 1.B.2.4.

Height/width ratio: 5/3; "h" is 1 stroke width; "m" & "w" are 1 stroke width.

Stroke width for black (white) characters on light (black) backgrounds 1/6 (1/7-1/8) of height.

Folding ladder left height: 2 min.

One min limits to left, shore ladder: 2 for 20 lb; 6 for 25 lb.

Stairs, ladders, platforms, ramps, overhead hoisted combined weight of user plus equipment plus safety factor.

Ladders curved, positioned, handled by 2 min max.

Spacing between characters (word) and stroke character width min.

Line spacing: 5 character height.

Counter numeral line ratio: 1/1 (except 1/2 separation: 5 to 6).

Optical projection: all caps, stroke width 1/6 to 1/8 by exceeds 15 minutes visual angle.

The, which, where, during, if, will also include considerations such as display, text, symbols, pictorial, etc.

Abbreviations all caps, no periods.

Extended caps users lower case.

Label characteristics determined by illumination level, color.

Labels clearly, accurately read at operational reading distance, vibration, light levels, environments.

Labels are sharp with high or color contrast.

With illumination above 1 ft-Ci black letters, light backgrounds.

Dark adaptations letters visible, do not interfere with night vision.

Numbers, letters, details viewed by TV light on dark background.

Label characteristics accuracy required: time available, distance, light level, color, criticality of function, consistency of design.

Labels on projection equipment are as durable as the equipment.

Labels for prototype equipment easily affixed, altered, removed.

Labels not covered by other units not obscured by grilles, dirt.

Markings, tags are as permanent, suitable as equipment.

Vertical labels used only when labels are not critical for personnel safety or for maintenance.

Warning notices illuminated.

Warning notices clear, direct characters 25% larger than any following instructions.

Placards adjacent to hazards.

Abbreviations are standard (MIL-STD-12H) new OK if obvious.

Trade names, irrelevant info do not appear on labeling.

Labels concise, min redundancy.

Abstract symbol only if meaningful.

Words familiar to user.

Hand grasp areas identified.

2. STEPS, LADDERS, PLATFORMS

Provide a surface to accommodate user's feet while climbing or conducting routine checks and for the temporary placement of loads.

Wheels, hubs and structural members used for climbing are evaluated as ladders.

Angle of ascent definitions: ladders, 75°-90°; stair ladders, 50°-75°; stairs, 20°-50°; ramps, 0°-20°; platforms, 0°.

Adequate footholds provided for user to reach handholds from ground.

Sequence of stepping points and with proper foot orientation to stair or ramp.

Step surfaces within, without step-space easily reached from either direction.

Self leveling device used on elevating stands, platforms.

Simultaneous two-way traffic uses separate up, down ladders.

Gross (limited) dimensions based on 95th (5th) body dimensions of users FIG 2.B.1.7.

Stair, stair-ladder, fixed-ladder dimensions do not exceed the maximum dimensions FIG 2.B.1.3.

Stairs, ladders accommodate 140-150 lb user wearing armor clothing FIG 2.B.8.8.

Folding ladder left height: 2 min.

One min limits to left, shore ladder: 2 for 20 lb; 6 for 25 lb.

Stairs, ladders, platforms, ramps, overhead hoisted combined weight of user plus equipment plus safety factor.

Ladders curved, positioned, handled by 2 min max.

Finger clearance is provided in folding steps, ladders.

Step width, spacing variable while wearing boots.

Step width, spacing accommodations: FIG 2.B.8.8.

Folding ladder railings, ladders operate with railings or arch sections: FIG 2.B.1.1.

Visual obstructions, blind footholds avoided.

Treads contrast with structure, conspicuous in dim light.

For reduced lighting reflective materials used.

Stairs, stair-ladder, ramps open on one or both sides have intermediate guard rails.

Stair-ladder handrails are non-slip.

Handholds variable if used, icy.

Handgrip variable with bare hands in hot climates, high temp.

Collapsible handholds available while wearing armor clothing.

Open personnel platforms guardrails w/intermediate rails top rail 42" min rails not back from edge 26" min.

Handgrip areas away from cables, lines, hot pipes, other hazards.

Inappropriate structures, wires cannot be used as handholds.

Railings no projections, snags.

Handholds marked, identified.

Footholds marked, identified.

"No Step" markings if applicable.

Warning labels for hazards.

Procedures listed for showing, replacing ladders, ramps.

3. HANDLES, HANDGRIPS

Assist users to mount and enter the item and to maintain balance.

Supply leverage and support to a climbing or working man.

Door handles, structural members, etc. used for gripping or balance, are evaluated as handholds.

Handholds, safety bars, chains around platforms or stair openings 62" above standing surface.

Handholds furnished where needed within easy reach.

Handholds integrated with doors, entry ways for stability.

Adequate handholds for balance while moving.

Handrail dimensions FIG 2.B.1.3.

Handhold length: 6" min.

Handhold opening 4" x 6" min.

Shaped handholds improve grip.

Handholds do not intrude into work-space.

Handhold accommodations: arch, gloves FIG 2.B.1.1.

Handholds clearly visible from inside and out prior to grasping.

Color coded to enhance visibility, prevent grasping error.

Stairs, stair-ladder, ramps open on one or both sides have intermediate guard rails.

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Handholds variable if used, icy.

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Collapsible handholds available while wearing armor clothing.

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Footholds marked, identified.

"No Step" markings if applicable.

Warning labels for hazards.

Procedures listed for showing, replacing ladders, ramps.

4. DOORS, HATCHES, PASSAGES

Provide a means for entering and leaving the work space.

Provide openings for loading or unloading material.

Components are evaluated for both normal and emergency use.

Well hatches flush with floor where structurally possible.

Latch handles can be reached from normal approach positions.

Handgrip, footsteps help user reach latch ends.

Overhead hatchway latch to hold open inside padded 1 hand operation.

Handles can be reached, operated by troops in bulky clothing.

Rectangular hatch sizes FIG 4.B.1.

Circular hatches 30" min dia.

Door hatches 17" x 20" min.

Overhead hatches opening force, 50 lb max; opening force with 50% arm, hand strength FIG 6.C.1.

Match opening force: 50 lb max.

Handles operable with gloves.

Fixed equipment is located 2" min from swept area of doors.

Gross (limited) dimensions based on 95th (5th) body dimensions of users FIG 2.B.1.7.

Well escape hatches in vehicle mounted shelters clear all obstructions.

Door escape hatches 22" min dia, 10" clear ground.

Handgrip, handgrip variable with arches FIG 2.B.1.1.

Latch control visible internally.

Door jamb or casing height allows full view of step point.

"See thru" where possible.

Hatches open with a single motion of hand, foot.

If "step down" through a top access exceeds 2", appropriate foot rests, steps provided.

Latch handles do not freeze up.

Doors lockable from inside.

Handles uniform in operation.

Doors, emergency exits are easily reached, unobstructed, quick opening 3 sec max, 10-15 lb. operating force.

Escape openings smooth-edged, no obstructions, permit passage with survival equipment.

Glass in doors shatteredproof.

Color of latch handle different from that of door.

Correct movement of latch handle diagrammed, labeled.

Fast instructions are legible, brief, clearly worded.

5. EXTENSIVE

Components are evaluated for both normal and emergency use.

Components are evaluated for both normal and emergency use.

Components are evaluated for both normal and emergency use.

Door, valves, etc. are accessible, reachable.

Filters accessible for replacement.

Components (e.g., valves, etc.) are visible or accessible.

Door, valves, etc. are accessible, reachable.

Special tests for operation mounted near user.

Full full-page units are accessible, reachable.

Gross (limited) dimensions based on 95th (5th) body dimensions of users FIG 2.B.1.7.

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Special tests for operation mounted near user.

Full full-page units are accessible, reachable.

Gross (limited) dimensions based on 95th (5th) body dimensions of users FIG 2.B.1.7.

Door, valves, etc. are accessible, reachable.

TEST FUNCTION _____

TEST ITEM CLASS II _____

SUBCLASS A _____

OBJECTIVE: Evaluate the effectiveness and safety of the design of individual weapons to enable the user to prepare the weapon for use and to actually use it. The HFE subtest should consider evaluation of operator performance and safety for those functions under conditions representative of those expected in combat use of the weapon.

The

1. Use
2. Error
3. Operator can

PREPARE FOR USE		
PRE-OPERATIONAL ACTIVITIES	ASSEMBLE/EMPLACE	
PURPOSE: Evaluate the design of the test item for the facility of the user to unpack, unstore, handle, field-strip, clean and to reassemble and adjust the weapon under a wide range of environmental and operational conditions. MAN/ITEM TASKS Store in/on vehicle. Unstore/unpack. Pick up/pick down. Carry in hand. Carry on body. Field-strip. Clean parts. Make parts. Tighten connections. Adjust sights.	PURPOSE: Evaluate the test item for the ease of mating subassemblies, making the necessary connections, and placing in position for operation. MAN/ITEM TASKS Mate subassemblies. Make connections. Engage. Position for firing.	PURPOSE: test the mating/mating sights MAN/ITEM TASKS Select Make Activate Ready Ready Ready

Test Item Components HUMAN ACTORS CONSIDERATIONS	INDEX TO DETAIL						
	Fastener Connectors (13)	Handles (14)	Operating Element (15)	Positioning (17)	Fastener Connectors (13)	Handles (14)	Label Marking Number (1)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B
C. DIRECTION & FORCE	C	C	C		C	C	
D. CLEARANCE	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H

IS II**INDIVIDUAL**

The conditions applicable to this class include:

1. User conditions - body size of users, and clothing and encumbrances
2. Environmental conditions - rain, cold, low levels of illumination, different types of terrain, and different climates (arctic, desert, tropic, temperate)
3. Operational conditions - New critical operations (quick assembly, rapid fire, combat conditions (blackout, noise suppression, alternate types of targets) and use conditions (duration of use).

INDEX TO DETAILED DESIGN CONSIDERATIONS

[illegible]

SYSTEM COMPONENTS

PRIMARY ACTIONS CURRENT ACTIONS

A. LOCATION AND ACCESSIBILITY
The position of a component or its effect on the ability of the operator to reach, operate or manipulate it, including factors of operability (reach, control or use operation, location of components (knobs, levers, etc.) as well as its relationship to other components.

B. SIZE & SHAPE

The maximum and/or minimum dimensions of components that are required for adequate use, including the effects of anthropometric and space of clothing (arctic, etc.) considerations, and the shape and location of handles, knobs and other controls to enhance both the ability to use and the safety of the component.

C. DIRECTION OF FORCE

The movement and/or force required to operate or manipulate a component (handle, control, fastener, etc.), with emphasis on the direction of motion corresponding to the display, component, total item reaction or stick/lever position as well as the minimum strength required.

D. CLARITY

The instructions given surrounding a component which allows the operator to perform required actions, the accuracy of which varies as a function of the amount of body involved (hand, fingers, arm, torso, etc.) and where designators, will also include considerations such as gloves, tools, helmets, protective clothing, etc.

E. VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F. USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G. SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventive actions for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or brittle stress.

H. IDENTIFICATION PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design handbooks as well as job aids, checklists, training texts, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1. LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates.
Make operator aware of hazards.
Give special guidance or instructions.

- Controls, displays, etc are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- ID label: not obscured by components on flat surfaces on main chassis; min coverage by grimes not easily removed.

- Character height determined by distance read, luminance FIG 14.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 14.B.2-A.
- Height/width ratio = 5/8 "M" is 1 stroke width wider "W" and "W" are 5/8 "I" and "I" are 1 stroke width.
- Stroke width for black (white) characters on light (black) background 1/6 (1/7-1/8) of height.

- Spacing between characters (words) and stroke (character) width min.
- Line spacing: 1/2 character height.
- Counter numeral low ratio = 1/2 (except 1/2 separation = 1/2 to 1/2).
- Optical projections: all caps, stroke width 1/6 to 1/8 h; exceeds 15 minutes visual angle.
- Thumbnail numeral low ratio = 3/2 h = 1/2 stroke width intensity (externally) (internally) 1/2 (1/3).
- Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environmental conditions.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-cd black letters, light background.
- Dark adaptations letters visible, do not interfere with night vision.
- Chart readings FIG 14.E.3.

- Label characteristics accuracy required: time available distance light level, color, criticality of function, consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grimes, dirt.
- Markings, tags are as permanent, washable as equipment.
- Roman numerals avoided.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Electrical receptacles marked with voltage, phase, frequency.
- Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-121) new OK if obvious.
- Trade names, irrelevant info do not appear on labeling.
- Labels cancel min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand grasp areas identified.

- Minimum decoding required.
- Control color related to display.
- Diagrams used where possible.

6. CONTROLS

Components used to activate, deactivate and modify the equipment power source or to modulate the operating elements.
Handles, grips, knobs, switches, triggers, levers, wheels, pedals and other man operated items as applicable.
Controls are associated only with the item under test, not with equipment placed on it.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
- Controls in functional groups are located in accordance with operational sequence and/or function.
- Controls oriented to operator.
- Can not accidentally be moved.
- Recurring groups similar throughout system.
- Rotary size, shape FIG 6.B.1-4.
- Linear size, shape FIG 6.B.7-12.
- Controls have non-slip surfaces.
- Gross (limiting) (adjustable) dimensions based on 95th% (5th%) (15-25th%) operator.
- Linear size, shape FIG 6.B.9-16.
- Minimize controls use only under space constraints; size and separation maximum.
- Rotary size, shape FIG 6.B.1-4.

- Adequate control response feedback.
- Control motion: CW, forward, up, right produces corresponding display motion on fixed scale (or reverse motion with a moving scale, fixed pointer) with increasing reading magnitude.
- Force, displacement (including miniature controls) FIG 6.B.1-16.
- Free from excessive backlash.

- Compatible with hardware used.
- Range of control action does not interfere with other controls.

- Shape coded controls visually, tactually identifiable.
- Pointers differentiated for each knob of group set.

- Precision of control manipulation is consistent with that of system.
- Selected, distributed to non-essential times are overburdened.
- Usable in time required despite inadvertent operation protection.
- Recommended manual controls FIG 6.F.1.
- ID rotaries: large (small) for small (large) range of display movement.

- Shape coding free of sharp edges.
- Critical controls are not susceptible to accidental movement.
- Controls that initiate hazardous operations require prior operation of a locking control.
- Emergency controls located near related warning display/hazardous hazard.

- Minimum decoding required.
- Control color related to display.
- Diagrams used where possible.

10. WORKSPACE

The area within which the user operates the equipment.
Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, consoles and seats.
Provides storage for excess clothing, personal gear, weapons and tools.
Protects operator from adverse environment, when applicable.

- Workspace allows ease of weapon handling, aiming, loading, firing, field stripping.

- Gross (limiting) dimensions based on 95th% (5th%) user: FIG 25.B.1-7.

- Stored arms readily accessible.

- Allowances made for heavy clothing, protective equipment.
- Workspace provides head, arm, body clearance at any weapon position.
- Sufficient clearance for use with gloves, arctic mitts, heavy clothing.
- User space not encroached upon by others.

- Illumination FIG 16.E.1.

- Acoustical environment does not degrade system effectiveness.
- Arctic climate: max not exposed to temp above 60°F; 35-45°F optimal.

- Exposure to gases, fumes, toxicities use THRESHOLD LIMIT VALUES.
- Impulse noise FIG 16.C.1.
- Noise duration limits FIG 16.C.3.
- Radiation hazards minimized.

- Conspicuous placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.
- Instructions kept simple.

13. FASTENERS, CONNECTORS

Securing devices used to assemble, package or hold an item in place.
Catches, hooks, screws, bolts, nuts, latches - both quick release and fast operated.
Includes fastener and connector alignment and locking devices such as lock pins, safety wires, pins, nuts, electrical plugs, and fittings.

- It is impossible to insert a wrong plug into a receptacle.
- Plugs, receptacles have aligning pins for insertion.
- Aligning pin extends beyond plug electrical pins.
- Plugs, receptacles arranged so aligning pins are oriented in the same relative position.
- Fastener, connector operating parts are easily accessible.
- Alignment aids, self alignment of parts for fastening.
- Identical screws, bolt heads provided throughout one removal tool.
- Fastener heads large enough to be grasped, handled.
- Non-interchangeable connectors for different use.
- Cotter key: snug fit, large head.
- Size, shape, color-coded pins avoid mismatches FIG 13.M.1.
- Connectors are physically different when lines carry different fluids.

- Fasteners, plugs require one turn min to tighten, loosen.
- Use 10 ft-lb torque use external, grippable below 10 ft-lb, use internal, external or combo grippable.
- Quick disconnect, snap action, release, twist up to one full turn for frequent, critical use.
- Tighten CW, loosen CCW.

- Gross (limiting) dimensions based on 95th% (5th%) operator's hand, arm FIG 13.J.1-5.
- Adequate space available to grasp connectors firmly.
- Adequate space to use connector wrench.
- Obstructions to use are re-removable.
- Connectors are separated by 0.75" (1.25" if used with bare (gloved) fingers).
- Connectors easily reached by user in bulky, restrictive clothing.
- Connectors visible, accessible.
- Labels, codes visible in connected, disconnected state.
- Easy visual access is provided for starting threads, pins.
- ID colors are readily discriminable from each other under real operational lighting.

- Captive fasteners used where dropping them creates hazard: covers need frequent removal.
- Bolts have min number of turns.
- Only standard tools are used.
- Adapters for pin connectors can be hand tightened.
- Plugs, connectors are self locking.
- Fasteners used outside are operable under all environmental conditions.

- Removal of plug, connector does not expose hot leads.
- Plug of one voltage rating cannot be inserted into the receptacle of another voltage rating.
- All hot contacts are insulated.
- Internal-grip: only use when critical to mechanical function, personnel safety.
- Use captive type dust covers where necessary.
- Caps, inserts, covers, coats, shields provided where necessary.
- Receptacles marked as to voltage, phase, frequency.
- Connecting plugs, receptacles identified by color, size.
- Plugs, receptacles have stripes, arrows, etc to show aligning pin points.
- Marker of connection obvious.
- Non-standard operating direction is clearly marked.
- Plug, receptacle identification FIG 13.M.1.

- Hand grip has
- Removable, with handles, for grasping, lifting or moving
- Carried item of personnel.

14. HANDLES

The special is to grasp, hold, lifting, moving, handles, knut etc.
Involves rough face when used.
Check also for

- Handles, pin relative to the
- Hinged, folding positions are 1
- Two handle handle/grasp or more
- Handles, local min distance 1
- Handles, rear wearing bulks

- Bar, T-bar, J FIG 14.B.1.
- Surface texture
- Hand shaped
- Carried frequ
- eds.

- Weight limits
- 16.C.1: if the
- ates are rea
- passed, item
- Handle, grasp
- 6.C.1.

- Handles have
- from abstract
- Straps, buckle
- operation of 1

- Hand grips ha
- Removable, with handles, for grasping, lifting or moving
- Carried item of personnel.

- Handle/grasp
- thermal/ryles
- Insulated hand
- Non-recessed
- personnel,
- damage equip
- 1 days round
- recessed.

- Hand grasp on

14 HANDLES	15 OPTICS	16 OPERATING ELEMENTS	17 PACKAGING
14 HANDLES The special or inherent devices used to grasp, hold, grip or lift an item for lifting, moving, steadying or aiming. Handles, knobs, projections, straps, etc. Involves roughened or non-slip surface when used for handling. (Check also for the lack of handles.) Handles, grab areas are located relative to the CG. Thickest, fold-out handles have a stop pin from one hand operation. Two handles, min. or one handle/grip area for units 10 lbs. or more. Handles located so that lifting is at arm distance from body. Handles reachable by 5th% user wearing bulky, restrictive clothing. For, T-bar, J-bar, recessed handles FIG 14.B.1. Surface texture of hand-manipulated force controls maximizes operator's grip. Hand shaped handle used on item carried frequently or for long periods. Weight limits for one man lifts FIG 14.C.1; if shape is convenient, handles are provided, lift is not repeated, item is not carried. Handle, grip area force limits FIG 6.C.1. Handles have at least 20° clearance from obstruction. Straps, buckles do not interfere with operation of item. Handles color coded to distinguish from similar shaped items. Handles are visible from the grasping, lifting position. Hand grips have nonslip surface. Removable, carried units provided with handles, either suitable means for grasping, handling, carrying. Handles do not interfere with operating or maintaining item. Carried item will sit clear of legs of personnel. Handle/grip surfaces are not thermally/electrically conductive. Insulated handles used on hot items. Non-recessed handles do not injure personnel, entangle clothing, damage equipment. Edges rounded; attaching screws recessed. Hand grasp areas identified.	15 OPTICS Components that use the human eye for sighting, aiming or viewing. Includes eyepieces, reticles, filters, sighting mechanisms, range finders, viewers. Excludes visual displays. Optical instruments are oriented to give operator a comfortable angle of view. Purging, changing fittings are accessible for maintenance. Components requiring frequent maintenance, special tools are readily accessible. Interpupillary distance between eyepieces adjustable 50-76 mm. Eyepiece prevent stray light from entering eyes. Built-in collimation for field adjust. Gross (limited) dimensions based on 95th% (5th%) user FIG 25.B.4. Field of view is compatible with use, optical-mechanical limits. Exit pupil = magnification x exit pupil diameters. Reticle lines thin enough not to block targets; thick enough to be easily seen. Eyepiece specifications FIG 15.B.1. Rifle, pistol sight (monocular, binocular) 4 (3) power max. 2 eyepieces used during low light level viewing that exceeds 1 minute. Eyes don't have to adjust beyond normal functional ability. Magnification difference between the two eyes 2% max. Difference in amount of light between the two eyes 5% max. Eye relief is at least 15 mm. Eyepiece, headrests compatible with helmets, masks, etc. Slip scales useable by 5-95th% hands. Line reticles preferred over those with 1, 2 or 3 central spots. Small cross or circle preferred over dot for reticle. Ring preferred over a spot for reticle. Optic components accommodate arctic headwear, handwear. Reticles are illuminated for night, twilight operations. Illumination even blue color not used, dimming provided level remains fixed under vibration. Level vials, scales, pointers are readily visible, illuminated for low light condition use. Lighting minimally affects the dark adaptations of observer. Luminous transmission exceeds 50% parallel limited. Filters used for high light levels. Adjustment of eyes beyond normal ability is not required. Magnification is high enough for required application. Resolution: 3.0 c.p.t. Resolution: 60 sec of arc min. Observers are matched pairs. Instruments needing ready eye use have brow pads. Flash protection shutters do not disturb lay of weapon. Level vials, scales, pointers are protected from damage. Headrest, brow pad is used to absorb energy which would be injurious to the user's head. Eyepieces are made of soft rubber or equivalent material. Proper eye relief, exit pupil location is consistent with weapon recoil characteristics 25 mm min. No skin contact with metal parts. Components, parts are labeled. If periodic purging, charging is required on instruction plate indicating time interval, pressure is attached.	16 OPERATING ELEMENTS Components which control the operation of the item. Includes triggers, fuses, cranks, etc. Does not include controls as such, although there is some overlap. Controls used only for maintenance, adjustment are covered during normal operation but are accessible, visible when required. Subassemblies accessible from station of all times. Safety operable without removing hand from weapon. Any part of weapon that contacts user's skin has thermal insulation. Safety catches have a distinctive shape, location. Weapon controls have distinctive shapes, locations. Rifle, machine gun guidance dimensions FIG 16.B.1. Bore-sight knobs lack resistance to lock, unlock 100b max. Triggers, safeties, aiming pins positive force, operable by 5th% user. Knobs preferred over screwdriver for frequent adjustment. Sight mount leveling vial supports strong enough to prevent bubble displacement. Recall, stress of field maneuvering does not disturb bubble extended, retracted setting. Parts can't be assembled backwards. Compatible with handwear used. Trigger guards, safety catches, etc accommodate gloved hand. Weapon ejects expended cases forward & to the right. Retracted bipod cannot catch on vegetation. Operated elements must be visible when accessed, especially if hazards present. Elements that are moved are color or shape coded. Weapon settings are immediately obvious with user in normal firing position. Settings can be verified in normal firing position without moving body, weapon manipulating any sight component counting of visual, setting cues. Bore-sight knobs have positive lock. Weapon operable under difficult conditions of weather, clothing, temperature, terrain, climate, illumination. Weapon controls are sturdy enough so that normal field handling cannot damage them. Loading requires only inserting the magazine & charging the weapon. Safety catches have positive action, standard operation. Mechanical operating parts guarded. CG, weight of equipment marked, where applicable. Control warning label located near hazard. Rate selectors, safeties, etc are clearly identified as to their positions. Magazine loading diagrammed if a particular pattern is required.	17 PACKAGING Components used for packaging, storage and transportation. Cases, packing cases, boxes, bags, and covers that are not part of the item but are used for transport. Carrying cases and storage boxes specifically designed for the item, or multiples of the item, and are part of the item configuration. Cases lift from units rather than units lift from cases. Inflammables stored away from engines, generators, exhaust pipes. For cross country ops items secured in storage boxes or restrained by straps, brackets. Stowage available for individual weapons, small-arms ammo, ration, helmets, etc. Stowed items accessible by 5-95th% personnel FIG 25.B.1-7. Small packages are sized for pockets, are relatively flat. Design Requirements (MIL-STD-1472) User-Computer Interface Data (MIL-STD-173C) Guidance Data (MIL-HDBK-759, Etc.) Cases are enough larger than units they cover to prevent damage when case is moved, replaced. Tight fitting stowage essential. Containers allow for full hand, finger clearance when using opening tool. Gloved hand clearance provided FIG 23.B.1. It is obvious when a cover is in place but not secured. Identification of package contents clearly visible. Cutlery, tools, steps are used to facilitate handling. Accessibility of stowed equipment reflects its function, use. Fully open, closed state obvious. Material remaining is easily determined. Sealed cans have integral opener device, strip, tab. Edges, corners on covers, cases are rounded, otherwise finished to prevent personnel injury. Orientation of a unit within its case is obvious or labeled. Labels, markings tell how to open, remove, position covers, cases. Labels warn of hazards, dangers within case. Stowage locations labeled.

TEST FUNCTION _____

TEST ITEM CLASS II _____

SUBCLASS B _____

OBJECTIVE: Evaluate the effectiveness and safety of the design of weapon systems to enable the crew to prepare the weapon for use and to actually use it. The HFE subtest should consider evaluation of crew performance and safety for these functions under conditions representative of those expected in actual combat use.

The cond

1. User con
2. Environ levels of
3. Operatio targets)

PREPARE FOR USE		
PRE-OPERATIONAL ACTIVITIES	ASSEMBLE/EMPLACE	LOI
PURPOSE: Evaluate the design of the test item for the ability of the crew to unpack, unstow, handle, field-strip, clean and to reassemble and adjust the weapon. MAN/ITEM TASKS Unpack/unstow. Select modes of operation. Perform static checkout. Perform cleaning. Tighten connections. Verify readiness.	PURPOSE: Evaluate the test item for the ease of the mating subassemblies, making the necessary connections, placing in position for operation and the necessary communications between the personnel engaged in these tasks. MAN/ITEM TASKS Read instructions. Mate subassemblies. Emplace weapon. Identify ammunition. Stabilize weapon. Communicate.	PURPOSE: Ev test item for t mating ammun munition feed sights or other the weapon car verifying that completed. MAN/ITEM TA Select ammun Ready ammun Ready weapon t Load ammunite Verify loading. Ready sighting/ Ready aiming a Ready visual ai Ready sensors. Ready weapon t Ready support t

Test Item Components HUMAN FACTORS CONSIDERATIONS	INDEX TO DETAILED						Labels Manuals Markings (1)
	Fasteners Connectors (13)	Handles (14)	Operating Elements (16)	Communi- cations (11)	Fastener Conne- ctors (13)	Handles (14)	
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B
C. DIRECTION & FORCE	C	C	C	C	C	C	C
D. CLEARANCE	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H

TEST ITEM COMPONENTS

HUMAN FACTORS CONSIDERATIONS

A LOCATION & ARRANGEMENT

The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of openings (accesses), cover or door operation, location of components (knobs, levers, etc.) as well as its relationship to other components.

B SIZE & SHAPE

The maximum and/or minimum dimensions of components that are required for adequate man use, including the effects of anthropometric and special clothing (arctic, NBC) considerations, and the shape and contour of handles, knobs and other controls to enhance both the identification and use of the component.

C DIRECTION & FORCE

The movement and/or force required to operate or generally manipulate a component (handle, control, fastener, etc.) with emphasis on the direction of motion corresponding to the display, component, total item reaction or standard practice as well as the minimum strength required.

D CLEARANCE

The unobstructed space surrounding a component which allows the operator to perform required actions, the adequacy of which varies as a function of the amount of body involved (hand, fingers, arm, torso, etc.) and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventative aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design handbooks as well as job aids, checklists, training texts, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1 LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates. Make operator aware of hazards. Give special guidance or instructions.

Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
Labels placed on or near items they identify.
Do not cover other information.
Label is not behind control.
Label location consistent.
ID labels not obscured by components on flat surfaces on main chassis; min coverage by grilles not easily removed.

Character height determined by distance read, luminance: FIG 6.B.1-1.
Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
Letter, numeral styles: FIG 6.B.2-4.
Height/width ratio = 5/3; "M" is 1 stroke width wider; "W" & "W" are 5/8; "I" & "I" are 1 stroke width.
Stroke width for black (white) characters on light (black) background: 1/16 (1/7-1/8) of height.

Design Requirements (MIL-STD-1472)
User-Computer Interface Data (MIL-STD-1472C)
Guidance Data (MIL-HDBK-759, Etc.)

Spacing between characters (word) is one stroke (character) width min.
Line spacing = 1.5 character height.
Counter numeral row ratio = 1:1 (except 1:1 separation = 1/2 to 1/4 w).
Optical projections: all caps, stroke width 1/6 to 1/8 h exceeds 15 minutes visual angle.
Thumbwheel numeral row ratio = 3/2; h = 1/2 stroke width internally (externally) illuminated = 10/11 (5/1).
Abbreviations all caps, no periods.
Extended copy use lower case.
Label characteristics determined by illumination level, color.

Labels easily, accurately read at operational reading distance, vibration, light levels, environmental conditions.
Labels are sharp with high or color contrast.
With illumination above 1 ft-C: black letters, light background.
Dark adaptation letters visible, do not interfere with night vision.
Chart reading: FIG 6.E-3.

Label characteristics accuracy required: time available, distances, light level, color, criticality of function, consistency of design.
Labels on production equipment are as durable as the equipment.
Labels for prototype equipment easily affixed, altered, removed.
Labels not covered by other units nor obscured by grilles, dirt.
Markings, tags are as permanent, readable as equipment.
Random numerals avoided.
Vertical labels used only when labels are not critical for personnel safety, performance.
Electrical receptacles marked with voltage, phase, frequency.
Pipes, hoses, tube lines clearly labeled as to content, pressure, temperature, hazards.
Warning placards illuminated.
Placards adjacent to hazards.

Abbreviations are standard (MIL-STD-121) new OK if obvious.
Trade names, irrelevant info do not appear on labeling.
Labels convey min redundancy.
Abstract symbol only if meaningful.
Words familiar to user.
Hand grasp areas identified.
Axes of graphs labeled and graduated appropriately.
Printed info directly usable min of decoding, interpolation.

6 CONTROLS

Components used to activate, deactivate and modify the equipment power source and to modulate the operating elements. Handles, grips, knobs, switches, triggers, levers, wheels, pedals and other man operated items as applicable. Controls are associated only with the item under test, not with equipment placed on it.

Control relationship to its display is apparent, compatible.
Functionally related controls are grouped together.
Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
Controls in functional groups are located in accordance with operational sequence and/or function.
Controls oriented to operator.
Can not accidentally be moved.
Recurring groups similar thru system.
Rotary size, shape: FIG 6.B.1-4.
Linear size, shape: FIG 6.B.9-18.
Controls have non-slip surfaces.
Grips (limiting) (adjustable) dimensions based on 95th% (5th%) (5-95th%) operator.
Miniature controls used only under space constraints size and separation maximum.
Grid & stylus: displaced grids, display same size; mounted/oriented below display preserve directional correlation.
Adequate control response feedback.
Conventional control movements: FIG 6.C.3.
Controller/follower movement ratio, displacement proportional.
Rotary valves open CCW.
Forces, displacements (including miniature controls): FIG 6.B.1-21.
High force controls: FIG 6.C.1-2.
High force controls provide limb/body support: 3 sec. sustained operation max.

Control spacing min: FIG 6.D.1; blind operation, 5" min.
Rotary separations: FIG 6.B.1-8.
Linear separations: FIG 6.B.9-16.
Compatible with hardware used.
XY controllers: cordless operable with either hand.
Foot switches separated 3" horizontally, 8" vertical minimum.
Range of control action does not interfere with other controls.
Larger diameter concentric control is used for fine adjustment.
Shape code: controls visually, tactually identifiable.
Color contrasts with background.
Ambient light color determines usable control colors.
Reference line has 50% min contrast with control color.
Painter parallax error between reference marks: 25% min.
Thumbwheel internally lighted if ambient illumination below 1 ft-C.
Thumbwheel readable 30° off-axis.
Legend switch legend is legible.

Precision of control manipulation is consistent with that of systems.
Selected, distributed so none of user's limbs are overburdened.
Coding uniform throughout system.
Usable in time required despite inadvertent operation protection.
Minimum use made of horizontal or 3-position toggle switches.
System response times: FIG 6.F.2.
Lightpens have feedback of pen placement, actuation, and input reception.
Shape coding free of sharp edges.
Critical controls are not susceptible to accidental movement.
"Dead man" control used when incapacity produces a critical condition.
Controls that initiate hazardous operations require prior operation of a locking control.
Main power ON-OFF switch cuts off power to equipment.
Emergency controls located near related warning display/nearest head.

Minimum decoding required.
Control color related to display.
Operating instructions provided except where use is obvious.
Diagrams used where possible.
Main power switch labeled.
Valve operation labeled, shown.
Transition matrix rate easily retrieved.
Internal software checks minimize user errors.
Critical entries require user acknowledgment can be edited.

Followover refresh rate: grant enough to create continuous track in free-draw graphics.
Pointers differentiated for each knob of analog set.
Interface controllers: in rate control applications, indicators provided to facilitate returning followers to display.
Variable function keys have a visual signal if standard function unavailable.
Small diameter ball tracker uses space constraints precision not essential.
XY controller uses position control of followers; data retrieval, entry; avoid free-draw graphics.
Grid-stylus used: CRT data retrieval, entry, generation of free-draw graphics.
Fixed function keys used for critical or frequent inputs.
Cursor control is consistent with speed and accuracy requirements.
Fast-operated switches located away from obstructions.
Data manipulated without concern for internal storage.

Control inputs result in positive response displayed to indicate performance.
User chooses sequence of trans. action.
Data entry requires explicit completion action: paced by user.

Standardization of keyboards within system.
Keyboard arrangement, number of keys compatible with info to be entered.
Heel rest provided for pedal angle over 20°.
Pedals reached easily.
Keyboards conform to MIL-STD-1280.

Isometric joystick: shaft length = 4.3" (7.1") grip diameter = 2".
Isometric joystick: hand-grip for integral switching; otherwise finger-grip.
70-1 switch per font (preferred).
Display interface controllers size, shape: FIG 6.B.19-21.
Rotary size, shape: FIG 6.B.1-8.

Avoid the requirement of constant force on joystick.
Isometric joystick: deflection minimal, perceptible.
Isometric joystick: max. force for full output not to exceed 26.7 lbs.
Direct relationship between stylus movement on grid and follower on display; follower remains stationary until stylus moved.
Free from backlash.
Display interface controllers forces, displacements: FIG 6.B.19-21.
Display interface controllers clearances: FIG 6.B.19-21.

Lightpens have feedback of pen placement, actuation, and input reception.

Isometric joystick uses: visual feedback, minimal delay; tight coupling of input/output; return to center after entry requirement.
Isometric joystick: delay between control movement and display response: 1 sec. max.
Recommended manual controls: FIG 6.F.1.
In bracketing, knobs swing thru 10-70° arc around target value.
C/F ratios: large (small) for small (large) range of display movement.

Isometric joystick uses: visual feedback, minimal delay; tight coupling of input/output; return to center after entry requirement.

Control inputs result in positive response displayed to indicate performance.

8 DISPLAYS

Components that provide positive visual displays are associated with the equipment.

Display relationship: parent determines equipment displayed.
Functionally related.
Recurring groups, 1 panel to panel local.
Displays, groups, h and/or top-to-bottom.
Display positions consistent of equipment.
Lighted control in unambiguously associated.
Display viewing distance.
Painter extends to score or extent and.
Painters use elaborate parallax, back.
CRT target visual minutes, 10 lines x 16" (10" mod).
Counters, flags, p: FIG 6.B.1.

Switches: flip stop between positions; resistance increases until snaps into position.
Pedals return to original position after use.
Stops at beginning and end of control active positions.
Fast-operated control uses force needed greater than upper body movement, frequent operations; alternative shutdown control.
Linear separations: FIG 6.B.9-18.

Display face to line 45° min parallax.
Frequently used d: optimal visual zone.
Illumination uniform.
Indicator lights h: sparingly, visible.
Contrast, luminance.
Flashing lights: 3-5.
Color coding used: unused scales cover.
Groups of information distinctive.

Display precision: tent with that of system.
Information display: precise, useful degraded by vibration.
Lights show function.
Scales: linear, 10 numbers, 2 points oriented upright.
Mechanical typist.
Audio signal evaluation.
Audio, verbal warn above background.
Failure immediate.
Signal absence does.
Indicator light emergency, warning: FIG 6.B.1; master.
Audio warnings: tri-sophones and vori.
Audio signal act: flag nature of problem.
Prohibited, persists: used: FIG 6.B.1.
Audio warning due until corrective.
Minimum decoding.
Coding techniques: false discrimination relationship, critical.
Auditory displays: overburdened, input desirable; warning.
Verbal warnings: on.
Audio warnings: use.
Labels: function located; graduated.
Need for entry of information minimum.

Display precision: tent with that of system.

Display precision: tent with that of system.

to modulate the operating items as applicable.

8 DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation. Provide positive indication of developing or current malfunctions. Displays are associated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Functionally related units grouped.
- Recurring groups, items have similar panel to panel location.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Display positions correspond to positions of equipment monitored.
- Lighted control indicators are unambiguously associated with controls.
- Display viewing distances: 13-28".
- Pointer extends to but does not obscure or exceed index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- CRT target visual angle exceeds 2.0 minutes, 10 lines of resolution distance 16" (10" min).
- Counters, flags, printers, plotters: FIG 8.B.1.

• Displays are designed for the operational environment.

- Emergency, critical, important displays located in 30° cone about line of sight.
- Recurring tabular data is similarly located.
- Tabular data is displayed left-to-right, top-to-bottom.
- All data needed to support activity is grouped together.
- Simple menus used when all selections fit on 1 page.
- For hierarchical menus a direct function call capability is provided.

- Display pointers are aligned for common stable values.
- Tabular displays used to present row-column data.
- Information density held to minimum on critical task displays.
- Information displayed limited to that necessary to make decisions.
- Location and presence of control input data clearly indicated.

10 WORKSPACE

The area within which the user operates the equipment. Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, consoles and seats. Provides storage for excess clothing, personal gear, weapons and tools. Protects operator from adverse environment, when applicable.

- Display placement above standing (seated) surfaces normal, 81-70° (6-46°); precisely, frequently read, 50-65° (14-35°), ± 21° from centerline.
- Controls on vertical surface above floor (seath normal, 34-70° (8-34°); precisely, frequently used, 34-53° (8-29°), ± 21° from user centerline.
- With vision over console top critical warning display 220° min above seat.
- Workspace allows ease of weapon handling, aiming, loading, firing, field stripping.
- Seats fit suitably clothed 5-95th% user without degrading performance. Arm rests 24" min.
- Back, seat height 17 min padding.
- Standard console FIG 10.B.1-3.
- Cane (limiting) dimensions based on 5th, 50th, 95th % fully equipped user: 14", 25.11-1.7, Area: 1.8, 1.54, 1.8.
- Adjustable dimensions fit 5-95th%.

- Vertical seat adjustments: 15-21" in 1" max increments.
- Seat backrest reclines 103-115°; supports torso so operator's eyes are within 3" of "eye-line".
- Cabinet kick space: 44" min.
- Seat adjusts fore, aft: 4" min.
- Operator does not have to lift self to adjust seat.
- Padding does not restrict entry.
- Loader's seat removable, stowable.
- Easy access to, from station.
- Stowed arms readily accessible.
- Console front floor space 4' min.
- Knee room 73x20x18" min.
- Workspace anthropometrics: FIG 10.B.1.1.
- Allowances made for heavy clothing, protective equipment.
- Seat adjustment overhead clearance from seat pan: 40" min.
- Loader can comfortably sit (stand) in closed (open) hatch mode.
- 1 man change barrel, service second armament in fighting compartment.
- User space not encroached upon.
- Right-left viewing angle for wrap-around console: 190° max.
- Illumination FIG 10.E.1.
- Instrument reflection avoided.
- Loader can see outside while operating in close hatch mode.
- Vision blocks field of view avoided.

- Acoustical environment does not degrade system effectiveness.
- Noise levels: FIG 10.F.2-8.
- Whole body vibration limits: X, Y, Z, time FIG 10.F.3.
- Arctic climate hatch not exposed to temp above 60°F; 35-59°F optimal.
- Temperature allowances made for heavy clothing, hand physical labor, protective equipment.
- Protective padding used.

- Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES.
- Impulse noise: FIG 10.G.1.
- Noise duration limits: FIG 10.G.2.
- Whole body vibration within twice that for proficiency: FIG 10.F.3.
- Hazard alerting device provided.
- Illumination adequate.
- Exposed edges (corners) rounded: 0.04" (0.5") min radius.
- Radiation hazards minimized.
- Motion sickness limits: FIG 10.G.4.
- Padding: non-abrasive, non-toxic.
- Adequate, suitable storage for manuals, worksheets, etc.
- Conspicuous placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.
- Instructions kept simple.
- Seat adjustment diagrammed.
- Manuals, markings include warnings on toxic, thermal hazards of heaters, exhaust gas.

11 COMMUNICATIONS

Devices and techniques for communicating information among crew men within the workspace, between the crew and externally located individuals, and between the crew and remotely located persons. Includes antennas, where applicable.

- Microphones, headphones, headsets permit hands-free operation.
- Accessible volume, gain controls are provided for each channel.
- Foot operated "Send-Receive" control when both hands busy.
- Radios, telephones are located for easy emergency access, time critical communications.
- Communication devices are located within easy reach of operator.

• Earphones, headsets easily adjusted, accommodates 5th-95th% users: FIG 25.B.6.

- Reach to communication controls is unobstructed.
- Workspace accommodates operators wearing earphones, headset.
- Radio antenna located to minimize radio-frequency hazards.

• Color coding used when multiple handsets are visible, available to operator.

- Microphone, headphone, single (multiple) speakers: 200-6100 Hz (100-4800 Hz) dynamic range 50 dB min.
- Microphones noise cancelling in 100 dB areas 10 dB rms min.
- Filtering, clipping is used to improve intelligibility.
- Binaural headsets used when ambient noise exceeds 85 dB(A).
- Volume, gain, audible min: 110 dB max; squelched.
- Volume/power control has detent between min volume, off.
- Communication equipment worn by operator is comfortable; metal parts do not contact user's skin.
- Headsets worn in high ambient noise provide attenuation equal to ear protective devices.
- Warning signal intensity does not cause discomfort, "ringing" in the ears.
- Exposed metal parts grounded.
- System allows emergency messages top priority, does not interfere with their transmission, reception.
- Speaker hears own voice in his headset in phase with his speech.
- Voice communication intelligibility criteria: FIG 11.H.1.
- Audio signals coded as to maintenance, emergency, health hazard, etc. to minimize operator's visual display search.
- Instructions provided for use and fault detection for communications equipment.

11 COMMUNICATIONS

Devices and techniques for communicating information among crew members within the workspace, between the crew and externally located individuals, and between the crew and remotely located persons. Includes antennas, where applicable.

- Microphones, headphones, headsets permit hands-free operation.
- Accessible volume, gain controls are provided for each channel.
- Fast operated "Send-Receive" control when both hands busy.
- Radio, telephones are located for easy emergency access, time critical communications.
- Communication devices are located within easy reach of operator.

- For phones, headsets easily adjusted, accommodates 5th-95th% user: FIG 25.3.6.

- Reach to communication controls is unobstructed.
- Workspace accommodates operators wearing earphones, headset.
- Radio antenna located to minimize radio-frequency hazards.

- Color coding used when multiple handsets are visible, available to operator.

- Microphone, headphone, single (multiple) speakers: 200-600 Hz (100-6000 Hz) dynamic range 50 dB min.
- Microphone noise cancelling in 100 dB area; 10 dB rms min.
- Filtering, clipping is used to improve intelligibility.
- Binaural headsets used when ambient noise exceeds 85 dBA.
- Volume, gain, audible min: 110 dB most; squelched.
- Volume/power control has detent between min volume, off.
- Communication equipment worn by operator is comfortable; metal parts do not contact user's skin.
- Headsets worn in high ambient noise provide attenuation equal to ear protective devices.
- Warning signal intensity does not cause discomfort, "ringing" in the ears.
- Exposed metal parts grounded.
- System allows emergency messages top priority, does not interfere with their transmission, reception.
- Speaker hears own voice in his headset in phase with his speech.
- Voice communication intelligibility criteria FIG 13.4.1.
- Audio signals coded as to maintenance, emergency, health hazard, etc to minimize operator's visual display search.
- Instructions provided for use and fault detection for communications equipment.

13 FASTENERS, CONNECTORS

Securing devices used to assemble, package or hold an item in place. Includes latches, hooks, screws, bolts, nuts, latches - both quick release and tool operated. Includes fastener and connector alignment and locking devices such as lock pins, safety pins, pins, nuts, electrical plugs, and fittings.

- It is impossible to insert a wrong plug into a receptacle.
- Plugs, receptacles have aligning pins for insertion.
- Aligning pin extends beyond plug electrical pins.
- Plugs, receptacles arranged so aligning pins are oriented in the same relative position.
- Connectors placed so that spillage does not cause damage.
- Fastener, connector operating parts are easily accessible.
- Identical screw, bolt heads provided throughout on removal tool.
- Fastener heads large enough to be grasped, handled.
- Non-interchangeable connectors for different use.
- Control keys: snug fit, large head.
- Size, shape, coded pins avoid mis-matches FIG 13.4.1.
- Connectors are physically different when lines carry different fluids.

- Bolts requiring high torque have an external grip head.
- Fasteners, plugs require a turn max to tighten, loosen.
- Over 10 ft.-lb. torque use external griphed below 10 ft.-lb. use internal, external or combi griphed.
- Quick disconnect, snap action, release, twist up to one full turn for frequent, critical use.
- Tighten CW; loosen CCW.

- Gross (limiting) dimensions based on 5th-95th% operator's hand, arm: FIG 25.8.4-5.
- Adequate space available to grasp connectors firmly.
- Obstructions to use are removable.
- Connectors are separated by 0.75" (1.25" if used with bare (gloved) fingers).
- Mounting screws have clearance holes.
- Connectors easily reached by user in bulky, restrictive clothing.
- Connectors visible, accessible.
- Labels, codes visible in connected, unconnected state.
- Easy visual access is provided for starting threads, pins.
- ID colors are readily discriminable from each other under real operational lighting.

- Number, types minimum commensurate with stress, bonding reqmts.
- Captive fasteners used where dropping them creates hazard; covers need frequent removal.
- Bolts have min number of turns.
- Only standard tools are used.
- Adapters for pin connectors can be hand tightened.
- Fasteners used outside are operable under all environmental conditions.
- Connectors are compatible with cables, lines, fasteners, mounting.
- Removal of plug, connector does not expose hot leads.
- Plug of one voltage rating cannot be inserted into the receptacle of another voltage rating.
- All hot contacts are sockets.
- Internal-griphed only use when critical to mechanical function, personal safety.
- Use captive type dust covers where necessary.
- Caps, inserts, covers, cases, shields provided where necessary.
- Receptacles marked as to voltage, phase, frequency.
- Connecting plugs, receptacles identified by color, size.
- Plugs, receptacles have stripes, arrows, etc to show aligning pin positions.
- Manner of connection obvious.
- Non-standard operating direction is clearly marked.
- Plug, receptacle identifications FIG 13.4.1.

14 HANDLES

The special or inherent devices used to grasp, hold, grip or lift an item for lifting, moving, steadying or aiming. Handles, knobs, projections, straps, etc. Involves roughened or non-slip surface when used for handling. Check also for the lack of handles.

- Handles on cabinets, consoles are recessed.
- Handles, grasp areas are located relative to the CG.
- Hinged, fold-out handles have a stop position and hand operation.
- Two handles min. or one handle/grasp area for units 10 lb. or more.
- Handles located so that lifting is at min distance from body.
- Handles reachable by 5th% user wearing bulky, restrictive clothing.
- Bar, T-bar, J-bar, recessed handles FIG 14.B.1.
- Surface texture of hand-manipulated fuses - controls maximizes operator's grip.
- Hand shaped handle used on item carried frequently or for long periods.

- Weight limits for one man lift: FIG 14.C.1, if shape is convenient, handles are provided, lift is not repeated, item is not carried.
- Horizontal push, pull force limits: FIG 14.C.2.
- Handle, grasp area force limits: FIG 14.C.1.
- Two-man lift values are twice one-man lift only if item configuration conveniently neither man exceeds one-man limit.
- Hoist lugs if item over 150 lb.
- Handles have at least 2 1/2" clearance from obstructions.
- Hoist lug has 1/2" min clearance around lifting eye.

- Handles color coded to distinguish from similar shaped items.
- Handles are visible from the grasping, lifting position.

- Hand grips have nonslip surface.
- Removable, carried units provided with handles, other suitable means for grasping, handling, carrying.
- Handles do not interfere with operating or maintaining item.
- Carried item will ride clear of legs of personnel.

- Handle/grasp surfaces are not thermally/electrically conductive.
- Non-recessed handles do not injure personnel, entangle clothing, damage equipment.
- Edges rounded; attaching screws recessed.

- Items exceeding one man lift (FIG 14.C.1) are labeled with weight, lift limits.
- For mechanical power lift hoist, lift prints, provided, labeled.
- Hand grasp areas identified.
- Hoist lugs marked "Lift Here".

15 OPTICS

Components that use the human eye for sighting, aiming or viewing. Includes eyepieces, reticles, filters, sighting mechanisms, range finders, viewers. Excludes visual displays.

- Optical instruments are oriented to give operator a comfortable angle of view.
- Purging, changing fittings are accessible for maintenance.
- Components requiring frequent maintenance, special tools are readily accessible.
- Interpupillary distance between eyepieces adjustable: 50-76 mm.
- Eyecups prevent stray light from entering eyes.
- Built-in collimation for field output.
- Gross (limiting) dimensions based on 95th% (5th%) user: FIG 25.B.6.
- Field of view is compatible with use, optical-mechanical limits.
- Entrance pupil a magnification x exit pupil diameters.
- Reticle linear: thin enough not to block target; thick enough to be easily seen.
- Eyecup specifications: FIG 15.B.1.

- 2 eyepieces used during low light level viewing that exceeds 1 minute.
- Eyes don't have to adjust beyond normal functional ability.
- Magnification difference between the two eyes 2% max.
- Difference in amount of light between the two eyes 5% max.

- Eye relief is at least 15 mm.
- Eyecups, headsets compatible with helmets, masks, etc.
- Slip scales usable by 5-95th% hands: no tools.
- Line reticles preferred over those with 1, 2 or 3 control spots.
- Small cross or circle preferred over dot for reticle.
- Ring preferred over a spot for reticle.
- Optic components accommodate arc/horizon, horizon.
- Reticles are illuminated for night, twilight operations.
- Illuminations: even blue color not used; dimming provided; level remains fixed under vibration.
- Level vials, scales, pointers are readily visible, illuminated for low light condition use.
- Lighting minimally affects the dark adaptation of observer.
- Luminous transmission exceeds 50%; parallel limited.
- Filters used for high light levels.
- Adjustment of eyes beyond normal ability is not required.
- Magnification is high enough for required application.
- Focusing: 3 diopters.
- Resolutions: 60 sec of arc min.
- Oculars are matched pairs.
- Instruments bearing steady eye use: hand brow pads.
- Flash protection shutters do not disturb lay of weapon.
- Level vials, scales, pointers are protected from damage.
- Headrest, brow pad is used to absorb energy which would be injurious to the user's head.
- Eyecups are made of soft rubber or equivalent material.
- Proper eye relief, exit pupil location is consistent with weapon recoil characteristics: 25 mm min.
- No skin contact with metal parts.

- Components, parts are labeled.
- If periodic purging, charging is required: an instruction plate indicating time interval, pressure is attached.

16 OPERATING ELEMENTS

Components which control the operation of the item. Includes triggers, fuses, cranks, etc. Does not include controls as such, although there is some overlap.

- Controls used only for maintenance, adjustment are covered during normal operation but are accessible, visible when required.
- Fast controls are not used for precise adjustments.
- A single control, joystick, ball is used for two dimensional tracking.
- Joysticks for tracking have hand, wrist support.

- Tracking crank size is a function of rotation speeds: 200 rpm max.
- Tracking crank radius for high (low) rpm: 2" (4 1/2").
- Handwheels knurled or indented.
- Manual turret traverse travel: 360° (pitched, cont'd 15°).

- Bore-sight knob lock resistance to lock, unlock: 10 lb max.
- Triggers, safeties, aiming pins: positive force, operable by 5th% user.
- Knobs preferred over screwdriver for frequent adjustment.
- Sight mount leveling vial supports strong enough to prevent bubble displacement.
- Foot pedals rise from a depressed position backwards & vertically.
- Power controllers: backlash, 0 dead spot ± 2°; operating torque, 5 lb.
- Compatible with handwear used.
- Self alignment devices provided for remotely handled items.
- Printers have quick, easy insertion, removal of printing materials.
- Plotters allow for annotation of data in the plotters.
- Full hand, tool clearance at all fastening points.
- Moving components have 2" hand clearance throughout range.
- Trigger guards, safety catches, etc accommodate gloved hand.
- Operated elements must be visible when obscured, especially if hazards present.
- Elements that are marked are color or shape coded.

- Bore-sight knobs have positive lock.
- Gunner environment minimizes obscuration, shock, vibration to permit resumption of tracking after firing, when applicable.
- Tracking control movement is compatible with expected, conventional control movements.
- Hoist points provided for mechanical lifting.
- Power gun control system allows selective use of manual, power control.
- Internal controls are not located near high voltage, rotating machinery, other hazards.
- Power manipulators provided with positive stops.
- Safety catches have positive action, standard operation.

- CG, weight of equipment marked, where applicable.
- Jack, hoist points labeled.
- Items exceeding one-man lift value, labeled as to weight, lift limitation.
- Control warning label located near hazard.
- Rate selectors, safeties, etc are clearly identified as to their position.

TEST FUNCTION

TEST ITEM CLASS III

SUBCLASS A

OBJECTIVE: Evaluate the effectiveness and safety of the design of man-operated material handlers to enable the operator to gain access and egress, prepare for operation, and to actually handle material. The HFE subtest should consider evaluation of operator performance and safety for these functions under conditions which are representative of those expected in actual use.

The conditions applicable to this class are:

1. User conditions - level of training experience and encumbrances;
2. Environmental conditions - noise and vibration, heat and cold, different levels of illumination;
3. Operational conditions - time critical conditions (duration of use, type of load).

GAIN ACCESS/EGRESS		PREPARE FOR OPERATIONS	
CLIMB UP/DOWN	OPEN/CLOSE	CHECKOUT	TAKE/LEAVE SEAT
PURPOSE: Evaluate the design of steps, ladders, platforms, handholds and labels for enabling a user to climb on to and off of the item. MAN/ITEM TASKS Mount steps/ladders/ramps/etc. Use handholds. Use footholds. Carry load. Lift/lower load to/from platform/ledge. Read instructions/labels/warnings.	PURPOSE: Evaluate the design of doors and other access covers for adequacy in enabling operators to open and close them from normal approach location inside or outside of workspace. MAN/ITEM TASKS Grasp door handle. Unlock/lock door latch. Unlatch/latch door. Push/pull door open/shut. Use handholds.	PURPOSE: Evaluate the design of operating components, both external and internal, for allowing a user to perform a preoperational check. MAN/ITEM TASKS Visually inspect external operating components. Verify adjustment, structural integrity, operational readiness. Input test signals to displays. Read/interpret displays. Determine control readiness. Set controls. Check load transport system. Check load lift system.	PURPOSE: Evaluate the design of the seat for enabling a user to take and leave the seat in both nominal and emergency conditions. MAN/ITEM TASKS Step into/out of work area. Take/leave seat. Move to/from operating position. Remove clothing if required. Stow clothing/equipment.

INDEX TO DETAILED DESIGN CONSIDERATIONS							
Test Item Components	Labels Manuals Markings (1)	Steps Ladders Platforms (2)	Handholds Railings (3)	Labels Manuals Markings (1)	Steps Ladders Platforms (2)	Handholds Railings (3)	Doors Hatches Passages (4)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B
C. DIRECTION & FORCE		C			C		C
D. CLEARANCE	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H

[illegible]

SUBCLASS

The conditions applicable to

1. User conditions - training or beliefs, arctic mitts, bulky clothes
2. Environmental conditions - v and vibration in the use area
3. Operational conditions - time conditions (duration of use, fit)

INDEX TO DETAILED DESIGN CON[illegible]

OPERABILITY

MATERIEL HANDLERS

MAN - MONITORED

The conditions applicable to this class includes:

1. User conditions - training and experience, body size of operators and clothing (gloves, arctic mitts, bulky clothing, etc.);
2. Environmental conditions - weather, terrain, climate, illumination levels, noise and vibration in the use area;
3. Operational conditions - time critical operations (emergency egress) and use conditions (duration of use, frequency of activities, 1 or 2 man performance).

PREPARE FOR USE		START/MONITOR/STOP	
	ALIGN/ADJUST	INITIATE/TERMINATE	MONITOR
Test item for alignment stations, including levels, alignment, and readings. MAN/ITEM TASKS Make gross calibrations/adjustments manually. Use tools/controls for fine adjustments. Tighten connections. Realign components as required. Change control settings.	PURPOSE: Evaluate the design of the test item for performance of on-line adjustment, alignment, or calibration both prior to and during operations, as a direct result of the check-out or monitoring tasks.	PURPOSE: Evaluate the design of the test item for starting and stopping the power subsystem, the movement of materiel, as well as for the loading and unloading of materiel. MAN/ITEM TASKS Take operating position. Determine when to start. Start/stop power. Operate power setting control. Begin loading/transferring operations. Operate controls for continued operation.	PURPOSE: Evaluate the design of the test item for determining the status of materiel in transit or in storage, and for verifying the operating condition of the item itself. MAN/ITEM TASKS Observe operation. Observe status. Observe performance. Determine rate of flow. Obtain samples. Identify problems. Communicate.

TAILED DESIGN CONSIDERATIONS

Displays (8)	Controls (6)	Displays (8)	Access Covers Caps (12)	Controls (4)	Displays (8)	Workspace (10)	Controls (6)	Displays (8)	Communications (11)	Access Covers Caps (12)
A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B
	C		C	C		C	C			C
	D		D	D		D	D		D	D
E	E	E	E	E	E	F	E	E		
F	F	F	F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H	H	H	H

TEST ITEM COMPONENTS

18 HUMAN FACTORS CONSIDERATIONS

A POSITIONING OF COMPONENTS
The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of controls, function, cover or clear operation, location of components (handles, levers, etc.) as well as its relationship to other components.

B SIZE & QUANT

The maximum and/or minimum dimensions of components that are required for adequate man use, including the effects of anthropometric data, age, sex, clothing (military, etc.), and the shape and contour of handles, levers and other controls to reduce both the identification and use of the component.

C DIRECTIONAL FORCE

The maximum and/or force required to operate or manipulate a component (handle, control, fastener, etc.), with emphasis on the direction of motion corresponding to the display, component, label, etc. as well as the minimum strength required.

D CLEARANCE

The unobstructed space surrounding a component which allows the operator to perform required actions, the clearance of which varies as a function of the amount of body involved (head, torso, arms, legs, etc.), and where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventive aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H OPERATING PROCEDURES

Those aspects of an informational aspect of a component that pertain to its performance as well as its use, including training, testing, troubleshooting, and repair manuals with specific attention to the safety aspects of the component.

1 LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates.
Make operator aware of hazards.
Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Display location consistent.
- ID labels not obscured by component on flat surface on main chassis; min coverage by grommet not easily removed.
- Character height determined by distance read, luminance FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 1.B.2-A.
- Height/width ratio = 5/3; "M" is 1 stroke width; "W" & "W" are 1 stroke width.
- Stroke width for black (white) characters on light (black) backgrounds 1/6 (1/7-1/8) of height.

- Spacing between characters (word) and stroke (character) with min.
- Line spacing: 5 character height.
- Counter numeral line ratio = 1/1 (except 1); separation = 5/8 to 1 in.
- Optical projections: all caps, stroke width 1/6 to 1/8; exceeds 15 minutes visual angle.
- Thumbwheel numeral line ratio = 3/2; h = 5/8 stroke width internally (externally) illuminated = 10/1 (5/1).
- Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environments.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-C black letters, light background.
- Dark adaptations letters visible, do not interfere with night vision.
- Chart readings FIG 1.B.2-J.

- Label characteristics accuracy required: time available; distance; light level; color; criticality or function; consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.
- Human numerals as aided.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Warning placards (illuminated).
- Warning notices clear, direct; characters 25% larger than any following instructions.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-147) new OK if obvious.
- Trade names, relevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand group areas identified.
- Printed info directly readable; min of decoding, interpretation.

6 CONTROLS

Components used to activate, deactivate or modify the equipment power source and to modulate the operating elements.
Handles, grips, levers, switches, triggers, levers, wheels, pedals and other man operated items as applicable.
Controls are associated only with the item under test, not with equipment placed on it.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
- Controls in functional groups are located in accordance with operational sequence and/or function.
- Controls oriented to operator.
- Can not accidentally be moved.
- Recurring groups similar thru system.
- Controls used for same function on different equipment are same size.
- Rotary size, shape: 1.8, 6.3, 1-8.
- Linear size shapes FIG 6.B.7-13.
- Controls have non-slip surfaces.
- Gras (lifting) (displacement) dimensions based on 95th (5th) (5-75th) operator.
- Keyboard push-buttons uniform.
- Linear size, shape: FIG 6.B.9-16.

- Adequate control response feedback.
- Conventional control movements: FIG 6.C.3.
- Stops of beginning and end of control active positions.

- Rotary size, shape: 1.8, 6.3, 1-8.
- Forces, displacements (including miniature controls): FIG 6.B.1-21.
- Free from backlash.
- Display interface controllers forces, displacements: FIG 6.B.19-21.
- Control spacing min: FIG 6.D.1; blind operation, 3" min.
- Rotary separations: FIG 6.B.1-8.
- Linear separations: FIG 6.B.9-16.
- Compatible with handwear used.
- Foot switches separated 2" horizontally, 8" vertical minimum.
- Range of control action does not interfere with other controls.
- Larger diameter concentric control is used for the fine adjustment.

- Shape coded controls visually, tactually identifiable.
- Color contrasts with background.
- Ambient light color determines useable control colors.
- Reference line has 50% min contrast with control color.
- Pointer parallel error between reference marks 25% min.
- Thumbwheel internally lighted if ambient illumination below 1 ft-C.
- Thumbwheel readable 30° off-axis.
- Legend switch legend is legible.
- Precision of control manipulation is consistent with that of system.
- Selected, distributed as name of user's limbs are over burdened.
- Coding uniform throughout system.
- Unable in time required despite inadvertent operation protection.
- Movement oriented to operator if several stations are used.
- Control motion minimum; not cycled thru ON/OFF unnecessarily.
- Recommended manual controls: FIG 6.F.1.
- Shape coding free of sharp edges.
- Critical controls are not susceptible to accidental movement.
- Controls that initiate hazardous operations require prior operation of a locking control.
- Main power ON/OFF switch cuts all power to equipment.
- Emergency controls located near related warning display/monitor hand.
- Foot-operated switches located away from distractions.
- Minimum decoding required.
- Control color related to display.
- Operating instructions provided except where use is obvious.
- Diagrams used where possible.
- Main power switch labeled.
- Valve operation labeled, shown.
- Emergency (noncritical) functional groups outlined with 3/16" red (1/16" black) bar.
- Controls labeled as to function.

8 DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation. Provide positive indication of developing or current malfunctions. Displays are associated only with the item under test, not with equipment placed on or in it.

- Display relationship to control is apparent; determine control used, equipment displayed.
- Recurring groups, items have similar panel to panel location.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Display positions correspond to positions of equipment monitored.
- Lighted control indicators are unambiguously associated with controls.
- Display pointers are aligned for common stable values.
- Display viewing distance: 13-20".
- Pointer extends to but does not obscure or exceed index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- Counters, flags, printers, plotters: FIG 8.B.1.
- CRT target visual angle exceeds 2.0 minutes, 10 lines of resolution distance 16" (10" min).

- Display face to line of sight exceeds 45° min parallax, reflection.
- Frequently used displays grouped in optimal visual zone: FIG 8.E.1.
- Illumination uniform: FIG 8.E.3.
- Indicator lights show response, used sparingly, visible.
- Contrast, luminance exceeds 50%.
- Flashing lights: 3.5 flashes/sec.
- Indicators used at night illuminated, dimmable 0.02-1.0 ft-L.
- Supplementary viewing system provided for remote handling.

- Display precision, response is consistent with that of system.
- Information displayed: Clear, specific, precise, useable; not redundant, degraded by vibrations timely.
- Lights show functions: FIG 8.F.1.
- Scales: linear, start at 0, use whole numbers, 2 pointers max, numerals oriented upright.
- Mechanical types: FIG 8.F.2.
- Audio signal evaluations: FIG 8.F.3.
- Audio, verbal warnings: 20 dB min above background.
- Failure immediately apparent.
- Signal absence does not mean "off".
- Indicator light color coding for emergency, warning, summation, etc: FIG 8.F.1; master lights set apart.
- Audio warnings transmitted to both earphones and work area.
- Audio signal action segment specific nature of problem.
- Prohibited, persistent signals are not used: FIG 8.G.1.
- Audio warning direction min of 5 sec; until corrective action taken.
- Minimum decoding required.
- Trademarks, irrelevant information, etc do not appear on panel face.
- Coding techniques uniform facilitate discrimination, identification, relationship, criticality.
- Auditory displays used where vision overburdened, degraded; redundancy desirable; warning, cue needed.
- Verbal warnings intelligible, apt.
- Audio warnings use standard signals.
- Labels functionally basic; well located; graduated in size.

- Illumination balanced full on to off.

- Transilluminated displays: FIG 8.F.3.
- Operator and maintainer information not combined unless compatible for both uses.

10 WORK

The area where the operator sits. Includes optics, color and window controls and provides personal and protective environment.

- Display 1 (seated) 65° prec 65° (16-31)
- Controls (seated) 18-27°
- Work surface 18°
- Dash top 18°
- Control panel 18°
- Standard 18-27°
- Controls (for 18-27°)
- Adjustable

- Vertical 90°
- Seat back 100°
- If arms at 90°
- Operator to adjust

- Cabinet 18°
- Console 18°
- Work area 18°
- Allowance protective
- Sufficient gloves, etc.
- User seat others.

- Right-left around co
- Illumination
- Instrument
- Direct view
- Distortion
- Reflection

- Seating 18°
- Detail use 18°
- Ventilation 18°
- Acoustic 18°
- Acoustic grade 18°
- Noise level 18°
- Room use 18°
- Whole body 18°
- Exposure 18°
- Impulse 18°
- Noise level 18°
- Hazardous 18°
- Illumination 18°
- Equipment 18°
- Exposure 18°
- Guards 18°
- Position 18°
- Fire exit 18°
- Adequate, 18°
- Standards 18°
- Elevators 18°
- Lead sign 18°
- Conducive 18°
- Areas not 18°
- Emergency 18°
- Instructive 18°

are associated only with a under test, not with equip and on it.

Components that provide visual and auditory information to the operator concerning the status of operation.

Provide positive indication of developing or current malfunctions.

Displays are associated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Recurring groups, items have similar panel to panel location.
- Displays, groups have left-to-right or top-to-bottom order.
- Display locations related to positions of equipment rendered.
- Lighted control indicators are unambiguously associated with controls.
- Display pointers are aligned for common dial values.
- Display viewing distances 13-20".
- Pointers are close to dial, are above or extend into mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- Gauges, flags, printers, plotters (F, G, H, I).
- CRT target visual resolution 2.0 mm (20 lines of resolution) distance 18" (10° min).

re, shape: 1.4, 6.4, 1-8.
displacement (including
controls) FIG 6.4.1-21.
backlash.
torque controllers (torque,
mass) FIG 6.4.19-21.
padding: min. fill: 0.1;
stitch, 3" min.
variations: FIG 6.4.1-18.
orientation: FIG 6.4.1-16.
+ with hardware used,
stitch separated 3" from
vertical midline.
control act or does not
with other controls.
meter concentric control
the force adjustment.

-d controls visually, fac-
 ilitates with background,
 color color determines vis-
 ibility colors.
 -time less 50% min contrast
 1 color.
 -less error between ref-
 erence 25% min.
 -internally lighted if
 illumination below 11-cd/
 m² readable 30° off-axis.
 -each legend is legible.
 -control manipulation is
 with that of systems.
 -distributed so none of
 are overburdened.
 -with throughout system.
 -no requirement despite
 operation protection.
 -wanted to operator if
 one are useful.
 -function minimized; not cy-
 cle/stop unnecessarily.
 -no manual controls

- free of sharp edges.
- tools are not susceptible to corrosion.
- initiates hazardous operation prior operation of a door.
- ON-OFF switch cuts all power.
- controls incandescent warning lamp/display segment.
- all switches latched.
- 115V AC power, wiring required.
- related to display.
- instructions provided as usual.
- is obvious.
- where possible, label labeled.
- is labeled, shown.
- nomenclature functional need with 3/16" red border.
- led as to function.

The area within which the user operates the equipment.

- Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, canopies and seats.
- Provides storage for excess clothing, personal gear, weapons and tools.
- Protects operator from adverse environment, when applicable.

- Display placement above standing level:
 - Isolated surfaces narrowest, 41–70° (64–80°) precisely, frequency read, 50–65° (18–35%), $\pm 21^\circ$ from centerline.
- Controls on vertical plane:
 - Floor to waist range, 34–70° (60–30%) precisely, frequency 40–55° (20–25%), $\pm 21^\circ$ from centerline.
 - Waist surface height: standing, 36–87° seated, 29–31°.
- Dash board, writing surface are 29–31° above floor.
- Display reading location identified.
- Standard controls FIC (R.B.1–3).
 - Gross (limbing) dimensions based on 95th % (5th %) fully equipped user: FIC, 253.1–1.7. Accel. 18.3, 253.0.
 - Adjustable dimensions fit 5–95th %.

- Vertical seat adjustment: 15-21" in 1" max increments.
- Seat backrest reclines 103-115°; supports torso so operator's eyes are within 3° of "eye-line".
- If arms adjust: 7½-11" above seat.
- Seat adjusts fore, aft: 4" min.
- Operator does not have to lift seat to adjust seat.

- Cabinet kick space 4x4" hxd min.
- Console front flange 4x4" hxd min.
- Knee room 25x20x18" hxd min.
- Workspace anthropometric: 110, 10, 11-2.
- Allowance made for heavy clothing, protective equip. etc.
- Sufficient clearance for use with gloves, arctic mitts, heavy clothing.
- User space not encroached upon by others.

- Right-left viewing angle for wrap-around console: 170° max.
- Illuminations FIG 10.E.1.
- Forward field of view: 160° min.
- Instrument reflection avoided.
- Direct view of work if possible.
- Distortion avoided in windows.
- Ref. distances: EMC 10.E.3.

- Sealing compatible with consoles.
- Sealing A/C to console (separant) detail work change: 50° F (65° F) to 85° F, does not discharge on crew.
- Ventilations 30 cu/ft/min/mining velocity 100/min max.
- Effective temperature FIG 10.F.1.
- Acoustical environment does not degrade system effectiveness.
- Noise levels FIG 10.F.2.
- Radiation dose limit 0.20 mrem.
- Whole body vibration limits X, Y, Z, time FIG 10.F.3.
- Exposure to gases, fumes, toxicity see THRESHOLD LIMIT VALUES.
- Impulse noise FIG 10.G.1.
- Noise duration limits FIG 10.G.3.
- Hazard alerting device provided.
- Illumination adequate.
- Equipment guarded if temp exceeds 140°F.
- Exposed edges (corners) rounded 0.04" (0.5P) min radius.
- Guards provided on moving parts.
- Motion sickness limits FIG 10.G.A.
- Fire extinguisher accessible.
- Adequate, suitable storage for manuals, worksheets, etc.
- Hand work surfaces to support manuals, etc.
- Elevators, hydraulic lifts have max load sign visible.
- Conspicuous placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency exits clearly identified.
- Instructions, legend simple.

Devices and techniques for communicating information among crewmen within the workspace, between the crew and externally located individuals, and between the crew and remotely located persons.
Includes antennas, where applicable.

- Microphones, headphones, headset permit hands-free operation.
- Accessible volumes, gain controls are provided for each channel.
- Fast operated "Send-Receive" control when both hands busy.
- Radios, telephones are located for easy emergency access. More critical communications.

- Earphones, headsets easily adjusted, accommodates 5th-95th% users FIG 25.B.4.

- Reach to communication controls is unobstructed.
- Workspace accommodates operators wearing earphones, headset.
- Radio antenna located to minimize radio-frequency hazards.

Plugs, sockets, quick-disconnect fittings for the above.

- Conductors are bound into cable held by lacing rope.
- Long conductors, cables internal equipment are clamped to chassis.
- Test cables terminating on control panel do not interfere with control displays.
- Ropes, steel cables provided to handle large, heavy, long lines, cables.
- Covered space for cable storage.
- Cable clamps spaced every 12".
- Line, cable attachment parts reachable by user in bulky clothing.
- Cables are long enough to allow functioning unit to be checked out conveniently or extension cables provided.
- Electrical plugs also, shape coded.
- Line fittings standardized so lines that differ in content are not interchangeable.
- Cables are size, shape coded for similar control.

- Hand operation or common tool used to tighten, loosen.
- Tighten CCW; loosen CCW.

- Adequate space provided to handle cables, lines, hoses.
- Clearance between cables & controls 3" min.
- Cable, line, hose connectors appropriate.

- ID tapes visible at line ends, intervals; near valves, vents, etc.
- Bands, tags, paint are adjacent to valves, regulators, clean outs, flow checks, clean outs, branch lines, or intervals & where line goes thru walls, floors.
- Line, hose, cable color contrast with background.
- Low overhead pipes highly visible.
- Manner of connection, disconnection is obvious.

- Number of inputs, outputs are minimized by grouping functions.
- Cables are reachable, visible.
- Irregular, fragile, awkward extensions removable for handling.
- Cables are not pinched by doors, lids; walked on, used as handholds, bent, twisted repeatedly.
- Cables routed thru holes are protected by grommets, etc.
- Protective caps, covers, inserts are available as necessary.

- Pipes, hoses guarded if temp over 140°F (120°F if handled).
- High pressure lines have retaining chain attached to line and source.
- Automatic shutoffs on fuel service equipment to prevent overflow, spills.
- Electric wiring routed away from lines carrying O_2 , flammable fluids.

- Multiple conductors color coded.
- Cables labeled as to which equipment, connector they belong.
- Lines labeled as to function, sub-function, hazard, flaws FIG 12.M.1.
- ID tapes encircle the line.
- ID tags, bands on cold, hot lines stainless over 4" not near intakes.
- ID point used on 4" min lines.
- Line color (symbol) (hazard) color FIG 12.M.2 (12.M.3) (12.M.4).
- Dangerous voltage placarded.
- Hydraulic, electric FIG 12.M.5-6.

(MAIL + DEK-759, Etc.)

10	11 COMMUNICATIONS	12 LINES, PIPES, CABLES	13 FASTENERS, CONNECTORS	14 PACKAGING	15 TEST ELEMENTS, TOOLS
which the user operates controls, displays, devices, weapons or standing arms. For access clothing, gear and foot, to from adverse or applicable. and above standard frequency band, 50-100 MHz; normal, 41-70 MHz; tactical surface above 100 MHz (B-3A); only used, 36-57 MHz; only centerline, right standing, 36-57 MHz; tables are 27-31 MHz ation identified: FIG 10.B.1-3. Information based on ally equipment users: FIG 10.B.3. ions for 5-95th%. stomach 15-20" in 1" lines 103-115" operator's eyes are line". 11" above seat, 41" min. all have to lift set 2" x 4" had min. space 4" min. 18" had min. space 4					

SUBCLASS A

The conditions applicable to this class are:

1. User conditions - body size of users and
2. Environmental conditions - weather, vibration in the use area;
3. Operational conditions - time critical conditions (blackout, NBC, noise sup different data rates, one or more users

INDEX TO DETAILED DESIGN CONSID[illegible]

SENSORS & DETECTORS

ational conditions - time critical operations (quick assembly and use), combat
itions (blockout, NBC, noise suppression) and use conditions (duration of use,
rent data rates, one or more users, range of things or status to be sensed.

USE		MONITOR INFORMATION FEEDBACK	
SE	ACTIVATE/ADJUST/DEACTIVATE	ACQUIRE/INTERPRET INFORMATION	DETERMINE OPERATIONAL STATUS
Design of the replacing and	PURPOSE: Evaluate the test item for the ease of use of those components and procedures that are required to power and adjust the sensor.	PURPOSE: Evaluate the output of the test item for the ability of intended users to understand fully the information presented.	PURPOSE: Evaluate the test item for ease and reliability of verifying operational readiness and existing status of various components.
on/orient.	MAN/ITEM TASKS	MAN/ITEM TASKS	MAN/ITEM TASKS
tion device.	Activate sensor.	Activate displays.	Identify problems.
	Verify activation.	Acquire/interpret sensed data.	Isolate problems.
	Follow safety procedures.	Verify validity of sensed data.	
red.	Read instructions.	Integrate data from different sensors.	
	Communicate.	Assess data quality.	
	Perform dynamic checkout.	Assess data quantity.	
	Perform quick deactivation.		
	Control location/position/operation/feedback of data.		
	Control rate of motion/field of view.		

RAILED DESIGN CONSIDERATIONS

[illegible]

HUMAN FACTORS CONSIDERATIONS

HUMAN FACTORS CONSIDERATIONS

A. LOCATION & ARRANGEMENT

The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of openings (accesses), cover or door operation, location of components (knobs, levers, etc.) as well as its relationship to other components.

B. SIZE & SHAPE

The maximum and/or minimum dimensions of components that are required for adequate man use, including the effects of anthropometric and special clothing (armor, NBC) considerations, and the shape and contour of handles, knobs and other controls to enhance both the identification and use of the component.

C. OPERATIONAL FORCE

The movement and/or force required to operate or manipulate a component (handle, control, fastener, etc.) with emphasis on the direction of motion corresponding to the display, component, total item reaction or standard practice as well as the minimum strength required.

D. CLEARANCE

The unobstructed space surrounding a component which allows the operator to perform required actions, the degree of which varies as a function of the amount of body involved (hand, fingers, arm, torso, etc.) and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E. VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F. USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G. SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventative aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H. OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design for fixed as well as job aids, checklists, training texts, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1. LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates. Make operator aware of hazards. Give special guidance or instructions.

- Controls, displays, etc are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- ID labels not obscured by components on flattest surface; on main chassis min coverage by grime not easily removed.

- Character height determined by distance read, luminance FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 1.B.2-4.
- Letter, numeral width: "M" & "W" h/w = 5/16; "I" & "l" are 1 stroke width.
- Stroke width for black (white) characters on light (black) background 1/16 (1/7-1/8) of height.

- Spacing between characters (words) one stroke (character) width min.
- Line spacing: 1/2 character height.
- Counter numeral h/w ratio = 1:1 (except 1); separation = 1/2 to 3/4 w.
- Optical projections all caps, stroke width 1/6 to 1/8 h/w exceeds 15 minutes visual angle.
- Thumbwheel numeral h/w ratio = 3/2; h/w = 8/5 stroke width internally (externally) illuminated = 10:1 (5:1).
- Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environmental conditions.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-Cd black letters, light background.
- Dark adaptation letters visible, do not interfere with night vision.
- Chart readings FIG 6.C.3.

- Label characteristics accuracy required: time available; distance; light level; color; criticality of function; consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.

- Vertical labels used only when labels are not critical for personal safety performance.
- Electrical receptacles marked with voltage, phase, frequency.
- Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-122); new OK if obvious.
- Trade names, irrelevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand grasp areas identified.

6. CONTROLS

Components used to activate, deactivate and/or manipulate the equipment power source and to modulate the operating elements. Handles, grips, knobs, switches, triggers, levers, wheels, pedals and other man operated items as applicable. Controls are associated only with the item under test, not with equipment placed on it.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
- Controls in functional groups are located in accordance with operational sequence and/or function.
- Controls oriented to operator.
- Can not accidentally be moved.
- Recurring groups similar thru system.
- Rotary size, shape: FIG 6.B.1-1.A.
- Linear size, shape: FIG 6.B.1-1.B.
- Controls have non-slip surfaces.
- Gross (limiting) (adjustable) dimensions based on 95th% (5th%) ((5-95th%)) operator.
- Linear size, shape: FIG 6.B.9-18.
- Display interface controllers size, shape: FIG 6.B.19-21.
- Miniature controls used only under space constraints; size & separation minimum.

- Adequate control response feedback.
- Conventional control movements: FIG 6.C.3.
- Control valves open CCW.
- Forces, displacements (including miniature controls): FIG 6.B.1-21.
- High force controls: FIG 6.C.1-2.
- Free from backlash.
- Switches: no stop between positions; resistance increases until snaps into position.
- Display interface controllers force, displacements: FIG 6.B.19-21.
- Control spacing min: FIG 6.D.1; blind operation, 5" min.
- Rotary separation: FIG 6.B.1-1.B.
- Linear separations: FIG 6.B.9-18.
- Compatible with hardware used.
- Range of control action does not interfere with other controls.
- Larger diameter concentric control is used for the fine adjustment.
- Display interface controllers clearances: FIG 6.B.19-21.

- Shape coded controls visually, tactually identifiable.
- Color contrasts with background.
- Ambient light color determines visible control colors.
- Reference line has 50% min contrast with control color.
- Pointer parallax error between reference marks: 25% min.
- Pointers differentiated for each knob of grouped set.
- Display interface controllers clearances: FIG 6.B.17-19.
- Precision of control manipulation is consistent with that of system.
- Selected, distributed so none of user's limbs are overburdened.
- Usable in time required despite inadvertent operation protection.
- (f) ratios: large (small) for small (large) range of display movement.
- Recommended manual controls: FIG 6.F.1.
- In bracketing, knobs swings thru 10-70° are around target value.

- Shape coding free of sharp edges.
- Critical controls are not susceptible to accidental movement.
- Controls that initiate hazardous operations require prior operation of a locking control.
- Emergency controls located near tripped warning display/reset point.

- Minimum decoding required.
- Operating instructions provided except where use is obvious.
- Diagrams used where possible.

8. DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation. Provide positive indication of developing or current malfunctions. Displays are associated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Functionally related units grouped.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Displays located so they can be read to the required degree of accuracy.
- Lighted control indicators are unambiguously associated with controls.
- Emergency, critical, important displays located in 30° cone about line of sight.
- Display viewing distances: 13-28".
- Pointer extends to but does not obscure or exceed index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- Controls, flags, printers, plotters: FIG 8.B.1.
- CRT target visual angle exceeds 2.0 minutes, 10 lines of resolution distance 16" (10" min).

- Design Requirements (MIL-STD-1472)
- User-Computer Interface Data (MIL-STD-1472C)
- Guidance Data (MIL-HDBK-759, Etc.)

- Display face to line of sight exceeds 45° min parallax, reflection.
- Frequently used displays grouped in optimal visual zone: FIG 8.E.1.
- Illumination uniform: FIG 8.E.3.
- Indicator lights show response, used sparingly, visible.
- Contrast, luminance exceeds 50%.
- Flashing lights: 3-5 flashes/sec.
- Color coding used where possible; unused scales covered.
- Illumination balanced full on to off.
- Flashing lights synchronized.
- Display precision, response is consistent with that of system.
- Information displayed: Clear, specific, precise, unambiguous; not redundant, degraded by vibration; timely.
- Lights show functions: FIG 8.F.1.
- Scales: linear, start at 0, use whole numbers, 2 pointers max, numerals oriented upright.
- Mechanical types: FIG 8.F.2.
- Audio signal evaluations: FIG 8.F.3.
- Audio, verbal warnings: 20 dB min above background.
- Failure immediately apparent.
- Signal absence does not mean "go".
- Indicator light color coding for emergency, warning, summation, etc: FIG 8.F.1; master lights set apart.
- Audio warnings transmitted to both earphones and work area.
- Audio signal action segment specifies nature of problem.
- Prohibited, persistent signals are not used: FIG 8.G.1.
- Audio warning durations min of 8 sec until corrective action taken.
- Minimum decoding required.
- Trademarks, irrelevant information, etc do not appear on panel face.
- Coding techniques uniform facilitate discrimination, identification, relationship, criticality.
- Auditory displays used where vision overburdened, degraded; redundancy desirable; warning, cue needed.
- Verbal warnings: intelligible, apt.
- Audio warnings use standard signals.
- Labels: functionally basic; well located; graduated in size.

- Display pointer tip same color as marks.
- Stacked, alternately presented legends visible.
- Pointer tip same color as marks.

- Display changes represent functional state.
- Transilluminated other displays: FIG 8.F.4-5.
- Transilluminated indicators display system status, immediate actions, adjustment functions.
- Operator presumption in a crew system allowed only for mission survival.
- Priority information obvious.
- Recommended manual controls: FIG 6.F.1.
- Auditory displays have test device.
- Auditory displays volume adjustable.

- Operator and maintainer information not combined unless compatible for both uses.

13. FASTENERS

Securing device package or hold on catches, hooks, latches - both operated. Includes fastener alignment and lock pins, safety electrical plugs, or

- It is impossible plug into a receptacle.
- Plugs, receptacle for insertion.
- Aligning pin electrical pins.
- Plugs, receptacle pins are or relative position.
- Fastener, cone are easily access.
- Alignment aids.
- Parts for fasteners.
- Identical screw, throughout one.
- Fastener heads grasped, handled.
- Non-interchange different use.
- Cotter keys: no

- Fasteners, plug max to tighten.
- Over 10 ft.-lb. grippable below not, external or.
- Quick disconnect release, twist for frequent, or.
- Tighten CW; loo

- Gross (limiting) 95th% (5th%) of FIG 25.3.4-5.
- Adequate space connectors firm.
- Adequate space wrench.
- Obstructions to connectors are (1.25") if used fingers.
- Mounting screw holes.
- Connectors visible.
- Labels, codes v unconnected side.
- Easy visual access.
- Visual threads.
- ID colors are r from each other for lighting.

- Number, type r rate with stress.
- Captive fastener pin they are need frequent re.
- Bolts have min r.
- Only standard is necessary.
- Adapters for pin hand tightened.
- Fasteners used under all environ.
- Connectors are ble, lines, faste
- Removal of plug expose hot leads.
- Plug of one volt inserted into the other voltage ra
- All hot contacts.
- Use captive typ necessary.
- Internal-griphe critical to mech
- Cap, inserts, e provided where r
- Receptacles ma phase, frequency
- Connecting plug fitted by color, s
- Plugs, receptacle rows, etc to the frame.
- Member of conn clearly marked.
- Plug, receptacle 13.H.1.

	13 FASTENERS, CONNECTIONS	14 HANDLES	15 OPTICS	17 PACKAGING	19 ACCESS, COVERS, CAPS
to the operator itions. d with equipment	Securing devices used to assemble, package or hold an item in place. - Catches, hooks, screws, bolts, nuts, latches - both quick release and tool operated. - Includes fastener and connector equipment and locking devices such as lock pins, safety wires, pins, nuts, electrical plugs, and fittings.	The special or inherent devices used to grasp, hold, grip or lift an item for lifting, moving, steadying or aiming. - Handles, knobs, projections, straps, etc. - Involves roughened or non-slip surface when used for handling. - Check also for the lack of handles.	Components that use the human eye for sighting, aiming or viewing. - Includes eyepieces, reticles, filters, sighting mechanisms, range finders, viewers. - Excludes visual displays.	Components used for packaging, storage and transportation. - Cases, packing cases, boxes, bags, and covers that are not part of the item but are used for transport. - Carrying cases and storage boxes specifically designed for the item, or multiples of the item, and are part of the item configuration.	Those openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components utilizing test points, and inserting or removing materials. Included is the access covering, if any.
are aligned for es.	- It is impossible to insert a wrong plug into a receptacle. - Plugs, receptacles have aligning pins for insertion. - Aligning pin extends beyond plug electrical pins. - Plugs, receptacles arranged so aligning pins are oriented in the same relative position. - Fastener, connector operating parts are easily accessible. - Alignment aids, self alignment of parts for fastening. - Identical screw, bolt heads provided throughout one removal tool. - Fastener heads large enough to be grasped, handled. - Non-interchangeable connectors for different use. - Cutter keys: snug fit, large head.	- Handles, grasp areas are located relative to the CU. - Hinged, fold-out handles have a stop position: one hand operation. - Two handles min. or one handle/ grasp area for units 10 lbs. or more. - Handles located so that lifting is at arm distance from body. - Lift points on large items are equidistant from the CG. - Handles reachable by 5th% user wearing bulky, restrictive clothing. - Bar, T-bar, J-bar, recessed handles FIG 14.B.1. - Hand shaped handle used on item carried frequently or for long periods.	- Optical instruments are oriented to give operator a comfortable angle of view. - Purging, charging fittings are accessible for maintenance. - Components requiring frequent maintenance, special tools are readily accessible. - Interpupillary distance between eyepieces adjustable 50-76 mm. - Eyecups prevent stray light from entering eyes. - Built-in collimation for field adjust. - Gross (limiting) dimensions based on 95th (5th%) user: FIG 25.B.6. - Field of view is compatible with use, optical-mechanical limits. - Entrance pupil: magnification x exit pupil diameters. - Reticle lines: thin enough not to block targets thick enough to be easily seen. - Eyecup specifications: FIG 15.B.1. - Rifle, pistol sight (monocular, binocular) 4 (8) power max.	- Cases lift from units rather than units lift from cases. - Inflammables stowed away from engines, generators, exhaust pipes. - For cross country ops items secured in storage boxes or restrained by straps, brackets. - Storage available for individual weapons, small-arms ammo, rations, helmets, etc. - Stowed items accessible by 5-95th% personnel: FIG 25.B.1-7.	- Sliding, rotating, hinged units open, rotate their full distance, remain in place without hand support. - Covers have mounting holes large enough to permit the attaching screws to pass without perfect alignment. - Covers not completely removable are self supporting. - Rubber stripping, sealing material located so user will not damage it when cover is removed. - Gross (limiting) dimensions based on 95th (5th%) user: FIG 25.B.1-7. - Hand, arm, finger access: FIG 19.B.1. - Requirements to see, work within access determines opening size. - Attached to user: FIG 25.B.8.
19, 20, 1-8, B.F.X.	- Fasteners, plugs require one turn max to tighten, loosen. - Over 10 ft.-lb. torque use external-griphead; below 10 ft.-lb. use internal, external or combo gripheads. - Quick disconnect, snap action, release, twist: up to one full turn for frequent, critical use. - Tighten CW; loosen CCW.	- Weight limits for one man lift: FIG 14.C.1. If shape is convenient, handles are provided, lift is not repeated, item is not carried. - Horizontal push, pull force limits: FIG 14.C.2. - Handle, grasp area force limits: FIG 6.C.1. - Two-man lift values are twice one-man lift only if item configuration convenient; neither man exceeds one-man limit.	2 eyepieces used during low light level viewing that exceeds 1 minute. - Gross (limiting) dimensions based on 95th (5th%) user: FIG 25.B.6. - Magnification difference between the two eyes 2% max. - Difference in amount of light between the two eyes 5% max.	- Structural members do not prevent access to components. - Replaceable items are not placed in a manner which makes them difficult to remove. - Small covers hinge at bottom, open down. - Cover latch requires positive force to open, is within capability of 5th% user: FIG 6.C.1. - Caps tighten CW, loosen CCW.	- Openings are large enough to permit required operations. - Allowance is made for gloved hand in externally located access. - Open covers do not interfere with controls, displays.
same color as v presented as marks.	- Gross (limiting) dimensions based on 95th (5th%) operator's hand, arm: FIG 25.B.4-5. - Avoidable space available to grasp connectors firmly. - Avoidable space to use connector wrench. - Distractions to use are removable. - Connectors are separated by 0.75" (1.25") if used with bare (gloved) fingers. - Mounting screws have clearance holes. - Connectors visible, accessible. - Labels, codes visible in connected, unconnected state. - Easy visual access is provided for starting threads, pins. - ID colors are readily discriminable from each other under real operational lighting.	- Handles have at least 26" clearance from obstructions. - Straps, buckles do not interfere with operation of item. - Handles color coded to distinguish from similar shaped items. - Handles are visible from the grasping, lifting position.	- Eye relief is at least 15 mm. - Eyecups, headrests: compatible with helmets, masks, etc. - Slip scales usable by 5-95th% hands no tools. - Line reticles preferred over those with 1, 2 or 3 control spots. - Small cross or circle preferred over dot for reticle. - Ring preferred over a spot for reticle. - Optic components accommodate arctic headwear, headwear. - Reticles are illuminated for night, twilight operations. - Illumination: even, blue color not used; dimming provided; level remains fixed under vibrations. - Level vials, scales, pointers are readily visible, illuminated for low light condition use. - Lighting minimally affects the dark adaptations of observer. - Luminous transmission exceeds 50%; parallel limited. - Filters used for high light levels. - Adjustment of eyes beyond normal ability is not required. - Magnification is high enough for required application.	- Cases are enough larger than units they cover to prevent damage when case is removed, replaced. - Tight fitting storage avoided. - Containers allow for full hand, finger clearance when using opening tool. - Gloved hand clearance provided: FIG 23.B.1. - Identification of package contents clearly visible.	- Visual access cover preferences: none, transparent, break-resistant glass, quick opening metal. - It is obvious when a cover is in place but not secured. - Visual access only for components requiring a visual check. - Instructions visible when access cover is open. - Openings allow visibility of internal components while operator performs tests.
present func- ther display: eters display date actions, in a crew sys- r mission sur- viving, ual controls: test device, volume adjust- r	- Number, types minimum commensurate with stress, banding requests. - Captive fasteners used where dropping them creates hazards covers need frequent removal. - Bolts have min number of turns. - Only standard tools are used. - Adapters for pin connectors can be hand tightened. - Fasteners used outside are operable under all environmental conditions. - Connectors are compatible with cables, lines, fasteners, mounting. - Removal of plug, connector does not expose hot leads. - Plug of one voltage rating cannot be inserted into the receptacle of another voltage rating. - All hot contacts are sockets. - Use captive type dust covers where necessary. - Internal-gripheads: only use when critical to mechanical function, personnel safety. - Caps, inserts, covers, cases, shields provided where necessary. - Receptacles marked as to voltage, phase, frequency. - Connecting plugs, receptacles identified by color, size. - Plugs, receptacles have stripes, arrows, etc to show aligning pin positions. - Manner of connection obvious. - Non-standard operating direction is clearly marked. - Plug, receptacle identification: FIG 14.C.1.	- Handles also guard against inadvertent control operation; protect meter faces used as support, stand, hanging or locking device. - Removable, carried units provided with handles, other suitable means for grasping, handling, carrying. - Hand grips have non-slip surface. - Carried item will ride clear of legs of personnel. - Handle/grasp surfaces are not thermally/electrically conductive. - Insulated handles used on hot items. - Non-recessed handles do not injure personnel, entangle clothing, damage equipment. - Edges rounded; attaching screws recessed.	- Resolutions: 60 sec of arc min. - Oculars are matched pairs. - Instruments needing steady eye usage have brow pads. - Level vials, scales, pointers are protected from damage. - Focusing: -4 to +2 diopters for over 4-power. - Eyecups are made of soft rubber or equivalent material. - No skin contact with metal parts.	- Guides, tracks, steps are used to facilitate handling. - Accessibility of stowed equipment reflects its function, use. - Fully open, closed state obvious. - Material remaining is easily determined. - Edges, corners on covers, cases are rounded, otherwise finished to prevent personnel injury.	- Access covers are equipped with grasp areas for opening. - Physical access cover preferences: none, sliding, hinged, quick-opening. - Captive fasteners used when periodic removal is required. - Cover fasteners self lock for closing with audible snap. - Replaceable caps captive. - Sliding doors, caps lock positively. - Edges, corners on covers, cases are rounded to prevent injury. - Hazardous voltage behind access cover is de-energized with an interlock attached to cover. - Access over dangerous mechanical, electrical component has an internal light, warning on door.
trainer inter- unless compat-	- Items exceeding one man lift (FIG 14.C.1) are labeled with weight, lift limits. - Hand grasp areas identified.	- Components, parts are labeled. - If periodic purging, charging is required an instruction plate indicating time interval, pressure is attached.	- Orientation of a unit within its case is obvious or labeled. - Labels, markings tell how to open, remove, position covers, cases. - Labels warn of hazards, dangers within case. - Storage locations labeled.	- Cover opening method is obvious or instructions are displayed on outside of cover. - Accesses are labeled with warning sign advertising of hazards within, precautions needed. - Labels indicate function of units behind enclosure, access. - Labels, instructions are properly oriented when cover, case, door is open. - Labels indicate how service equipment is oriented, connected.	

TEST FUNCTION _____

TEST ITEM CLASS IV _____

SUBCLASS B _____

INFORMATION/CONTROL _____

OBJECTIVE: Evaluate the effectiveness and safety of the design of information systems and command-control systems to enable the operator or crew to enter and leave the station, prepare for operations, and operate the station. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use.

The conditions applicable to this class are:

1. User conditions - body size, clothing, the users;
2. Environmental conditions - weather, vibration;
3. Operational conditions - time critical conditions (data rates, alternate appropriate different operational requirements).

ENTER/LEAVE STATION		PREPARE FOR OPERATION	
ENTER/LEAVE	TAKE POSITION	CONFIGURE STATION	PERFORM
PURPOSE: To evaluate the design of doors and other access covers for adequacy in enabling operators to open and close them from normal approach locations inside or outside of workspace. MAN/ITEM TASKS Grasp and operate door control. Push/pull/slide door open/closed.	PURPOSE: To evaluate the normal operating position for ease of entry and exit in both nominal and contingency conditions. MAN/ITEM TASKS Step into/out of work area. Take/leave seat. Move to/from standing operator position. Remove excess clothing (rain/NBC/arctic). Stow clothing/tools/packs/other encumbrances.	PURPOSE: Evaluate the design of components and procedures for ease of preparing the station for use. MAN/ITEM TASKS Adjust environment controls. Select modes of operation. Integrate with other operators. Establish command links. Make connections. Follow procedures. Communicate. Interact with support systems.	PURPOSE: Evaluate the design of components and procedures for ease and reliability of operation of various components. MAN/ITEM TASKS Check control settings. Check data return. Check data return. Check links. Verify operation.

INDEX TO DETAILED DESIGN CONSIDERATIONS

Test Item Components HUMAN FACTORS CONSIDERATIONS	Doors Hatches Passages (4)	Workspace (10)	Labels Manuals Markings (1)	Workspace (10)	Labels Manuals Markings (1)	Controls (6)	Displays (8)	Fastener Connectors (13)	Labels Manuals Markings (1)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B	B	B
C. DIRECTION & FORCE	C	C		C		C		C	
D. CLEARANCE	D	D	D	D	D	D		D	D
E. VISIBILITY	E	E	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H	H	H

INFORMATION/COMMAND- CONTROL SYSTEMS

- 1. User conditions - body size, clothing, number of operators, and general skill level of the users;
- 2. Environmental conditions - weather, climate, illumination levels, and noise and vibration;
- 3. Operational conditions - time critical operations (emergency egress) and use conditions (data rates, alternate tactical situations, time on station, range of appropriate different operational requirements and constraints).

PREPARE FOR OPERATION		OPERATE STATION	
ACTION	PERFORM CHECKOUT	ACQUIRE/INTERPRET INFORMATION	CONTROL/ADJUST OPERATIONS
design of com- or ease of pre-	PURPOSE: Evaluate the test item for ease and reliability of verifying operational readiness and existing status of various components.	PURPOSE: Evaluate the output of the test item for the ability of intended users to understand fully the information presented.	PURPOSE: Evaluate the test item for ease of use of those components that contribute to the operational readiness of the station.
als.	MAN/ITEM TASKS Check control settings.	MAN/ITEM TASKS Obtain/monitor continuous data.	MAN/ITEM TASKS Activate system/change control settings.
itors.	Check data return quality.	Obtain/monitor discrete data.	Change system configuration.
	Check data return format.	Obtain/monitor status data.	Change software.
	Check links.	Obtain verification data.	Input discrete commands.
	Verify operational readiness.	Identify/isolate problems.	Input continuous control.
		Assess requirement to modify operations.	Monitor computer/communications/sensor systems.
ITTS.			

[illegible]

DESIGN CONSIDERATIONS

HUMAN FACTORS CONSIDERATIONS

A LOCATION & ORIENTATION

The positioning of a component as it affects the ability of the operator to reach, see, or manipulate it, including the amount of space accessible, view of the operation, location of the controls, levers, etc., as well as its relationship to other components.

B SIZE & SHAPE

The maximum and minimum dimensions of components that are required for adequate man use, including the effects of anthropometric and special clothing (armor, NBC considerations), and the shape and contour of handles, knobs and other controls to enhance both the identification and use of the component.

C DIRECTION & FORCE

The movement and/or force required to operate or generally manipulate a component (handle, control, fastener, etc.), with emphasis on the direction of motion corresponding to the display, component, total item reaction or standard practice as well as the forces in strength required.

D CLEARANCE

The unobstructed space surrounding a component which allows the operator to perform required actions, the degree of which varies as a function of the amount of body involved (hand, fingers, arm, torso, etc.), and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F ENVIRONMENTAL CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace area.

G SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventive aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design handbooks as well as job aids, checklists, training texts, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1. LABELS, MATERIALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates. Make operator aware of hazards. Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- ID label: not obscured by components; on flat surface on main chassis; min coverage by grime; not easily removed.

- Character height determined by distance read, luminance: FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control; display position characters each by 25% min.
- Letter, numeral styles: FIG 1.B.2-4.
- Height/width ratio: $\geq 5/3$; "M" & "W" is 1 stroke width with "M" & "W" h/w: $\geq 5/4$; "I" & "L" are 1 stroke width.
- Stroke width for black (white) characters on light (black) background: $1/6$ ($1/7$ - $1/8$) of height.

- Spacing between characters (words): one stroke (character) width min.
- Line spacings: ≥ 1 character height.
- Counter numeral h/w ratio: $\geq 1/1$ (except 1/2 separation: ≥ 1 to $1/2$ h/w).
- Optical projections: all caps, stroke width $1/6$ to $1/8$ h; exceeds 15 minutes visual angle.
- Thumbwheel numeral h/w ratio: $\geq 3/2$; h: $\geq 1/2$ stroke width internally (externally illuminated: $\geq 10/1$ (5/1)).
- Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environments.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-C black letters, light background.
- Dark adaptations: letters visible, do not interfere with night vision.
- Chart reading: FIG 8.L.3.

- Label characteristics: accuracy required; time available; distance; light level, color; criticality of function; consistency at design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.

- Vertical labels used only when labels are not critical for personnel safety, performance.
- Electrical receptacles marked with voltage, phase, frequency.
- Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-12); new OK if obvious.
- Trade names, irrelevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand grasp areas identified.
- Axes of graphs labeled and graduated appropriately.
- Printed info directly useable; min of decoding, interpolation.

- Sliding doors are not installed as the only personnel exit.
- Doors, emergency exits are easily reached, unobstructed, quick opening: 3 sec max; 10-30 lb. operating force.
- Escape openings: smooth-edged, no obstructions, permit passage with survival equipment.
- Glass in doors shatterproof.
- No hazards or obstructions in entryways or on either side.

- Color of latch handle different from that of door.
- Correct movement of latch handle diagrammed, labeled.
- Exit instructions are legible, brief, clearly worded.

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4. ENVIRONMENTAL PASSAGE

Provide a means for entering and leaving the workspace. Provide openings for loading or unloading material. Components are evaluated for both normal and emergency use. Some doors serve dual purposes and must also be evaluated as steps, ramps or platforms.

- Wall hatches flush with floor where structurally possible.
- Latch handles can be reached from normal approach positions.
- Overhead hatches: latch to hold open inside padded; 1 hand operation.
- Handles can be reached, operated by troops in bulky clothing.

- Doors: 80-84" h; 32-34" w.

- Hatch handle unlocking force: 20 lb max.
- Overhead hatch: opening force, 50 lb max; operable by user with 5th% army hand strength: FIG 6.C.1.
- Hatch opening force: 50 lb max.
- Handles operable with gloves.

- Fixed equipment is located 3" min from swept area of doors.
- Gross (limiting) dimensions based on 95th% (5th%) fully equipped user: FIG 25.B.1-2.
- Door frames 3" min from corner.
- Wall escape hatches in vehicle mounted shelters clear all obstructions.
- Exit, egress possible wearing boots.

- Passageway illumination: 10 ft-C min.
- Latch control visible initially.
- Door jamb or ceiling height allows full view of step point.
- "See thru" where possible.

- Clatches open with a single motion of hand, foot.
- If "step down" through a top access exceeds 27", appropriate foot rests, steps provided.
- Latch handles do not freeze up.
- Doors lockable from inside.
- Handles uniform in operation.

- Sliding doors are not installed as the only personnel exit.
- Doors, emergency exits are easily reached, unobstructed, quick opening: 3 sec max; 10-30 lb. operating force.
- Escape openings: smooth-edged, no obstructions, permit passage with survival equipment.
- Glass in doors shatterproof.
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6. CONTROLS

Components used to activate, deactivate and modify the equipment power source and to modulate the elements. Handles, grips, knobs, switches, triggers, levers, wheels, pedals and other man operated items as applicable. Controls are associated only with the item under test, not with equipment placed on it.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
- Controls in functional groups are located in accordance with operational sequence and/or function.
- Controls are oriented to operators.
- Can not accidentally be moved.
- Recurring groups similar thru system.
- Controls used for same function on different equipment are same size.
- Rotary size, shape: FIG 6.B.1-6.
- Linear size, shape: FIG 6.B.7-13.
- Designate control response feedback.
- Gross (limiting) (adjustable) dimensions based on 95th% (5th%) (15-95th%) operator.
- Standardization of keyboards.
- PC switches: surface oriented; dimensions sufficiently high for error-free use with common styles.
- Linear size, shape: FIG 6.B.9-18.
- Designate control response feedback.
- Control motions: CW, forward, up, right produces corresponding display motion on fixed scale (or reverse motion with a moving scale, fixed pointer) with increasing reading magnitude.
- Rotary valves open CCW.
- Forces, displacements (including miniature controls): FIG 6.B.1-21.
- Free form backlash.
- Isometric joystick: deflection minimal, perceptible.
- Control spacing min: FIG 6.D.1; blind operation, 5" min.
- Rotary separations: FIG 6.B.1-8.
- Linear separations: FIG 6.D.2-8.
- Foot switches: separated 3" horizontally, 8" vertical minimum.
- XY controllers: cordless; operable with either hand.
- Display interface controllers clear: FIG 6.B.19-21.
- Larger diameter concentric control is used for the fine adjustment.

- Shape coded controls visually, tactually identifiable.
- Color contrasts with background.
- Ambient light color determines useable control color.
- Reference line has 50% min contrast with control color.
- Pointer parallax error between reference marks: 25% min.
- Thumbwheel internally lighted if ambient illumination below 1 ft-C.
- Thumbwheel readable 30° off-axis.
- Legend switch legend is legible.
- Precision of control manipulation is consistent with that of system.
- Selected, distributed so none of user's limbs are overburdened.
- Coding uniform throughout system.
- Useable in time required despite inadvertent operation protection.
- Movement oriented to operator if several stations are used.
- Control motion minimized; not cycled thru ON/OFF unnecessarily.
- Minimum use mode of horizontal or 3-position toggle switches.
- Shape coding free of sharp edges.
- Critical controls are not susceptible to accidental movement.
- Controls that initiate hazardous operations require prior operation of a locking control.
- Main power ON-OFF switch cuts all power to equipment.
- Emergency controls located near related warning display/instrument panel.
- Data manipulated without concern for internal storage.
- Control color related to display.
- Operating instructions provided except where use is obvious.
- Diagrams used where possible.
- Main power switch labeled.
- Emergency (noncritical) functional groups outlined with 3/16" red (1/16" black) border.
- Controls labeled as to function.
- Emergency entries are easily corrected.
- Internal software checks minimize user errors.

- Keyboard arrangement, number of keys compatible with info to be entered.
- Keel rest provided for pedal angle over 100°.
- Pedals reached easily.
- Keypads conform to MIL-STD-1290.
- Fixed function keys used for critical or frequent inputs.

- Isometric joystick: shaft length = 4.3"-7.1"; grip diameter = 2".
- Isometric joystick: hand-grasped for integral switching; otherwise finger-grasped.
- Only 1 switch per foot (preferred).
- Foot & stylus: required grips, display same size; mounted/oriented below display; preserve directional correlation.
- Display interface controllers size, shape: FIG 6.B.19-21.
- Rotary size, shape: FIG 6.B.1-8.
- Avoid the requirement of constant force on joystick.
- Isometric joystick: max. force for full output not to exceed 26.7 lbs.
- Direct relationship between stylus movement on grid and follower on display; follower remains stationary until stylus moved.
- Controller/follower movement ratio, displacement proportional.
- Conventional control movements: FIG 6.C.3.

- X controller: cordless; operable with either hand.
- Follower refresh rates great enough to create continuous track in free-draw graphics.
- Buttons differentiated for each knob of keypad set.
- Interface controllers: in rate control applications, indicators provided to facilitate returning followers to display.
- Variable function keys have a visual signal if standard function unavailable.
- Foot-stylus use: CRT data retrieval, entry, generation of free-draw graphics.
- PC switch use: manual programming with PC board.
- Ball tracker use: applications that require accumulative travel of follower to given direction.
- Small diameter ball tracker use: space constraints; precision not essential.
- Cursor control is consistent with speed and accuracy requirements.
- Foot-operated switches located away from obstructions.

- Lightpens have discrete activating mechanism.
- Data manipulated without concern for internal storage.
- Critical entries require user acknowledgment; can be edited.
- Control inputs result in positive response displayed to indicate performance.
- User chooses sequence of transmission.
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8 DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation. Provide positive indication of developing or current malfunctions. Displays are associated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Recurring groups, items have similar panel to panel location.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Displays located as they can be read to the required degree of accuracy.
- Display positions correspond to positions of equipment monitored.
- Lighted control indicators are unambiguously associated with controls.
- Display viewing distances: 13-28".
- Pointer extends to but does not obscure or enclose index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- Conveyers, flags, printers, plotters: FIG. 8.B.1.
- CRT target visual angle exceeds 2.0 minutes, 10 lines of resolution distance 16" (10" min).
- Large screen optically displays FIG. 8.E.A.

• Design Requirements (MIL-STD-1472)
• User-Computer Interface Data (MIL-STD-1472C)
• Guidance Data (MIL-HDBK-759, Etc.)

- Display face to line of sight exceeds 45° min parallax, reflector.
- Frequently used displays are placed in optimal visual zones FIG. 8.E.1.
- Illumination uniform FIG. 8.E.1.
- Indicator lights show responses, used sparingly, visible.
- Contrast, luminance exceeds 50%.
- Flashing lights: 3-5 flashes/sec.
- CRT headed if ambient over 5 ft-C.
- Printed, plotted output visible.
- Projection displays FIG. 8.E.2.
- Illumination balanced full on in all.
- Display precision, response is constant with that of system.
- Information displayed: Clear, specific, precise, readable; not redundant, degraded by vibration; timely.
- Scales: linear, short of 0, use whole numbers, 2 pointers max, numerals oriented upright.
- Audio signal evolutions FIG. 8.F.3.
- Audio, verbal warnings 20 dB min above background.
- Material in printers, plotters easily changed; supplies indicated.
- Failure immediately apparent.
- Signal absence does not mean "out".
- Indicator light color coding for emergency, warning, summation, etc: FIG. 8.F.1; master lights set apart.
- Audio warnings transmitted to both earphones and work area.
- Audio signal action segment specifies nature of problem.
- Prohibited, persistent signals are not used FIG. 8.G.1.
- Audio warning duration min of 5 sec until corrective action taken. Minimum decoding required.
- Trademarks, irrelevant information, etc do not appear on panel face.
- Coding techniques uniform facilitate discrimination, identification, relationship, criticality.
- Auditory displays used where vision overburdened, degraded redundancy desirable; warning, cue needed.
- Verbal warnings intelligible, apt.
- Audio warnings use standard signals.
- Labels: functionally basic; well located; graduated in size.

- Display pointer tip same color as marks.
- Flashing lights synchronized.
- In form fillings user doesn't remove unused underscores; cursor machine positioned and tab bar advanced; missing data indicated; protected areas designated.
- Text conforms to MIL-STD-490; paragraphs separated by min. of 1 blank line.
- Feedback for correct control input consists of changes of state or value for controlled elements.
- Display changes represent functional state.
- Transilluminated indicators display system status, immediate action, adjustment functions.
- Software minimizes operator task complexity.
- Novelty minimization minimized.
- Inventory indicators acceptance and unavailability of input and delay.
- Data entered via keyboard are displayed, as keyed, on the screen.
- Auditory displays have test device.
- Operator and maintainer information not combined unless compatible for both uses.
- Spelling and common errors don't produce valid commands.
- Multiple level systems have minimum levels, priority access to critical levels, indicate current position.
- Auditory displays volume adjustable.
- Projection displays avoid "keyhole" effects.
- Display freeze made provided; has mode feedback.
- Information grouped to permit association of like classes.
- Data presented in readily usable and readable format.
- Internally detected error messages explicit, neutral in tone.
- Need for entry of already available information minimized.

- Large screen displays: visual access to critical operators prevents inadvertent deletion of info; assigned to command; person; separate display for individual change/received info.
- Location and presence of control input data clearly indicated.
- Recurring tabular data is similarly located.
- All data needed to support activity is grouped together.
- Digital values requiring reliable reading updated 1 per second or less.
- Cross or rate of change values updated between 2 and 5 per second.
- Graphic displays requiring integration of rapidly changing patterns updated consistent with the user's information handling rate.
- Feedback for correct control input consists of changes of state or value for controlled elements.
- Priority information obvious.
- Large screen user group viewing space constraints; mobile operators.
- Inserted items are collected in buffer, displayed in insert area, and inserted simultaneously.
- Mechanical overlays for keyboards, displays are avoided.
- Displays are designed for the expected operational environment.
- Expected use of information determines update rates.
- Hard copies of displays are obtainable.
- Prompts and structuring features available for interactive sessions and error location.
- Nomenclature approved by procedure agency.
- Abbreviations from MIL-STD-17, MIL-STD-411, and MIL-STD-781.
- Feedback provided to articulate system status.
- Command language reflects user's point of view.
- Program allows for orderly shutdown and establishment of checkpoints.

10 WORKSPACE

The area within which the user operates the equipment. Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, consoles and seats. Provides storage for excess clothing, personal gear, weapons and tools. Protects operator from adverse environment, when applicable.

- Display placement above standard (seated) surface: normal, 41-70" (64" precisely, frequently read, 51-65" (14-35"), 21" from centerline.
- Controls on vertical surface above floor (seated normal, 34-70" (48-53" precisely, frequently used, 34-53" (18-29"), 21" from user centerline).
- With vision over console top critical warning display 22" min above seat.
- Work surface height: standing, 34-48" seated, 28-31".
- User oriented to work site.
- Seats fit suitably clothed 5-95th user without degrading performance.
- Arm rests 24" min.
- Back, seat have 1" min padding.
- If van occupancy exceeds 1 ceiling height 78" min.
- Lateral work (writing) space 30 in (24 in) min.
- Standard console FIG. 10.B.1-3.
- Cases (limited) dimensions: 19 in (15 in) (5th % fully equipped, 19 in (15 in) (5th % fully equipped).
- Adjustable dimensions for 5-95th user.
- Vertical seat adjustments 15-27 in increments.
- Seat backrest reclines 103-115°; supports torso as operator's eyes are within 3" of "eye-line".
- If arms adjust: 78-11" above seat.
- Seat adjusts fore, aft: 6" min.
- Operator does not have to lift wrist to adjust seat.

- Cabinet kick space 44" had min.
- Console front floor space: 4 min.
- Knee room 23x20x8 min.
- Work space: 24x18x18 min.
- Allowances made for heavy clothing, protective equipment.
- Seat adjustment overhead clearance from seat pans 40" min.
- Sufficient clearance for use with gloves, arctic mitts, heavy clothing.
- User space not encroached upon by others.
- Reflection of instruments, consoles in windows, windshields avoided.
- Right-left viewing angle for wrap-around console: 135° min.
- Illuminations: FIG. 10.2.1.
- Surface colors conform to MIL-STD-1473.
- Reflectances: FIG. 10.2.3.

- Seating compatible with consoles.
- Heating, A/C for multiple (permanent) duty work areas: 50° F (65° F) in 85° F; do not discharge on crew.
- Ventilation: 30 cu ft/min/man max; velocity 100 ft/min max.
- Effective temperature: FIG. 10.F.1.
- Acoustical environment does not degrade system effectiveness.
- Noise levels: FIG. 10.F.2-8.
- Room sound absorption coeff: 0.20 min.
- Whole body vibration limits: X, Y, Z times FIG. 10.F.9.
- Exposure to gases, fumes, toxicity are THRESHOLD LIMIT VALUES.
- Impulse noises: FIG. 10.G.1.
- Noise duration limits: FIG. 10.G.3.
- Hazard starting device provided.
- Illumination adequate.
- Equipment guarded if temp exceeds 160° F (120° F if handled).
- Exposed edges (corners) rounded: 0.04" (0.5") min radius.
- Guards provided on moving parts.
- Arctic climate men not exposed to temp above 60°F; 35-65°F optimal.
- Adequate, suitable storage for manuals, worksheets, etc.
- Stands have work surfaces to support manuals, etc.
- Conspicuous placards adjacent to equipment hazardous to use.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.
- Instructions kept simple.
- Manuals, markings include warnings on toxic, thermal hazards of heaters, exhaust gas.

	10 WORKSPACE	11 COMMUNICATIONS	13 FASTENERS, CONNECTORS	15 OPTICS	16 ORIENTATION MODELS
operation.	The area within which the user operates the equipment. Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing areas, consoles and seats. Provides storage for excess clothing, personal gear, weapons and tools. Protects operator from adverse environment, when applicable.	Devices and techniques for communicating information among crewmen within the workspace, between the crew and externally located individuals, and between the crew and remotely located persons. Includes intercoms, where applicable.	Securing devices used to assemble, package or hold on item in place. Catches, hooks, screws, bolts, nuts, latches. Both quick release and tool required. Includes fasteners and connectors for alignment and locking devices such as lock pins, safety wires, pins, nuts, electrical plugs, and fittings.	Components that use the human eye for sighting, aiming or viewing. Includes eyepieces, reticles, filters, sighting mechanisms, range finders, viewers. Includes visual displays.	Components which control the operation of the item. Includes triggers, levers, cranks, etc. Does not include controls on seats, although there is some overlap.
work area of it prevent the information being received. The area of control located.	- Display placement above standing level: surface normal, 41-70° (4-64°); previously, frequently read, 50-65° (14-35°); 21° from centerline. - Controls on vertical surface above floor (seats normal, 34-70° (8-34°); previously, frequently used, 34-53° (8-29°); 21° from user centerline. - With vision over console top critical warning display 22° from above seat. - Work surface at height: standing, 36-41° seated, 29-31°. - User oriented to work site. - Seats fit suitably clothed 5-95th% user without degrading performance. - Arm rests 248° min. - Back, seat have 17° padding. - If von accuracy exceeds 1 hr: ceiling height 78" min. - Lateral work (writing) space: 30x16" (24x16") min. - Standard console: FIG. 10.B.1-3. - For as standing top of console: 25th-75th% (10-15% equipment user); FIG. 10.B.4, 10.B.5, 10.B.6. - Adjustable dimensions fit 5-95th%. - Vertical seat adjustments 15-20" in 1" increments. - Seat backrest reclines 103-115° supports torso as operator's eyes are within 3° of "eye line". - If arms adjust 74-114° above seat. - Seat adjusts fore, aft: 4" min. - Operator does not have to lift self to adjust seat.	- Loudspeakers used to monitor several channels are mounted on least 10° apart radially to operator. - Microphones, headphones, headsets permit hands-free operation. - When several handsets are used, the most frequently, urgently needed is the most accessible. - Accessible volume, gain controls are provided for each channel. - Foot operated "Send-Receive" control when both hands busy. - Earphones, headsets easily adjusted, accommodates 5th-95th% users: FIG. 25.B.6.	- It is impossible to insert a wrong plug into a receptacle. - Plugs, receptacles have clipping pins for insertion. - Aligning pin extends beyond plug electrical pins. - Plugs, receptacles arranged so aligning pins are oriented in the same relative position. - Receptacles placed so that spillage does not cause damage. - Fastener, connector operating parts are easily accessible. - Identical screw, bolt heads provided throughout are removal tool. - Fasteners, heads large enough to be grasped, handled. - Non-interchangeable connectors for different use. - Cutter keys snug fit, large head. - Size, shape coded pins avoid mismatch: FIG. 13.D.1. - Connectors are physically different when lines carry different fluids.	- Optical instruments are oriented to give operator a comfortable angle of view. - Purging, charging fittings are accessible for maintenance. - Components requiring frequent maintenance, special tools are readily accessible. - Inter-pupillary distance between eyepieces adjustable: 50-76 mm. - Eyecups prevent stray light from entering eyes. - Gross (limiting) dimensions based on 95th% (5th%) user: FIG. 25.B.6. - Fastener heads large enough to be grasped, handled. - Entrance pupil: magnification > exit pupil diameter. - Reticle lines: thin enough not to block target; thick enough to be easily seen. - Eyecup specifications: FIG. 15.B.1.	- Controls used only for maintenance adjustment are covered during normal operation but are accessible inside when required. - Foot controls are not used for precise adjustments. - Joysticks for tracking have hand, wrist support.
group viewing information being received. The area of control located.	- Cabinet lock space: 4x6" min. - Console front floor space: min. - Knee room 25x20x18" head min. - Allowances made for heavy clothing, protective equipment. - Seat adjustment overhead clearance from seat post 40" min. - Sufficient clearance for use with gloves, arctic mitts, heavy clothing. - User space not encroached upon by others. - Reflection of instruments, consoles in windows, windshields avoided. - Right-left view angle for wrap-around console: 170° max. - Illumination: FIG. 10.E.1. - Surface colors conform to MIL-STD-1473. - Reflections: FIG. 10.E.3.	- Reach to communication controls is unobstructed. - Workspace accommodates operators wearing earphones, headset. - Radio antenna located to minimize radio-frequency hazards. - Operations possible wearing arctic mitts, arctic headwear. - Color coding used when multiple handlers are visible, available to operator.	- Bolts requiring high torque have an external gripper. - Fasteners, plugs require one turn only to tighten, loosen. - Over 10 ft.-lb. torque use external gripper: below 10 ft.-lb. use internal, external or combo grippers. - Locks disengage, snap action, release, twist up to one full turn for frequent, critical use. - Tighten C/W, loosen CC/W.	7 eyepieces used during low light level viewing that exceeds 1 minute. - Eyes don't have to adjust beyond normal functional ability. - Magnification difference between the two eyes 2% max. - Difference in amount of light between the two eyes 5% max.	- Knobs preferred over screwdriver for frequent adjustment. - Sight means leveling vial supports strong enough to prevent bubble displacement. - Foot pedals rise from a depressed position back up 8" vertically. - Power controller: backlash, dead spot < 2°; operating torque, 5 lb.
airing reliable per second or change values and 5 per second, during integrating patterns with the user's rate.	- Seating compatible with consoles. - Heating, A/C for mobile (permanent) seat work areas: 50° F (45° F) to 85° F, does not discharge on crew. - Ventilation: 30 cu ft./min/man min velocity 100 fpm max. - Effective temperatures: FIG. 10.F.1. - Acoustical environment as not degrade system effectiveness. - Noise levels: FIG. 10.F.2-8. - Room sound absorb coeff 0.20 min. - Whole body vibration limits X, Y, Z: time: FIG. 10.F.9. - Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES. - Impulse noise: FIG. 10.G.1. - Noise duration limits: FIG. 10.G.2. - Hazard alerting device provided. - Illumination adequate. - Equipment guarded if temp exceed: 140° F (120° F if handled). - Exposed edges (corners) rounded: 0.04" (0.5") min radius. - Guards provided on moving parts. - Arctic clothed man not exposed to temp above 60°F; 35-45°F optimal. - Adequate, suitable storage for manuals, worksheets, etc. - Standees have work surfaces to support manuals, etc. - Conspicuous placards adjacent to equipment hazardous to user. - Areas requiring special equipment, clothing are specifically identified. - Emergency procedures detailed. - Instructions kept simple. - Manuals, markings include warnings on toxic, thermal hazards of heaters, exhaust gas.	- Microphones, headphones, single (multiple) speakers: 200-4100 Hz (100-8000 Hz) dynamic range 50 dB min. - Microphone noise cancelling in 100 dB areas 10 dB rms min. - Filtering, clipping is used to improve intelligibility. - Binaural headsets used when ambient noise exceeds 85 dBA. - Volume, gain audible min 110 dB max squelched. - Volume/power control has detent between min volume, off. - Communication equipment worn by operator is comfortable; metal parts do not contact user's skin. - Headsets worn in high ambient noise provide attenuation equal to ear protective devices. - Warning signal intensity does not cause discomfort, "ringing" in the ears. - Exposed metal parts grounded. - System allows emergency messages top priority, does not interfere with their transmission, reception. - Speaker hears own voice in his headset in phase with his speech. - Voice communication intelligibility criteria: FIG. 11.H.1. - Audio signals coded as to maintenance, emergency, health hazard, etc. to minimize operator's visual display search. - Instructions provided for use and fault detection for communications equipment.	- Gross (limiting) dimensions based on 95th% (5th%) operator's hand, arm: FIG. 25.B.4-5. - Adequate space available to grasp connectors firmly. - Adequate space to use connector wrench. - Fasteners to be use are removable. - Connectors are separated by 0.75" (1.25") if used with bare (gloved) fingers. - Mounting screws have clearance holes. - Connectors visible, accessible. - Labels, codes visible in connected, unconnected states. - Easy visual access is provided for starting threads, pins. - ID colors are readily discernible from each other under real operational lighting.	- Eye relief is at least 15 mm. - Eyecups, headsets compatible with helmets, masks, etc. - Line reticles preferred over those with 1, 2 or 3 central spots. - Small cross or circle preferred over dot for reticle. - Ring preferred over a spot for reticle. - Optic components accommodate arctic headwear, headwear.	- Compatible with hardware used. - Self alignment devices provided for remote handled items. - Prevents hose quick, easy insertion, removal of gunning materials. - Placards allow for orientation of data on the printer.
ing reliable per second or change values and 5 per second, during integrating patterns with the user's rate.	- Seating compatible with consoles. - Heating, A/C for mobile (permanent) seat work areas: 50° F (45° F) to 85° F, does not discharge on crew. - Ventilation: 30 cu ft./min/man min velocity 100 fpm max. - Effective temperatures: FIG. 10.F.1. - Acoustical environment as not degrade system effectiveness. - Noise levels: FIG. 10.F.2-8. - Room sound absorb coeff 0.20 min. - Whole body vibration limits X, Y, Z: time: FIG. 10.F.9. - Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES. - Impulse noise: FIG. 10.G.1. - Noise duration limits: FIG. 10.G.2. - Hazard alerting device provided. - Illumination adequate. - Equipment guarded if temp exceed: 140° F (120° F if handled). - Exposed edges (corners) rounded: 0.04" (0.5") min radius. - Guards provided on moving parts. - Arctic clothed man not exposed to temp above 60°F; 35-45°F optimal. - Adequate, suitable storage for manuals, worksheets, etc. - Standees have work surfaces to support manuals, etc. - Conspicuous placards adjacent to equipment hazardous to user. - Areas requiring special equipment, clothing are specifically identified. - Emergency procedures detailed. - Instructions kept simple. - Manuals, markings include warnings on toxic, thermal hazards of heaters, exhaust gas.	- Microphones, headphones, single (multiple) speakers: 200-4100 Hz (100-8000 Hz) dynamic range 50 dB min. - Microphone noise cancelling in 100 dB areas 10 dB rms min. - Filtering, clipping is used to improve intelligibility. - Binaural headsets used when ambient noise exceeds 85 dBA. - Volume, gain audible min 110 dB max squelched. - Volume/power control has detent between min volume, off. - Communication equipment worn by operator is comfortable; metal parts do not contact user's skin. - Headsets worn in high ambient noise provide attenuation equal to ear protective devices. - Warning signal intensity does not cause discomfort, "ringing" in the ears. - Exposed metal parts grounded. - System allows emergency messages top priority, does not interfere with their transmission, reception. - Speaker hears own voice in his headset in phase with his speech. - Voice communication intelligibility criteria: FIG. 11.H.1. - Audio signals coded as to maintenance, emergency, health hazard, etc. to minimize operator's visual display search. - Instructions provided for use and fault detection for communications equipment.	- Number, types, minimum communication rate with stress, banding required. - Captive fasteners used where dropping them creates hazard; covers need frequent removal. - Bolts have min number of turns. - Only standard tools are used. - Adapters for pin connectors can be hand tightened. - Fasteners used outside are operable under all environmental conditions. - Connectors are compatible with cables, lines, fasteners, mounting. - Removal of plug, connector does not expose hot leads. - Plug of one voltage rating cannot be inserted into the receptacle of another voltage rating. - All hot contacts are sockets. - Internal-gripheads only use when critical to mechanical function, personnel safety. - Use captive type dust covers where necessary. - Caps, inserts, covers, cases, shields provided where necessary. - Receptacles marked as to voltage, phase, frequency. - Connecting plugs, receptacles identified by color, size. - Plugs, receptacles have stripes, arrows, etc. to show aligning pin positions. - Manner of connection obvious. - Non-standard operating direction is clearly marked. - Plug, receptacle identification: FIG. 13.H.1.	- Optics are illuminated for night, twilight operations. - Illumination: over blue color not used; dimming or dark level remains fixed under vibration. - Level vials, scales, pointers are readily visible, illuminated for low light condition use. - Lighting minimally affects the dark adaptations of observer. - Luminous transmission exceeds 50%; parallel limited. - Filters used for high light levels. - Adjustment of eyes beyond normal ability is not required. - Magnification is high enough for required applications. - Resolutions: 60 sec of arc min. - Oculars are matched pairs. - Instruments needing steady eye usage have brow pads. - Level vials, scales, pointers are protected from damage. - Focusing: 4 to 12 diopters for over 4-power.	Tracking control movement is compatible with expected, conventional control movements.
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TEST FUNCTION _____

TEST ITEM CLASS V _____

SUBCLASS A _____

OBJECTIVE: Evaluate the effectiveness and safety of the design of maintenance and repair equipment and systems to enable the user to prepare the item, prepare the work-site, and perform maintenance and repair. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use of the item.

1.
2.
3.

PREPARE ITEM		
UNSTOW/CONFIGURE	EMPLACE/POSITION AT WORKSITE	
PURPOSE: Evaluate the design of the test item and procedural guidance for ease of assembly and disassembly of item elements. MAN/ITEM TASKS Identify parts. Unstow parts. Layout/display parts. Align/adjust parts. Make connections. Assemble parts. Make subassemblies. Prepare rig. Read instructions.	PURPOSE: Evaluate the design of the test item for moving and positioning at the worksite. MAN/ITEM TASKS Move assembly. Position/orient components. Emplace at worksite. Locate components at worksite.	PURP design mani nomic MAN/ Take Adju Set u Prep Sele Part Read Prep Lead

Test Item Components HUMAN FACTORS CONSIDERATIONS	INDEX TO DET					
	Labels Manuals Markings (1)	Lines Hoses Cables (12)	Fasteners Connectors (13)	Handles (14)	Operating Elements (15)	Lab Mark (16)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B
C. DIRECTION & FORCE	C	C	C	C	C	C
D. CLEARANCE	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H

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The sex-tuning of a component as it affects the action of the operator to reach, operate or manipulate it, including location of openings (inlets), valves or other operation, location of components (knobs, levers, etc.) and its relationship to other components.

The first means of determining the essentiality of components that are required for the complete repair, are isolating the effects of both structural and functional changes together, like sensory function, and the shape and position of the fingers, wrist and other parts of the hand with the tool. In this way, the use of the component

The maximum end-of-force required to pull force generally manipulate a component, usually, a control, fastener, etc), with emphasis on the direction of pull on corresponding to the display, component, fastener reaction or standard practice as well as the maximum strength required.

The concentrated space surrounding a movement which allows the operator to perform required actions, the envelope of which varies as a function of the amount of body involved (head, fingers, arm, torso, etc.), and, where appropriate, will also take considerations such as obstacles, threats, weapons, protective clothing, etc.

These aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

These aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace are:

These aspects of a component that could cause injury to the operator or other personnel, including preventative aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, toxicity, radiation and pressurization hazards, and danger to sight and hearing, particularly under the condition of direct or hostile stress.

These operational and informational needs often lead to improving management systems or to the development of new technologies or methods. For example, the need for better forecasting methods may lead to the development of new forecasting techniques, such as the use of artificial neural networks or fuzzy logic.

- Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instructional plates.
- Make operator aware of hazards.
- Give special guidance or instructions.

- * Controls, displays, etc are clearly appropriately labeled except where use is obvious.
- * Labels placed on or near items they identify.
- * Labels cover other information.
- * Label is not behind control.
- * Label location not obscured.
- * (3) Label: not consistent by components; on flat/straight surface; on main chassis; min coverage by grimes; not easily removed.
- * Character height determined by distance read; luminance: FIG 1.B.1.
- * Group label characters larger than those of controls, displays which are placed on control, display position characters: each by 25% more.
- * Letter, numeral styles: FIG 1.B.2.4.
- * Height/width ratio: 5/3; "M" is 1 stroke width wider; "K" is 1 stroke wider; "A" is 1 stroke wider.
- * Letter, numeral label characters on light (background) background: 1/6 (1/7-1/8) of height.

- Spacing between characters (word): one stroke (character) with min. Line spacing: 1 character height.
- Counter numeral: how ratio = 1:1
- Stroke width: 1/16 to 1/8 inch
- (Optical projections) all caps, stroke width 1/16 to 1/8 h exceeds 15 minutes visual angle.
- Thumbwheel numeral: how ratio = 3:2; h character width internally (usually) illuminated = 10:15.
- Abbreviations all caps, no periods.
- Extended cap uses lower case.
- Label characteristics determined by illumination:
 - Labels visible, accurately read at operational reading distance, vibration, light levels, environments.
 - Labels are sharp with high or color contrast.
- With illumination above 10 f-c: black letters, light background.
- Dark adaptations: letters visible, do not interfere with night vision.

- Labels characteristics accuracy required; time/availability; distances; light level; color; criticality of function; consistency of design.
- Labels on production equipment are as critical as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.
- Common nomenclature.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Warning placards illuminated.
- Warning placards clear, directly characterizable, larger than any following instruction.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-112); new OK if obvious.
Trade names, irrelevant info do not appear on labeling.
Labels concise; min redundancy.
Abstract symbol only if meaningful.
Words familiar to user.
Fund group areas identified.
Axes of graphs labeled and graduated appropriately.

Components that provide visual and auditory information to the operator concerning the status of operation.

Provide positive indication of developing or current malfunctions.

Displays are associated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Functionally related units grouped.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Displays located so they can be read without head or eye movement.
- Lighted control indicators are unambiguously associated with controls.
- Emergency, critical, important displays located in 30° cone about line of sight.
- Pointer viewing distance: 13-18".
- Pointer extends to but does not obscure or exceed index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- **Examples:** flags, pointers, plotters: FIG. 8.B.1.
- **CN Target visual angle:** resolution: 2.0 arc min; limits of resolution: distance 16" (10° min).

- Display face to line of sight exceeds 45°; min parallax, reflection.
Frequently used displays grouped in optimal visual zone: FIG 8.E.1.
Illumination uniform: FIG 8.E.3
Indicator lights show response, used sparingly, visible.
Contrast, luminance exceeds 50%.
Flashing lights: 3-5 flashes/sec.
Color coding used where possible; unused scales covered.
Display pointer tip same color as display.

- Display precision, response is consistent with that of system.
Information displayed: Clear, specific, precise, usable; not redundant, degraded by vibration timing.
Lights show functions: FIG.B.F.1.
Seating: 2 seats, start at 0, use numbers 1-2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 82

- Display pointers are aligned for common stable values.

- Stacked, - alternately presented legends visible.
- Illumination balanced full on to off.

- Display changes represent functional state.
- Transilluminated other displays: Display B.F. A-5.
- Transilluminated indicators display system status, immediate action or status functions.
- Circular dials: Display B.B.2.
- Opening and maintaining information not combined unless compatible for both uses.
- Priority information obvious.
- All free displays have test device.
- All free displays volume adjustable.
- Present information obvious.

- 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

- The area within which the user operates the equipment.
- Includes space for controls, displays, optics, electronic devices, weapons and windows as well as standing area, consoles and seats.
- Provides storage for excess clothing, personal gear, weapons and tools.
- Protects operator from adverse environment, when applicable.

- Display placement above stand (rotated) surface: normal, 41-70° (46°), precisely, frequently read, 5-65° (4-35°), ± 21° from centerline.
- Controls on vertical surface above floor (seated) normal, 36-70° (8-34°), precisely, frequently used, 34-5 (8-29°), ± 21° from very centerline.
- Work surface heights standing, 36-64°; seated, 29-31°.
- User oriented to work site.

- Seats fit suitably clothed 5-95th percentile men without degrading performance. Arm rests: 20° min. Back rest: seat have 1 min padding. If an occupant exceeds 1 h ceiling height 78" min. Latent work (writing) space: 30x16 (24x16) and min. Standard cargo load: FIG.10.3.1-3. Standard cargo dimensions limited to 95th% (55th%) cargo: FIG.25.B.1-2. Adjustable dimensions fit 5-95th%.
- Vertical seat adjustments: 15-27" in min increments. Seat backrest reclines 103-115° as seat bases turn so operator's eyes are within 3" of "eye-line". If arms adjust 7"-11" above seat. Seat height: 18"-24" after 4 min. Operator does not have to lift or to adjust seat.

- 10.D.1-2.
- Cabinet light spaces 4 in. had min.
Canister floor space 4 in.
Knee room 25 in. 20 in. had min.
- Allowances made for heavy clothing
protective equipment.
Seat adjustment overhead clearance
from seat pan 60 in.
- Sufficient clearance for use with
gloves, arctic mitts, heavy clothing.
User space not encroached upon by
others.
- Right-left viewing angle for wrap
around consoles 190° max.
Illuminations FIG 10.E.1.
Surface colors conform to MIL-STD-
1473.
Reflectances FIG 10.E.3.

- Operating continuously with fans on.
Moisture: A/C for multiple (30 min) at
50% fan duty worst case 50° F (65° F) to
85° F, does not discharge on control.
Ventilations: 30 cu ft/min/man min v.
velocity 100 ft/min man.
E-Effective temperature FIG 10.G.1.
Illumination: 100 foot candles, does not de-
grade system effectiveness.
Noise levels: FIG 10.F.2-8.
Moisture body vibration limit X, Y, Z,
linear FIG 10.F.9.
- Exposure to gases, fumes, toxicity
see THRESHOLD LIMIT VALUES.
Impulse noise FIG 10.G.1.
Noise duration limits FIG 10.G.3.
Illumination adequate.
Equipment guarded if temp exceeds
140° F (120° F) if handled.
Exhaust: 100 ft/min, safety control rounds
0.06" (0.59 mm) safety control rounds
Controls serviced on routine basis.

- Adequate, suitable storage for manuals, worksheets, etc.
- Standees have work surfaces to support manuals, etc.
- Conspicuous placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.
- Instructions kept simple.
- Manuals, markings include warnings on toxic, thermal hazards of

All c
vents, e
test item
Plugs
tings for
Includ
wall on A

- Console held by
- Long equipment
- Test panel
- Display
- Reels, large,
- Covers
- Line, 1 mile in
- Cables function
- Various
- Electr
- Cables
- Similar

- Hand used to
- Tighten

- Adequate cables
- Clear frost
- 1 mile, able to

- Line, with 6
- Mirror is about

- Normalized
- Cable
- Irregularities
- Cable
- Lids, 1
- Cable
- Tested
- Protected

- Pipes 140°F
- High chain
- Auto equipment
- Electric lines

- Multip
• Cable
ment,
Lines
first to
Line c
FIG 12
Dange
Hydrog

DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation. Provide positive indication of developing or current malfunctions. Displays are associated only with the item under test, not with equipment control or on it.

Display relationship to control is up-
erly determines control used, e-
ment displayed, relationally related units grouped.
Displays, groups have left-to-right
d/or top-to-bottom order of use.
Displays located so they can be read
the required degree of accuracy.
Shifted control indicators are un-
quously associated with a func-
tion, warning, critical, important func-
tions located in 80° cone of vision
sight.
Display viewing distance is 13-28".
Inter-extends to but does not ob-
scure or exceed index mark with-
in 10° of centerline.
Indicators are close to dial to elimi-
nate parallax, shadows.
Numbers, flags, pointers, plotters:
2.8.8.1.
"T" target visual angle exceeds 2.0
mils, 10 lines of resolution dis-
tance 14" (10° min).

Display face to line of sight exceeds
1 min parallax, reflection.
Display used displays grouped in
normal visual zone: FIG 8.F.1.
Indication uniform: FIG 8.F.3
Color lights show response, used
ringly, visible.
Contrast, luminance exceeds 50%.
Jung lights: 3-5 flashes/sec.
or coding used where possible;
red scales covered.
Display pointer tip same color as
text.
Display precision, response is charac-
teristic with that of system.
Information displayed: Clear, speci-
fically, unambiguously not redundant,
defined by vibration; timely
its show functions: FIG 8.F.1.
Text: linear, start at 0, use whole
bars, 2 pointers max, numerals
aligned upright.
Alphanumeric types: FIG 8.F.2.
Signal evaluation: FIG 8.F.3.
Verbal warnings: 20 dB min
background.
Warning immediately apparent.
Absence does not mean "go".
Color light color coding for
emergency, warning, summation, etc.
8.F.1; master lights set apart.
Warnings transmitted to both
horns and work area.
Signal action segment specifi-
cally of problem.
Indicated, persistent signals are not:
FIG 8.G.1.
Warning duration min of 1/2
until corrective action taken.
Alarm decoding required.
Unambiguous, irrelevant information
not appear on panel face.
Sign techniques uniform for dis-
crimination, identification,
analysis, criticality.
Color displays used when vision
is deficient, degraded; redomance
color warning, red needed.
Warnings intelligible, opti-
mal; warnings use standard signals;
functional; basic; well in-
cluded in size.

* Display pointers are aligned for
common stable values.

* Stacked, alternately presented
legends visible.
* Illumination balanced full on to off.

* Display changes represent func-
tion state.
* Transilluminated other displays:
FIG 8.F.4-5.
* Transilluminated indicators display
system status, immediate actions
or status functions:
* Circular dials: FIG 8.B.2.
* Graphic and maintain information
not combined unless compat-
ible for both uses.
* Priority information obvious.
* Auditory displays have test device.
* Auditory displays: volume adjust-
able.
* Priority information obvious.

10 WORKSPACE

The area within which the user op-
erates the equipment.
Includes space for controls, displays,
optics, electronic devices, weapons
and windows as well as standing areas,
consoles and seats.
Provides storage for excess clothing,
personal gear, weapons and tools.
Protects operator from adverse en-
vironment, when applicable.

* Display placement above standing
surface: normal, 41-70" (6-
46°); precisely, frequently read, 50-
65" (14-35°); 21° from centerline.
* Controls on vertical surface above
floor (seal) normal, 34-70" (8-34°);
precisely, frequently used, 34-53"
(8-29°); 21° from user centerline.
* Work surface height: standing, 34 ±
1 1/2" seated, 29-31".
* User oriented to work site.
* Seats fit suitably clothed 5-95th%
user without degrading performance.
* Arm rests 240° min.
* Back seat height 1" min padding.
* If van occupancy exceeds 1 hrs
ceiling height 78" min.
* Lateral work (writing) space 30x16"
(24x16") wide min.
* Standard console FIG 10.B.1-3.
* Gross (limiting) dimensions based on
95th% (5th%) user: FIG 25.B.1-7.
* Adjustable dimensions fit 5-95th%.

* Vertical seat adjustment 15-21" in 1"
max increments.
* Seat backrest reclines 103-115°, sup-
ports torso so operator's eyes are
within 3° of "eye-line".
* If arms adjust 78-111° above seat.
* Seat adjusts fore, aft 4" min.
* Operator does not have to lift self
to adjust seat.
* Workspace anthropometrics: FIG
10.D.1-2.
* Cabinet kick space 4x4" hnd min.
* Console front floor space 4" min.
* Knee room 25x20x18" hnd min.
* Allowances made for heavy clothing,
protective equipment.
* Seat adjustment overhead clearance
from seat pans 40" min.
* Sufficient clearance for use with
gloves, arctic mitts, heavy clothing.
* User space not encroached upon by
others.

* High-left viewing angle for wrap-
around displays: FIG 10.E.1.
* Illumination: FIG 10.E.1.
* Surface colors conform to MIL-STD-
1473.
* Reflectance: FIG 10.E.2.
* Seating compatible with consoles.
* Heating, 1°C for mobile (permanent)
detail seat area: 50° F (10° F) to
85° F, does not discharge on crew.
* Ventilation 30 cu/min/man min ve-
locity 100/min max.
* Effective temperature: FIG 10.F.1.
* Acoustical environment does not de-
grade system effectiveness.
* Noise levels: FIG 10.F.2-8.
* Whole body vibration limits: X, Y, Z,
time: FIG 10.F.9.

* Exposure to gases, fumes, toxicity
see THRESHOLD LIMIT VALUES.
* Impulse noise: FIG 10.G.1.
* Noise duration limits: FIG 10.G.3.
* Illumination adequate.
* Equipment guarded if temp exceeds
140° F (120° F if handled).
* Exposed edges (corners) rounded
0.04" (0.5° min radius).
* Guards provided on moving parts.

* Adequate, suitable storage for man-
uals, worksheets, etc.
* Standard work surfaces to support
manuals, etc.
* Conspicuous placards adjacent to
equipment hazardous to user.
* Areas requiring special equipment,
clothing are specifically identified.
* Emergency procedures detailed.
* Instructions kept simple.
* Manuals, markings include warnings
on toxic, thermal hazards of
heaters, exhaust gas.

12 LINES, HOSES, CABLES

All cables, wires, lines, hoses, pipes,
vents, etc. that pass from or to the
test item.
Plugs, sockets, quick-disconnect fit-
tings for the above.
Includes components for transport as
well as for stationary use.

* Conductors are bound into cables,
held by facing tape.
* Long conductors, cables internal to
equipment are clamped to chassis.
* Test cables terminating on control
panel do not interfere with controls,
displays.
* Reels, reel carts provided to handle
large, heavy, long lines, cables.
* Covered space for cable storage.
* Line, cable attachment parts reach-
able by user in bulky clothing.
* Cables are long enough to allow
functioning unit to be checked con-
veniently or extension cables pro-
vided.
* Covered space for cable storage.
* Line, cable attachment parts reach-
able by user in bulky clothing.
* Cables are long enough to allow
functioning unit to be checked con-
veniently or extension cables pro-
vided.
* Covered space for cable storage.
* Line, cable attachment parts reach-
able by user in bulky clothing.

* Hand operation or common tools
used to tighten, loosen.
* Tighten CW; loosen CCW.

* Adequate space provided to handle
cables, lines, hoses.
* Clearance between cables & con-
trols: 3" min.
* Cable, line, hose connectors oper-
able by user wearing arctic mittens.

* Line, hose, cable color contrasts
with background.
* Manner of connection, disconnection
is obvious.

* Number of inputs, outputs are mini-
mized by grouping functions.
* Cables are reachable, visible.
* Irregular, fragile, awkward exten-
sions removable for handling.
* Cables are not pinched by doors,
lids; walked on, used as handholds;
bent, twisted repeatedly.
* Cables routed thru holes are pro-
tected by grommets, etc.
* Protective caps, covers, inserts are
available as necessary.

* Plugs, hoses guarded if temp over
140° F (120° F if handled).
* High pressure lines have retaining
chain attached to line and source.
* Automatic shutoffs on fuel service
equipment to prevent overflow, spill-
age.
* Electric wiring routed away from
lines carrying O₂, flammable fluids.

* Multiple conductors color coded.
* Cables labeled as to which equip-
ment, connector they belong.
* Lines labeled as to function, sub-
function, hazard, flow: FIG 12.H.1.
* Line color (symbol) (hazard) codes:
FIG 12.H.2 (12.H.3) (12.H.4).
* Dangerous voltage placarded.
* Hydraulic, electric: FIG 12.H.5-6.

13 FASTENERS, CONNECTORS

Securing devices used to assemble,
package or hold an item in place.
Catches, hooks, screws, bolts, nuts,
latches - both quick release and tool
operated.
Includes fastener and connector al-
ignment and latching devices such as
lock pins, safety wires, pins, nuts,
electrical plugs, and fittings.

* It is impossible to insert a wrong
plug into a receptacle.
* Plugs, receptacles have aligning pins
for insertion.
* Aligning pin extends beyond plug
electrical pins.
* Plugs, receptacles arranged so align-
ing pins are oriented in the same
relative position.
* Fastener, connector operating parts
are easily accessible.
* Alignment aids, self alignment of
parts for fastening.
* Identical screw, bolt heads provided
throughout; one removal tool.
* Fastener handles large enough to be
grasped, handled.
* Non-interchangeable connectors for
different use.
* Cotter keys snug fit, large head.
* Size, shape coded pins avoid mis-
match: FIG 13.H.1.
* Connectors are physically different
when lines carry different fluids.

* Bolts requiring high torque have an
external griphood.
* Fasteners, plugs require one turn
max to tighten, loosen.
* Over 10 ft.-lb. torque use external-
griphood; below 10 ft.-lb. use inter-
nal, external or combo griphoods.
* Quick disconnect, snap actions,
release, twist, up to one full turn
for frequent, critical use.
* Tighten CW; loosen CCW.

* Gross (limiting) dimensions based on
95th% (5th%) operator's hand, arm:
FIG 25.H.4-5.
* Adequate space available to grasp
connectors firmly.
* Adequate space to use connector
wrench.
* Obstructions to use are removable.
* Connectors are separated by 0.75"
(1.25" if used with bare (gloved)
fingers).
* Connectors easily reached by user in
bulky, restrictive clothing.
* Connectors visible, accessible.
* Labels, codes visible in connected,
unconnected state.
* Easy visual access is provided for
starting threads, pins.
* ID colors are readily discriminable
from each other under real opera-
tional lighting.

* Captive fasteners used where drop-
ping them creates hazards; covers
needed frequent removal.
* Bolts have min number of turns.
* Only standard tools are used.
* Adapters for pin connectors can be
hand tightened.
* Fasteners used outside are operable
under all environmental conditions.

* Removal of plug, connector does not
create hot leads.
* Plug of one voltage rating cannot be
inserted into the receptacle of
another voltage rating.
* All hot contacts are sockets.
* Internal-griphood only use when
critical to mechanical function, per-
sonnel safety.
* Use captive type dust covers where
necessary.
* Caps, inserts, covers, cases, shields
provided where necessary.

* Receptacles marked as to voltage,
phase, frequency.
* Connecting plugs, receptacles iden-
tified by color, size.
* Plugs, receptacles have stripes, ar-
rows, etc to show aligning pin po-
sition.
* Manner of connection obvious.
* Non-standard operating direction is
clearly marked.
* Plus, receptacle identification: FIG
13.H.1.

14 HANDLES

The special or inherent de-
sign to grasp, hold, grip or lift a
lifting, moving, steadying or
handling, knobs, projectors,
etc.

Involves roughness or no
face when used for handling.
Check also for the lack of

* Handles on cabinets, ca-
recessed.
* Handles, grasp areas re-
lative to the CG.
* Hinged, fold-out handles h-
position; one hand operat-
* Handles located so that li-
min distance from body.
* Lift points on large items
distant from the CG.
* Handles provided to remain
- Handles are on front of or
is pulled from a rack.
* Bar, T-bar, J-bar, recess
FIG 14.B.1.
* Two handles min, or on
grasp area for units 10 lb.
- Hand shaped handle use
carried frequently or
periods.
* Handles reachable by 5
wearing bulky, restrictive

* Weight limits for one ma
14.C.1; if shape is conver-
dies are provided, lift
peated, item is not carrier
Horizontal push, pull for
FIG 14.C.2.
* Handle, grasp area force
6.C.1.
* Two-man lift values are
man lift only if item can
conveniently; neither ma
one-man limit.

* Handles have at least 25°
from obstructions.

* Handles color coded to
from similar shaped items
Handles are visible from
ing, lifting position.

* Hand grips have nonslip su-
Removable, carried unit
with handles, other suite
for grasping, handling, car-
Handles do not interfere
ing or maintaining item.
Carried item will ride ch
of personnel.
* Handles, lugs, push bars i-
next parts of equipment o
personnel, entangle cloth
age equipment.
* Handle/grasp surfaces
thermally/electrically car-
Edges rounded attach
recessed.

* Items exceeding one ma
14.C.1) are labeled with i-
limits.
* Hand grasp areas identifi-

ires, lines, hoses, pipes,
all pass from or to the
is, quick-disconnect fit-
ers.
parents for transport as
inary use.

Irreversible fastener and connector alignment and latching devices such as buck pins, safety wires, pins, nuts, electrical plugs, and fittings.

The special or inherent devices used to grasp, hold, grip or lift an item for lifting, moving, steadying or aiming. Handles, knobs, projections, straps, etc.

Involves roughened or non-slip surface when used for handling.

Check also for the lack of handles.

Components which control the operation of the item.
Includes triggers, fuses, cranks, etc.
Does not include controls as such, although there is some overlap.

Includes special maintenance equipment such as lubrication points, pouring spouts, filter tubes and nozzles.

are bound into cables, 4 tops.
lers, cables internal to a clamped to chassis.
terminating on control
interfere with controls,
arts provided to handle
long lines, cables.
e for cable storage.
Hardware parts reach-
bulky clothing.

long enough to allow
it to be checked con-
extension cables pro-
gress size, shape coded.
ize, shape coded for
rents.

on of certain facts
3, loose.
loose CCW.

are provided to handle
uses.
between cables & con-
nectors are.

able color contrasts
section, disconnection

- its outputs are mini-
ing functions.
- hable, visible.
- is, awkward exten-
: for handling.
- 1 pinched by doors,
4 used as handhold;
pestered.
- thru holes are pre-
nets, etc.
- 4 covers, inserts are
easy.

carded if temp over
handled).
lines have retaining
a line and source.
offs on fuel service
event overflow, spil-
routed away from
flammable fluids.

fers color coded,
as to which equip-
ment they belong.
s to functions, sub-
flows FIG 12.H.1.
Dedicated (hard) codes
(3) (12.H.4).
re placed.
let FIG 12.H.5-6.

- It is impossible to insert a wrong plug into a receptacle.
- Plugs, receptacles have aligning pins for insertion.
- Aligning pin extends beyond plug.
- Aligning pins are of different sizes.
- Plugs, receptacles arranged so aligning pins are oriented in the same relative position.
- Fastener, connector aligning parts are easily accessible.
- Alignment aids, self alignment parts for fasteners.
- Identical access, both heads provided throughout are removed fast.
- Fasteners are large enough to be gripped, handled.
- Non-interchangeable connectors for different use.
- Collar keys: snug fit, large head.
- Size, shape coded pins avoid misalignment.
- Connectors are physically different when lines carry different fluids.

- Tools requiring high torque have an external-griphead.
- Wrenches, plugs require one turn max to tighten, loosen.
- Over 10 ft.-lb. torque use external-griphead; below 10 ft.-lb. use internal, external or combi gripheads.
- Quick disconnect, snap actions, release, twist up to one full turn for frequent, critical use.
- Tighten CCW; loosen CCW.

- Grasp (firming) dimensions based on 95th/50th operators' hand, arms fig 23.14-5.
- Adequate space available to grasp controls safely.
- Adequate space to use connector wrench.
- (Restrictions to use are removable, connectors are separated by 0.75" (1.25") if used with bare (gloved) fingers).
- Connectors easily reached by user in bulky, restrictive clothing.
- Connectors visible, accessible.
- Labels, code's visible in connected, unconnected state.
- Easy visual access is provided for sharing threads, pins.
- Colors are readily discriminable from other under real operational conditions.

- Captive fasteners used where dropping them creates hazards; covers need frequent removal.
- Belts have min number of turns.
- Only standard tools are used.
- Adapters for pin connectors can be hand tightened.
- Fasteners used outside are operable under all environmental conditions.

- Removal of plug, connector does not require hot leads.
- Plug of one voltage rating cannot be connected into the receptacle of another voltage rating.
- All hot contacts are sockets.
- Internal-graphoids: only use when critical to mechanical function, permitted.
- Use captive type dust covers where necessary.
- Caps, inserts, covers, coats, shields provided where necessary.
- Receptacles identified as to voltage, phase, frequency.
- Connecting plugs, receptacles identified by color, size.
- Plugs, receptacles have stripes, arrows, etc to show aligning pin positions.
- Manner of connection obvious.
- Non-standard operating direction is clearly marked.
- Plugs, receptacle identifications FIG 10-10.

- Handles on cabinets, canisters are recessed.
- Handles, grasp areas are located relative to the CG.
- Hinged, fold-out handles have a stop position for one hand operation.
- Handles located so that lifting is in mid distance from body.
- Lift points on larger items are equidistant from the CG.
- Handles provided to remove cover.
- Handles are in front of an item if it is pulled from a rack.
- Bar, T-bar, J-bar, recessed handles: FIG 14.8.1.
- Two handles min. or one handle/grasp area for units 10 lbs. or more.
- Hand shaped handle used on item carried frequently or for long periods.
- Handles reachable by 5th% user wearing bulky, restrictive clothing.

- Weight limits for one man lifts: FIG 14.C.1; if shape is convenient, handles are provided, lift is not repeated, item is not carried.
- Horizontal push, pull force limits: FIG 14.C.2.
- Handle, grasp area force limits: FIG 14.C.1.
- Two-man lift values are twice one-man lift only if: item configuration convenient; neither man exceeds one-man limit.

- Handles have at least 2½" clearance from obstructions.

- Handles color coded to distinguish from similar shaped items.
- Handles are visible from the grasping, lifting position.

- Hand grips have nonslip surface.
- Removable, carried units provided with handles, either suitable means for grasping, handling, carrying.
- Handles do not interfere with operating or maintaining item.
- Carried items will ride clear of legs of personnel.
- Handles, lugs, push bars are permanent parts of equipment case.
- Removable handles do not injure personnel, entangle clothing, damage equipment.
- Handle/grasp surfaces are not thermally/electrically conductive.
- Edges rounded; attaching screws recessed.

- Items exceeding one man lift (FIG 14.C.1) are labeled with weight, lift limits.
- Hand cross areas identified.

- Controls used only for maintenance, adjustment are covered during normal operation but are accessible, visible when required.
- Foot controls are not used for precise adjustments.
- Lift, attachment points accessible, equidistant from CG.

- Safety catches have a distinctive shape, location.
- Shape, size is aid to function.

- Units frequently pulled out of installed position mounted on pullout racks, slides, hinges.
- Rollouts provided with limit stops.
- Use of pullouts does not shift CG of item so entire rack, console falls.
- Knobs preferred over screwdriver for frequent adjustment.

- Compatible with handwear used.
- Self alignment devices provided for remotely handled items.
- Full hand, tool clearance at all fastening points.
- Moving components have 2" hand clearance throughout range.

- Tie-down points visible for checking.
- Operated elements must be visible when accessed, especially if hazards present.
- Elements that are mated are color or shape coded.

- Hoist points provided for mechanical lifting.
- Frequently used elements are within easy reach of seated or standing station position.
- Special tools for handling, tie-down are avoided.

- Internal controls are not located near high voltage, rotating machinery, other hazards.
- Handles, lift points distributed evenly.
- Projections, edges, corners around tie down or lift points are rounded, padded, or eliminated.
- Electrical, thermal, mechanical hazards near location where user's hand must access are shielded.
- Safety catches have positive action, attend.
- CG, weight of equipment marked, where applicable.
- Weight capacity indicated on all lifting equipment.
- Items exceeding one-man lift value, labeled as to weight, lift limitation.
- Control warning label located near
- Air dropped items have quick release capability.

- Cables terminating on control, display panels do not interfere with controls, displays.
- Test points reflect the sequence for sequential testing.
- Test points for adjustment are close to the controls, displays used.
- Special tools required for adjustment are with equipment.
- Test points are accessible.
- Test points, built-in meters used to isolate failed unit, module.

- Limiting body dimensions based on 5th% user for reaching test position: FIG 25.B.1.
- Sensitive adjustment points have a hand, arm rest nearby if vibration is present during adjustment.
- Cables are long enough to check unit in place.
- Braces hold hinged assays in working position.
- Test equipment fits the hand or has handle, hand support.

- Calibration, adjustment controls with limited motion have mechanical stops to prevent damage.
- Built-in aligning devices, other aids are used for positioning optical assemblies within instrument.
- Rollout racks do not shift CG to extent that console topples.
- Quick-release removal for optics.
- Stands, casters (wheels, hoist-lifting) is provided for equipment exceeding 30 lb (90 lb).

- Adequate storage provided in portable test equipment case, lid to contain tools, probes, spares, manuals, tools.
- Large parts are not mounted to deny access to smaller ones.
- Sufficient space provided for test equipment, tool use without difficulty, storage, and access.
- Equipment purging, charging fittings are accessible.
- Sensitive adjustment points, guarded against accidental disturbance.
- Indication of equipment power failure provided.
- Display provided to show equipment out-of-tolerance, failure.
- Test, adjustment, check point and cables, connectors, labels are accessible, visible during maintenance.
- Positive indication of open fuse.
- Test area and adjustment points have mechanical shaft guide.
- Test equipment has panel lighting.

- Enough test points are provided to prevent removing sub-assemblies.
- Special tool use minimized.
- Items to be removed for tests are mounted on rollout racks, slides, hinges.
- Knobs preferred to screwdriver for frequent adjustment.
- Lamp test circuits incorporated.
- Lamp replacement is possible with power on, from panel front.
- Test equipment is not overly complex, difficult to use.
- Electrical potentials over 300V are stepped down for test points.
- Tools, test leads used near high voltages are insulated.
- Electrical hand-held tools have 3-wire power with ground or are dual-grounded.
- Exposed surfaces of electrical hand-held tools are non-conducting or grounded.
- Contacts, terminals are shielded with suitable protective measures to prevent accidental contact.
- Test points permanently labeled, color coded.
- Operating instructions for portable test equipment affixed to unit, lid or compartment.
- Calibration reminder included with test instructions.
- Contacts, terminals, etc over 500V are clearly labeled.
- Reference scale is provided for control adjustment.
- A visual check shows when equipment is out of calibration.

- Design Requirements (MIL-STD-1472)
- User-Computer Interface Data (MIL-STD-1472C)
- Guidance Data (MIL-HDBK-759, Etc.)

TEST FUNCTION _____

TEST ITEM CLASS V _____

SUBCLASS B _____

MATERIEL PRODUCT _____

OBJECTIVE: Evaluate the effectiveness and safety of the design of materiel production and environmental control systems and equipment to enable the operator to assemble and set up the item, prepare it for use, and actually use it. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use.

The conditions apply

1. User conditions - b
2. Environmental conditions
3. Operational conditions - rates, types of mix and time critical a

ASSEMBLE/SET UP		PREPARE FOR USE	
ASSEMBLE/DISASSEMBLE	EMPLACE	ALIGN/CALIBRATE/ADJUST	
PURPOSE: Evaluate the design of the test item for ease and safety of assembling component parts and for the procedural guidance provided. MAN/ITEM TASKS Unstow/stow components. Read/interpret instructions/technical manuals. Identify parts. Connect components. Mate components to chassis.	PURPOSE: Evaluate the design of the test item for ease of situating the item in its use area and connecting vent pipes, power cables, liquid hoses and pipes. MAN/ITEM TASKS Install subassemblies. Make connections. Position for use.	PURPOSE: Evaluate the design of the test item for ease and reliability of performing alignment and calibration of operating components. MAN/ITEM TASKS Interpret technical manual/labels. Tighten/loosen fasteners. Set/adjust controls.	PURPOSE: Evaluate the design of the test item for ease of obtaining of materiel. MAN/ITEM TASKS Determine s Open/close Remove/rep

INDEX TO DETAILED DESIGN CONSIDERATIONS

Test Item Components HUMAN FACTORS CONSIDERATIONS	Labels Manuals Markings (1)	Fasteners Connectors (13)	Handles (14)	Lines Hoses Cables (12)	Fastener Conne- ctors (13)	Handles (14)	Controls (6)	Displays (8)	Workspace (10)	Fasteners Connectors (13)	Display (8)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B	B	B	B	B
C. DIRECTION & FORCE	C	C	C	C	C	C	C	C	C	C	C
D. CLEARANCE	D	D	D	D	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H	H	H	H	H

OPERABILITY

OPERATIONAL SUPPORT

MATERIAL PRODUCTION & ENVIRONMENT CONTROL

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The conditions applicable to this class includes

1. User conditions - body size and clothing;
2. Environmental conditions - weather, climate and illumination levels;
3. Operational conditions - use conditions (duration of use, through put rates, types of material or environments to be produced or modified) and time critical operations (quick response).

PREPARE FOR USE		USE	
ADJUST	SERVICE	ACTIVATE/DEACTIVATE	PERFORM PRIME FUNCTION
design of the reliability of calibration of	PURPOSE: Evaluate the design of test item for ease and safety of loading raw materials, adding liquids, and storing and obtaining operating quantities of necessary materials. MAN/ITEM TASKS Determine status of expendables. Open/close access covers. Remove/replace filler caps.	PURPOSE: Evaluate the design of the test item for the operation of the tasks required. MAN/ITEM TASKS Start gasoline engines. Ignite pilot light/burner. Turn on electrical power. Initiate air/hydraulic power.	PURPOSE: Evaluate the design of the test item for performance of the tasks required to produce or service materials, modify environment, or generate power. MAN/ITEM TASKS Operate equipment according to operating manuals. Manipulate controls. Observe/monitor displays. Perform manual/tool assisted operations. Observe/test status of materials. Remove/inspect finished product.

DETAILED DESIGN CONSIDERATIONS

Fasteners Connectors (13)	Displays (8)	Access Covers Caps (19)	Controls (6)	Displays (8)	Operating Elements (16)	Controls (6)	Displays (8)
A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B
C		C	C		C	C	
D		D	D		D	D	
E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H

TEST ITEM COMPONENTS

HUMAN FACTORS CONSIDERATIONS

A LOCATION & ALIGNMENT

The positioning of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of openings (access), cover or clear operation, location of components (knobs, levers, etc.) as well as its relationship to other components.

B SIZE & SHAPE

The maximum and/or minimum dimensions of a component that are required for adequate man use, including the effects of anthropometric and special clothing (e.g., NBC) considerations, and the shape and contour of handles, knobs and other controls to enhance both the identification and use of the component.

C DIRECTION & FORCE

The movement and/or force required to operate or generally manipulate a component (handle, control, fastener, etc.), with emphasis on the direction of motion corresponding to the display, component, total item reaction or function as well as the minimum strength required.

D CLEARANCE

The unobstructed space surrounding a component which allows the operator to perform required actions, the adequacy of which varies as a function of the amount of body involved (arms, legs, torso, etc.), and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventative aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as based in equipment design handbooks as well as job aids, checklists, training texts, troubleshooting guides and repair manuals with specific attention to the safety aspects when using the components.

1 LABELS, MANUALS, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction plates. Make operator aware of hazards. Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- Labels not obscured by components on flat test surface; on main chassis; min coverage by grime; not easily removed.

- Character height determined by distance read; luminance: FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control; display position characters: each by 25% min.
- Letter, numeral styles: FIG 1.B.2.4.
- Height-width ratio: 5:3; "x" is 1 stroke width wider; "M" & "W" are 1.5:4; "I" & "l" are 1 stroke width.
- Stroke width for black (white) characters on light (black) background: 1/6 (1/7-1/8) of height.

- Design Requirements (MIL-STD-1472)
- User-Computer Interface Data (MIL-STD-1472C)
- Guidance Data (MIL-HDBK-759, Etc.)

- Spacing between characters (words): one stroke (character) width min.
- Line spacing: 1/2 character height.
- Counter numeral row ratio: 1:1 (except 1:2 separation: 1/2 to 1/4).
- Optical projections: all caps, stroke width 1/6 min; 1/8 in exceeds 15 min; vertical min.
- Thumbwheel numeral row ratio: 3:2; h: 1/4; stroke width internally (externally) illuminated: 10:1 (5:1).
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environments.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-cd: black letters, light background.
- Dark adaptation: letters visible, do not interfere with night vision.
- Chart reading: FIG 1.B.1.3.

- Label characteristics accuracy required: time available; distance; light level; color; criticality of function; consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grime, dirt.
- Markings, tags are as permanent, washable as equipment.
- Roman numerals avoided.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Warning placards illuminated.
- Warning notices clear, direct; characters 25% larger than any following instructions.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-121); new OK if obvious.
- Trade names, irrelevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand grasp areas identified.

6 CONTROLS

Components used to activate, deactivate and modify the equipment power source and to modulate the operating elements.

Handles, grips, knobs, switches, triggers, levers, wheels, pedals and other man-operated items as applicable. Controls are associated only with the item under test, not with equipment placed on it.

- Control relationship to its display is apparent, compatible.
- Functionally related controls are grouped together.
- Control groups, sequential operations have left-to-right and/or top-to-bottom order of use.
- Controls in functional groups are located in accordance with operational sequence and/or function.
- Controls oriented to operator.
- Can not accidentally be moved.
- Recurring groups similar thru system.
- Controls used for same function on different equipment are same size.
- Rotary size, shape: FIG 6.B.1.6.
- Linear size, shape: FIG 6.B.1.7.
- Controls have non-slip surfaces.
- Gross (limiting) (adjustable) dimensions based on 95th (5th) (5-95th) operation.
- Linear size, shape: FIG 6.B.9.16.
- Grid & stylus: displaced grids, display same size; mounted/oriented below display; preserve directional correlation.
- Adequate control response feedback.
- Rotary valves open CCW.
- Forces, displacements (including miniature controls): FIG 6.B.1-16.
- High force controls: FIG 6.C.1-2.
- Free from excessive backlash.

- Control spacing min: FIG 6.D.1; blind operation, 5" min.
- Rotary separation: FIG 6.D.1-8.
- Linear separation: FIG 6.D.9-16.
- Compatible with hardware used.
- Foot switches: separated 3" horizontally, 8" vertically minimum.
- Range of control action does not interfere with other controls.
- Larger diameter concentric control is used for the fine adjustment.

- Shape coded controls visually, tactually identifiable.
- Color contrasts with background.
- Ambient light color determines useable control colors.
- Reference line has 50% min contrast with control color.
- Thumbwheel internally lighted if ambient illumination below 1 ft-cd.
- Thumbwheel readable 30° off-axis.
- Legend switch legend is legible.

- Precision of control manipulation is consistent with that of system.
- Selected, distributed so none of user's limbs are overburdened.
- Coding uniform throughout system.
- Useable in time required despite inadvertent operation protection.
- Movement oriented to operator if several stations are used.
- Control motion minimized; not cycled thru ON/OFF unnecessarily.
- Minimum use made of horizontal or 3-position toggle switches.
- Shape coding free of sharp edges.
- Critical controls are not susceptible to accidental movement.
- Controls that initiate hazardous operations require prior operation of a locking control.
- Main power ON/OFF switch cuts all power to equipment.
- Emergency controls located near related warning display/nearest hand.

- Minimum decoding required.
- Control color related to display.
- Operating instructions provided except where use is obvious.
- Diagrams used where possible.
- Main power switch labeled.
- Emergency (noncritical) functional groups outlined with 3/16" red (1/16" black) border.
- Controls labeled as to function.

8 DISPLAYS

Components that provide visual and auditory information to the operator concerning the status of operation.

Provide positive indication of developing or current malfunctions. Displays are associated only with the item under test, not with equipment placed in or on it.

- Display relationship to control is apparent; determines control used, equipment displayed.
- Functionally related units grouped.
- Displays, groups have left-to-right and/or top-to-bottom order of use.
- Displays located in order can be read to the required degree of accuracy.
- Positions of related controls, displays on separate panels correspond.
- Lighted control indicators are unambiguously associated with controls.
- Display viewing distance: 13-28".
- Pointer extends to but does not obscure or exceed index mark width.
- Pointers are close to dial to eliminate parallax, shadows.
- CRT target visual angle exceeds 2.0 minutes, 10 lines of resolution; distance 16" (10" min).

- Display face to line of sight exceeds 45°; min parallax, reflection.
- Frequently used displays grouped; in optimal visual zone: FIG 8.B.1.
- Illumination uniform: FIG 8.E.3.
- Indicator lights show response, used sparingly, visible.
- Contrast, luminance exceeds 50%.
- Flashing lights: 3-5 flashes/sec.
- Color coding used where possible; unused scales covered.
- Display pointer tip same color as marker.
- Display precision, response is consistent with that of system.
- Information displayed: Clear, specific, precise, useable; not redundant, degraded by vibration.
- Lights show function: FIG 8.F.1.
- Scales: linear, start at 0, use whole numbers, 2 pointers max, numerals oriented upright.
- Mechanical types: FIG 8.F.2.
- Audio signal evaluations: FIG 8.F.3.
- Audio, verbal warnings: 20 dB min above background.
- Failure immediately apparent.
- Signal absence does not mean "go".
- Indicator light color coding for emergency, warning, summation, etc: FIG 8.F.1; master lights set apart.
- Audio warnings transmitted to both earphones and work area.
- Audio signal action segment specifies nature of problem.
- Prohibited, persistent signals are not used: FIG 8.G.1.
- Audio warning durations min of 1/2 sec; until corrective action takes.
- Minimum decoding required.
- Trademarks, irrelevant information, etc do not appear on panel face.
- Coding techniques uniform; facilitate discrimination, identification, relationship, criticality.
- Reliability displays used when vision overburdened, degraded redundancy desirable; warning, cue needed.
- Verbal warnings: intelligible, apt.
- Audio warnings use standard signals.
- Labels: functional; basic; well located; graduated in size.

- Cabinet kick space: 4x4" hxd min.
- Console front floor space: 4" min.
- Knee room 25x20x18" hxd min.
- Unusual positions: FIG 10.J.1-2.
- Alliances made for heavy clothing, protective equipment.
- Workspace anthropometrics: FIG 10.J.1-2.
- Seal adjustment overhead clearance from seat pan: 40" min.
- Sufficient clearance for use with gloves, arctic mitts, heavy clothing.
- User space not encroached upon by others.
- Reflection of instruments, consoles in windows, windshields avoided.
- Right-left viewing angle for wrap-around consoles: 180° max.
- Illuminations: FIG 10.E.1.
- Surface colors conform to MIL-STD-1472.
- Reflectances: FIG 10.E.3.
- Seating compatible with consoles.
- Heating, A/C for man (permanent) seat work areas: 50° F (65° F) to 85° F, does not discharge on crew.
- Ventilation: 30 cu ft/min/man min; velocity 100 ft/min max.
- Effective temperatures: FIG 10.F.1.
- Acoustical environment does not degrade system effectiveness.
- Noise levels: FIG 10.F.2-8.
- Room sound absorption: 0.20 min.
- Whole body vibration limits: X, Y, Z, times FIG 10.F.9.
- Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES.
- Impulse noise: FIG 10.G.1.
- Noise duration limits: FIG 10.G.3.
- Hazard alerting device provided.
- Illumination adequate.
- Equipment guarded if temp exceeds 140° F (120° F if handled).
- Exposed edges (corners) rounded: 0.04" (0.07" min radius).
- Guards provided on moving parts.
- Radiation hazards minimized.
- Maximum sickness limits: FIG 10.G.4.
- Advancers, suitable storage for manuals, worksheets, etc.
- Standards have work surfaces to support manuals, etc.
- Lifters, hydraulic lifts have max load sign visible.
- Compensatory placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.

- Multiple console
- Cables labeled
- Man, cones to
- Lines labeled
- function, hazard
- ID tapes marked
- ID tags, hands
- stainless steel
- ID point used
- Line color (see FIG 12.H.2 (12))
- Dangerous volt
- Hydraulic, elec

10 WORKSPACE

The area within which the user operates the equipment.

Includes space for controls, displays, optics, electronic devices, weapons and sensors as well as standing areas, consoles and seats. Provides storage for excess clothing, personal gear, weapons and tools. Protects operator from adverse environment, when applicable.

- Display placement above standing (seated) surfaces: normal, 41-70" (6-46"); precisely, frequently read, 50-65" (14-35"); 2" from centerline.
- Controls on vertical surface above floor (seal) normal, 34-70" (8-34"); precisely, frequently used, 34-51" (8-27"); 2" from user centerline.
- Work surface height: standing, 36 ± 1/2"; seated, 29-31".
- Desk tops, writing tables are 29-31" above floor.
- Display reading location identified.
- Seats fit suitably clothed 5-95th % user without degrading performance.
- Armrests 2-8" min.
- Back seat have 1" min padding.
- If van occupancy exceeds 1 hr: ceiling height 78" min.
- Lateral work (writing) space: 30x16" (24x14" wxd min).
- Shoulder consoles: FIG 10.J.1-3.
- Gross (limiting) dimensions based on 95th (5th) % fully equipped user: FIG 25.J.1-7. Aerics: FIG 25.J.8.
- Adjustable dimensions fit 5-95th %.
- Vertical seat adjustment: 15-21" in 1" increments.
- Seat backrest reclines 103-115°; supports torso so operator's eyes are within 3" of "eye-line".
- If arms adjust: 75-11" above seat.
- Seat adjusts fore, aft: 4" min.
- Operator does not have to lift self to adjust seat.

- Seating compatible with consoles.
- Heating, A/C for man (permanent) seat work areas: 50° F (65° F) to 85° F, does not discharge on crew.
- Ventilation: 30 cu ft/min/man min; velocity 100 ft/min max.
- Effective temperatures: FIG 10.F.1.
- Acoustical environment does not degrade system effectiveness.
- Noise levels: FIG 10.F.2-8.
- Room sound absorption: 0.20 min.
- Whole body vibration limits: X, Y, Z, times FIG 10.F.9.
- Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES.
- Impulse noise: FIG 10.G.1.
- Noise duration limits: FIG 10.G.3.
- Hazard alerting device provided.
- Illumination adequate.
- Equipment guarded if temp exceeds 140° F (120° F if handled).
- Exposed edges (corners) rounded: 0.04" (0.07" min radius).
- Guards provided on moving parts.
- Radiation hazards minimized.
- Maximum sickness limits: FIG 10.G.4.
- Advancers, suitable storage for manuals, worksheets, etc.
- Standards have work surfaces to support manuals, etc.
- Lifters, hydraulic lifts have max load sign visible.
- Compensatory placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.

- Seating compatible with consoles.
- Heating, A/C for man (permanent) seat work areas: 50° F (65° F) to 85° F, does not discharge on crew.
- Ventilation: 30 cu ft/min/man min; velocity 100 ft/min max.
- Effective temperatures: FIG 10.F.1.
- Acoustical environment does not degrade system effectiveness.
- Noise levels: FIG 10.F.2-8.
- Room sound absorption: 0.20 min.
- Whole body vibration limits: X, Y, Z, times FIG 10.F.9.
- Exposure to gases, fumes, toxicity: see THRESHOLD LIMIT VALUES.
- Impulse noise: FIG 10.G.1.
- Noise duration limits: FIG 10.G.3.
- Hazard alerting device provided.
- Illumination adequate.
- Equipment guarded if temp exceeds 140° F (120° F if handled).
- Exposed edges (corners) rounded: 0.04" (0.07" min radius).
- Guards provided on moving parts.
- Radiation hazards minimized.
- Maximum sickness limits: FIG 10.G.4.
- Advancers, suitable storage for manuals, worksheets, etc.
- Standards have work surfaces to support manuals, etc.
- Lifters, hydraulic lifts have max load sign visible.
- Compensatory placards adjacent to equipment hazardous to user.
- Areas requiring special equipment, clothing are specifically identified.
- Emergency procedures detailed.

12 LIFE SUPPORT

All cables, wires, vents, etc. that test items.

- Cables are held by harness
- Long cables to equipment are
- Test cables to panel do not in displays.
- Handles, need car
- torque, better, in
- Control use
- Cable clamps
- Line, cable att
- able by user

- Cables are in functioning unit
- ventually or
- viewed.
- Electric panel
- Cables are
- similar compen

- Hand operation
- used to tighten
- Lighten (W) h

- Adequate space
- cables, lines, h
- Clearance bet
- trials: 3" min
- Cable, line, h
- able to user

- ID tapes visible
- near vents
- Handles, tags, p
- valves, regulat
- checks, clean
- intervals & a
- balls, floors
- Line, base, c
- with background
- Manner of con
- is obvious.

- Thickness of equipment
- marked by group
- Cables are risk
- Irregular, frag
- sions removable
- Cables are not
- lights, walked or
- best, twisted r
- Cables, raised
- tested by group
- Protective cap
- available in new

- Pipes, hoses @
- 100° (120°)
- High pressure
- chain attached
- Automatic shu
- equipment to p
- page.
- Electric wiring
- lines carrying C

- Multiple console
- Cables labeled
- Man, cones to
- Lines labeled
- function, hazard
- ID tapes marked
- ID tags, hands
- stainless steel
- ID point used
- Line color (see FIG 12.H.2 (12))
- Dangerous volt
- Hydraulic, elec

Lines intended as to function, sub-
 function, hazard, flow: FIG. 12.3.1.
 ID tapes encircle the line.
 ID tags, bands: on cold, hot lines
 stainless over 3"; not near intakes.
 ID point used on 4" man lines.
 Line color (symbol) (hazard) codes
 FIG. 12.3.2 (12.3.3) (12.3.4).
 Dangerous voltage placarded.
 Hydraulic, electric: FIG. 12.3.5, 6.

Receptacles marked as to voltage, phase, frequency.
Connecting plugs, receptacles identified by color, size.
Plugs, receptacles have stripes, arrows, etc to show aligning pin positions.
Manner of connection obvious.
Non-standard operating direction is clearly marked.
Plug, receptacle identifications FIG 13.1

- Items exceeding one man lift (FIG 14.C.1) are labeled with weight, lift limits.
- For mechanical power lift: hoist, lift points, provided, labeled.
- Hand grasp areas identified.
- Most lugs marked "Lift Here".

- Frequently used elements are within easy reach of seated or standing station position.

Cover opening method is obvious or instructions are displayed on outside of cover.
Accesses are labeled with warning sign advertising of hazards within, precautions needed.
Labels indicate function of units behind enclosure, access.
Labels, instructions are properly oriented when cover, case, door is open.
Labels indicate how service equipment is oriented, connected.

TEST FUNCTION _____

TEST ITEM CLASS VI _____ T

SUBCLASS A _____

OBJECTIVE: Evaluate the effectiveness and safety of the design of consumables to enable the user to unpackage or repackage them, prepare them for use, and use or consume them. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use.

The conditions applicable to:

1. User conditions - number of
2. Environmental conditions - w
3. Operational conditions - diff

UNPACKAGE/PACKAGE		PREPARE FOR USE	
STOW/UNSTOW	OPEN/CLOSE PACKAGE	PREMIX	HEAT
PURPOSE: Evaluate the design of the test item for ease of attachment, insertion, and removal from person, for individually carried items, or from storage, for general removal of garrison mess types of items. MAN/ITEM TASKS Insert item into/remove item from carrying case. Place item in/remove item from pockets/shirt/pack. Strap/connect item to personal carrying gear. Remove large item from storage area.	PURPOSE: Evaluate the item package for ease and safety of opening to gain access to the item and for reclosing to retain remaining material. MAN/ITEM TASKS Rip/tear plastic/foil/paper sacks/envelopes. Open/pierce metal/plastic containers (not recloseable). Remove/replace caps/covers.	PURPOSE: Evaluate the test item for adequacy of containers and for instructions for the addition of water or combination with other materials. MAN/ITEM TASKS Measure water/other liquids. Measure dry materials. Add liquid/dry materials in correct proportions.	PURPOSE: Evaluate safety and conversion of final food or drink such as heating, stirring. MAN/ITEM TASKS Place item over fire. Empty consumable utensil. Stir material. Agitate package.

INDEX TO DETAILED DESIGN CONSIDERATIONS

Test Item Components HUMAN FACTORS CONSIDERATIONS	Labels Manuals Markings (1)	Handles (14)	Packaging (17)	Accesses Covers Caps (19)	Labels Manuals Markings (1)	Measures (20)	Labels Manuals Markings (1)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B
C. DIRECTION & FORCE		C	C	C			
D. CLEARANCE	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H

OPERABILITY

TROOP SUPPORT EQUIPMENT

CONSUMABLES

The conditions applicable to this class includes:

1. User conditions - number of users;
2. Environmental conditions - weather, temperature, illuminations;
3. Operational conditions - different uses, different packaging, time critical operations and combat conditions (blackout, noise suppression).

PREPARE FOR USE		USE/CONSUME	
	HEAT/AGITATE	APPLY/REMOVE	INGEST
test item for 1 for instructor or combi-	PURPOSE: Evaluate the test item for safety and convenience of performance of final food or drink preparation steps, such as heating, stirring and shaking.	PURPOSE: Evaluate the test item for ease and convenience of spreading or applying oils, salves, and powders to the body and of its subsequent removal, if required.	PURPOSE: Evaluate food, drink and oral medicines for palatability and general troop acceptance.
	MAN/ITEM TASKS Place item over fire or in hot water. Empty consumable into cooking/eating utensil. Stir material. Agitate package.	MAN/ITEM TASKS Remove/replace cap/cover. Obtain/prepare applicator. Clean/prepare skin. Apply/remove salve/oil. Sprinkle/spread powder.	MAN/ITEM TASKS Eat/drink item. Utilize pouring/drinking spout. Dispose of wastes.
correct pro-			

DETAILED DESIGN CONSIDERATIONS

Measures (20)	Labels Manuals Markings (1)	Handles (14)	Labels Manuals Markings (1)	Accessories Covers Caps (12)	Handles (14)	Packaging (17)
A	A	A	A	A	A	A
B	B	B	B	B	B	B
		C		C	C	C
D	D	D	D	D	D	D
E	E	E	E	E	E	E
F	F	F	F	F	F	F
G	G	G	G	G	G	G
H	H	H	H	H	H	H

HEAVYWEIGHT EQUIPMENT

A. LOCATION OF COMPONENTS

The position of a component as it affects the ability of the operator to reach, operate or manipulate it, including location of operating levers, switches, control or display knobs, location of components (levers, knobs, etc.) as well as its relationship to other components.

B. SIZE AND SHAPE

The maximum and/or minimum dimensions of components that are required for adequate man use, including the effects of anthropometric and special clothing factors, such as seat belts, and the shape and control of handles, knobs, and other controls to achieve both the identification and the use of the component.

C. POSITION AND FORCE

The movement and/or force required to operate or manipulate a component (handle, control, fastener, etc.) with emphasis on the direction of motion corresponding to the display, component, total item reaction or standard practice as well as the minimum strength required.

D. CLARITY

The unobstructed view surrounding a component which allows the operator to perform required actions, recognize a fault or warning as a function of the amount of body involved (head, fingers, arm, torso, etc.) and, where appropriate, will also include considerations such as gloves, boots, helmets, protective clothing, etc.

E. VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflectance, and illumination.

F. USE CONDITIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G. SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventative aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressure hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H. OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man performance as found in equipment design handbooks as well as placards, check lists, training facts, troubleshooting guides and repair manuals which draw attention to the safety aspects of using the components.

1. LABELS, MATERIAL, MARKINGS

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction placards. Make operator aware of hazards. Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- ID labels not obscured by components on flattest surface; on main chassis; min coverage by grimes not easily removed.

- Character height determined by distance read, luminance FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles: FIG 1.B.2.4.
- Height/width ratio: 5/3; "H" is 1 stroke width wider; "M" & "W" low 5/6; "I" & "L" are 1 stroke width.
- Stroke width for black (white) characters on light (black) background: 1/8 (1/7-1/8) of height.

- Spacing between characters (words): one stroke (character) width min.
- Line spacing: 1/2 character height.
- Counter numeral low ratio: 1:1 (except 13 separation: 4 to 1 w).
- Optical projection: all caps, stroke width 1/6 to 1/8 h; exceeds 15 minutes visual angle.
- Thumwheel numeral low ratio: 1:2; h 1/2 stroke width internally externally illuminated: 10:1 (5:1). Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environments.
- Labels are sharp with high or color contrast.
- With illumination above 1 ft-c: black letters, light background.
- Dark adaptations letters visible, do not interfere with night vision.
- Chart reading: FIG 6.1.3.

- Label characteristics: accuracy required; time available; distance; light level; color; criticality of function; consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily affixed, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.
- Roman numerals avoided.
- Vertical labels used only when labels are not critical for personnel safety, performance.
- Electrical receptacles marked with voltage, phase, frequency.
- Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.

- Abbreviations are standard (MIL-STD-12); new OK if obvious.
- Trade names, irrelevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Hand grasp areas identified.

1.4. HANDLES

The specification of inherent devices used to grasp, hold, grip or lift an item for lifting, moving, the closing or opening. Handles, knobs, projections, struts, etc. Involves rounded or non slip surface when used for handling. Check also for the lack of handles.

- Handles on channels, consoles are recessed.
- Handles, grasp areas are located relative to the CG.
- Hinged, fold-out handles have a stop position; one hand operation.
- Handles located so that lifting is at min distance from body.
- Lift points on large items are equidistant from the CG.
- Handles provided to remove cover.
- Handles are on front of an item if it is pulled from a rack.
- Bar, T-bar, J-bar, recessed handles: FIG 1.B.1.1.
- Two handles min, or one handle/grasp area for units 10 lbs. or more.
- Hand shaped handle used on item carried frequently or for long periods.
- Handles reachable by 5th% user wearing bulky, restrictive clothing.

- Weight limits for one man lift: FIG 1.B.1.1; if shape is convenient, handles are provided, lift is not repeated, items are not carried.
- Handle, grasp area force limits: FIG 6.C.1.
- Two-man lift values are twice one-man lift only if item configuration convenient; neither man exceeds one-man limit.

- Handles have at least 2h" clearance from obstructions.
- Straps, buckles do not interfere with operation of item.

- Handles color coded to distinguish from similar shaped items.
- Handles are visible from the grasping, lifting position.

- Hand grips have nonslip surface.
- Removable, carried units provided with handles, other suitable means for grasping, handling, carrying.
- Handles do not interfere with operating or maintaining item.
- Carried item will ride clear of legs of personnel.
- Handles, lugs, push bars are permanent parts of equipment case.

- Handle/grasp surfaces are not thermally/electrically conductive.
- Insulated handles used on hot items.
- Non-recessed handles do not injure personnel, entangle clothing, damage equipment.
- Edges rounded; attaching screws recessed.

- Items exceeding one man lift (FIG 1.B.1.1) are labeled with weight, lift limits.
- Hand grasp areas identified.

2. ACCESSORIES

Components used for locking, unlatching, securing, opening, closing, covering, uncovering, and covers that are not part of the item are used for transport. Carrying cases and storage boxes specifically designed for the item, or multiples of the item, and are part of the item configuration.

- Cases lift from seats rather than units lift from cases.
- For cross country ops items secured in storage boxes or restrained by straps, brackets.
- Storage mail slots for ration.
- Tools for opening are built in or attached to containers.
- Tools, devices that are carried fold, roll up so they require minimum carrying space.
- Stowed items accessible by 5-95th% personnel: FIG 2.B.1.2.
- Small packages are sized for pockets, are relatively flat.

- Catches, fasteners lock, unlock easily.
- Flaps, tabs, etc. are large enough for full hand or finger grasp & force application.

- Cases are enough larger than units they cover to prevent damage when case is removed, replaced.
- Light fitting stowage avoided.
- Containers allow for full hand, finger clearance when using opening tool.
- Flapless hand clearance provided: FIG 2.B.1.1.

- It is obvious when a cover is in place but not secured.
- Identification of package contents clearly visible.
- Tools, grasp points for opening are clearly visible, identifiable.

- Accessibility of stowed equipment reflects its function, use.
- Fully open, closed state obvious.
- Material remaining is easily determined.
- Sealed cans have integral opener device, strap, tab.
- Stowage boxes are part of vehicle, rather than attachments.
- Special opening tools avoided.

- Edges, corners on covers, cases are rounded, otherwise finished to prevent personnel injury.
- Glass containers avoided for field usage.

- Orientation of a unit within its case is obvious or labeled.
- Labels, markings tell how to open, remove, position covers, cases.
- Instructions on opening a cover are permanently displayed if opening is not obvious.

3. ACCESSORIES

Those components used for locking, unlatching, securing, opening, closing, covering, uncovering, and covers that are not part of the item are used for transport. Carrying cases and storage boxes specifically designed for the item, or multiples of the item, and are part of the item configuration.

- Stowing, unlatching, and unlatching items rotate them full distance, remove in place without hand support.

- Gross (lifting) dimensions based on 95th% (5th%) user: FIG 2.B.1.2.
- Hand, arm, finger access: FIG 1.B.1.1.
- Caps are large enough to be handled with gloves.
- Regimens to open, work within access limits are obvious size.
- Flapless hand clearance provided: FIG 2.B.1.1.

- Replaceable items are not placed in a manner which makes them difficult to remove.
- Small covers hinge at bottom, open down.
- Covers latch, require positive force to open, is within capacity of 5th% user: FIG 6.C.1.
- Caps tighten CW, loosen CCW.

- Openings are large enough to permit required operations.
- Allowance is made for gloved hand or externally located access.
- Containers opening large enough to allow full entry, passage of measuring devices.

- Visual access cover preference: none, transparent, break-resistant glass, quick opening metal.
- It is obvious when a cover is in place but not secured.
- Visual access only for components requiring a visual check.
- Instructions visible when access cover is open.
- Openings allow visibility of internal components while operator performs tasks.

- Access covers are equipped with grasp means for opening.
- Physical access cover preference: none, sliding, hinged, quick opening.
- Captive fasteners used when periodic removal is required.
- Cover fasteners self lock for closing with double snap.
- Replaceable caps captive.
- Sliding doors, caps lock positively.

- Edges, corners on covers, cases are rounded to prevent injury.
- Hazardous voltage behind access cover is demarcated with an interlock attached to cover.
- Access over dangerous mechanical, electrical component has an internal light, warning on door.
- Pressurized caps are captive.

- Cover opening method is obvious or instructions are displayed on outside of cover.
- Accesses are labeled with warning signs advertising of hazards within, precautions needed.
- Labels, instructions are properly oriented when cover, case, door is open.
- Labels indicate how service equipment is oriented, connected.

4. ACCESSORIES

Those components used for locking, unlatching, securing, opening, closing, covering, uncovering, and covers that are not part of the item are used for transport. Carrying cases and storage boxes specifically designed for the item, or multiples of the item, and are part of the item configuration.

- Labels are clearly visible from the front of the unit.
- Labels are clearly visible from the side of the unit.
- Labels are clearly visible from the rear of the unit.

- Display viewing post.
- Minimum viewing distance.
- Display viewing post.
- Minimum viewing distance.
- Display viewing post.
- Minimum viewing distance.

- Containers of unit are clearly visible from the front.

- Display frame to the front.
- 45° min. viewing angle.
- Other relevant factors.

- Display projection, in front with that of the unit.
- Sealed, hinged, etc. numbered, 2 positions oriented upright.
- Field stress, etc. are considered in design.

- Information located are to be in the front.
- Info is directly visible.
- Specified means are consistent with man.
- Measurements are clearly visible.
- For groups used in components, open compartments, open.

COVERS, CAPS

20 MEASURES

an item that allows
straps, connectors,
fasteners, visual
is or components
and inserting or
access covering, it

hinged units open,
distance, remain in
support.

dimensions based on
FIG 25.B.1-7.
access: FIG
ough to be handled
see, work within
opening size.
FIG 25.B.1-9.

s are not placed in
makes them diffi-
at bottom, open
fires positive force
capability of 3m%
loosen CCW.

e enough to permit
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ethod is obvious or
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rs are properly ori-
er, case, door is
ow service equip-
connected.

Displays are located so they can be
read to the required accuracy.
Display arrangement is consistent
from one application to another.
Measuring marks or opac-
containers are placed inside.

Display viewing distance 13-28".
Minimum number of measuring de-
vices used.
Container cup useable as standard or
emergency measuring device for
field use.
Item container used for measuring
where possible.
Measurement marks raised.

- Design Requirements
(MIL-STD-1472)
- User-Computer Interface
Data (MIL-STD-1472C)
- Guidance Data
(MIL-HDBK-759, Etc.)

Containers allow for full hand, finger,
clearance when using opening
tool.

Display face to line of sight exceeds
65°; min parallax, reflection.
Other reflection minimized.

Display precision, response is consist-
ent with that of system.
Scales: linear, start at 0, use whole
numbers, 2 pointers max, numerals
oriented upright.
Field items are non-corrosive, easily
cleaned or disposed.

Information limited to that necess-
ary to take action.
Info is directly usable.
Specified measuring amounts are
consistent with measuring device.
Measures clearly detailed.
For group use: multiple of food
components, general formula for
computation given.



MAINTAINABILITY

VEHICLES

The conditions applicable to this class includes:

1. User conditions - body size, clothing and encumbrances, technician skills;
2. Environmental conditions - weather, temperature, noise, vibration, altitude and illumination levels;
3. Operational conditions - use conditions (different types of failures to be detected, isolated and repaired, and different work pieces) and time critical operations (quick fix, rapid troubleshooting, etc.).

PERFORM CORRECTIVE MAINTENANCE			
APPLY	DETECT/ISOLATE FAULTS	PREPARE FOR REPAIR	REPAIR
design of the 1. resupply ac-	PURPOSE: Evaluate the design of the item to enable the technician to detect faults and perform troubleshooting. MAN/ITEM TASKS Identify failure. Identify affected system. Identify faulty component. Identify faulty part. Read displays. Use test sets.	PURPOSE: Evaluate the design of the item for completion of system preparation activities. MAN/ITEM TASKS Configure system. Configure component. Configure part. Select tools. Configure support systems. Remove component. Disassemble component. Inspect parts.	PURPOSE: Evaluate the design of the item to enable the technician to perform repair activities. MAN/ITEM TASKS Perform electrical repair. Perform mechanical repair. Perform hydraulic repair. Remove/replace parts. Repair parts. Conduct tests. Verify readiness. (See "Inspect/Check-out")

DETAILED DESIGN CONSIDERATIONS

Replacable Items (21)	Displays (8)	Test Elements Tools (18)	Workpiece (19)	Lines Hoses Cables (12)	Fasteners Connectors (13)	Workpiece (19)	Replacable Items (21)
A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B
C		C	C	C	C	C	C
D		D	D	D	D	D	D
E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H

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[illegible]

TEST ITEM CLASS II

The conditions appl

1. User conditions - be
2. Environmental con
and illumination lev
3. Operational condit
detected, isolated (operations (quick fi

PERFORM PREVENTIVE MAINTENANCE			
ADJUST/ALIGN	SERVICE	REMOVE/REPLACE	
PURPOSE: Evaluate the design of the item to facilitate adjustment and alignment. MAN/ITEM TASKS - Identify requirements. - Consult publications. - Read labels. - Assemble tools. - Access test points. - Gain access to parts. - Align/adjust parts. - Use controls and tools.	PURPOSE: Evaluate the item design for ease of lubrication, filling, draining, and cleaning. MAN/ITEM TASKS - Remove covers. - Access service points/drains/parts. - Lubricate item. - Fill with fluid. - Read displays. - Disassemble. - Clean components. - Tighten parts. - Disconnect lines. - Blow/clean lines.	PURPOSE: Evaluate the design of the item for removal and replacement of parts and units. MAN/ITEM TASKS - Handle expendables/replaceables. - Prepare system for module removal. - Prepare module for removal. - Prepare workspace for module. - Stow module. - Install fresh module. - Replace module.	PURPOSE: Evaluate the design of the item to facilitate detection and isolation of faults. MAN/ITEM TASKS - Detect faults. - Access components. - Acquire test equipment. - Interpret test results. - Consult manuals. - Isolate faults.

[illegible]

WEAPONS

1. User conditions - body size, clothing and encumbrances, technician skills;
2. Environmental conditions - weather, temperature, noise, vibration, climate and illumination levels;
3. Operational conditions - use conditions (different types of failures to be detected, isolated and repaired, and different work pieces) and time critical operations (quick fix, rapid troubleshooting, etc.).

DETAILED DESIGN CONSIDERATIONS

[illegible]

12 WIRING, CABLES	13 FASTENERS, CONNECTORS	18 TEST ELEMENTS, TOOLS	19 ACCESS, COVERS, CAPS	21 RELEVANT ITEMS
Wiring, cables, wires, lines, hoses, pipes, vents, etc., that pass from or to the test item. Plugs, sockets, quick-disconnect fittings, etc., for use in transport as well as for stationary use. Includes fastener and connector alignment and locking devices such as lock pins, safety wires, pins, nuts, electrical plugs, and fittings. Common and special tools and test instruments for assembly, adjustment, calibration and alignment. Includes special maintenance equipment such as lubrication points, pouring spouts, filter tubes and nozzles. Three openings in an item that allow manipulation of controls, conversion and disconnection of fasteners, visual checking of displays or components utilizing test points, and inserting or removing materials. Included is the access covering, if any. Reservoir fill points and drains for lubricants, hydraulic fluids, other liquids, air, gases, etc. Filters for fuel, oil, air. Includes vacuum tubes, electronic modules and low MTBF parts.	Conductors are bound into cables, held by lacing tape. Long conductors, cables internal to equipment are clamped to chassis. Test cables terminating on panel do not interfere with controls, displays. Cables are routed so as to be accessible for maintenance, repair. Feet, feet cuts provided to handle large, heavy, long lines, cables. Cable clamps spaced every 12". Cable attachment parts reachable by user in bulky clothing. Cables are long enough to allow functioning unit to be checked conveniently or extension cables p. 2-10. Electrical plug size, shape coded. Line fittings standardized so lines that differ in content are not interchangeable. Cables are size, shape coded for similar components. Line, cable attachment parts reachable by user in bulky clothing. Hand operation or common tools used to tighten, loosen. Tighten CW; loosen CCW. Adequate space provided to handle cables, lines, hoses. Clearance between cables & controls: 3" min. Cable, line, hose connectors operable by user wearing arctic mittens. ID tapes visible at line ends, intervals; near valves, vents, etc. Labels, tags, paint are adjacent to valves, regulators, clean outs, flow checks, clean outs, branch lines, at intervals & where line goes thru walls, floors. Line, hose, cable color contrasts with background. Manner of connection, disconnection is obvious. Number of inlets, outputs are minimized by grouping functions. Cables are reachable, visible. Irregular, fragile, outward extensions removed, cable for handling. Cables are not pinched by doors, latches, walked on, used as handholds, bent, twisted repeatedly. Cables routed thru holes are protected by grommets, etc. Protective caps, covers, inserts are available as necessary. High pressure lines have retaining chain attached to line and source. Electric wiring routed away from lines carrying O₂ (flammable fluids). Multiple conductors color coded. Lines labeled as to function, sub-function, hazard, flow FIG 12.4.1. ID tapes encircle the line. Cables labeled as to which equipment, connector they belong. Line color (symbol) (hazard) color FIG 12.4.2 (12.4.3) (12.4.4). Dangerous voltage placarded. Hydraulic, electric FIG 12.4.5-6. Receptacles marked as to voltage, phase, frequency. Connecting plugs, receptacles identified by color, size. Plugs, receptacles have stripes, arrows, etc to show aligning pin position. Manner of connection obvious. Non-standard operating direction is clearly marked. Plug, receptacle identification FIG 13.1.1.	Cables terminating on control, display panels do not interfere with controls, displays. External (internal) test points are of the jack (standard) terminal design. Test points reflect the sequence for sequential testing. Test points for adjustment are close to the controls, displays used. Special tools required for adjustment are with equipment. Test points, built-in meters used to make fastened unit, module. Limiting body dimensions based on 5th% user for reaching test points FIG 25.B.1. Sensitive adjustment points have a hand, arm rest nearby if vibration is present during adjustment. Cables are long enough to check unit in place. Braces held hinged as in working position. Test equipment fits the hand or has handle, hand support. Calibration, adjustment controls located close to prevent damage. Built-in aligning devices, optical aids are used for positioning optical assemblies within instrument. Access to unit maintained by one technician does not require removal of fasteners maintained by another. Quick-release removal for optics. Stands, casters (wheels), hoist-lifting is provided for equipment exceeding 30 lb (70 kg). Adequate storage provided in portable test equipment cases, lid to contain leads, probes, spares, manuals, tools. Large parts are not mounted to deny access to smaller ones. Sufficient space provided for test equipment, tool use without difficulty, hazard. Optics purging, charging fittings are accessible. Sensitive adjustment points, guarded against accidental disturbance. Indication of equipment power failure is provided. Test, adjustment, check point and labels, connectors, labels are accessible, visible during maintenance. Positive indication of open fuse. Non-visible screwdriver adjustments have mechanical shut guide. Test equipment has panel lighting. Enough test points are provided to prevent removing sub-assemblies. Special tool use minimized. Items frequently removed for test are mounted on rollout racks, slides, hinges. Knobs preferred to screwdriver for frequent adjustment. Tools provided with rings, eyes compatible with quick-release snaps, hooks on tool belts. Test equipment is not overly complicated, difficult to use. Electrical potentials over 300V are stepped down for test points. Electrical hand-held tools have 3-wire power with ground or are double insulated. Exposed surfaces of electrical hand-held tools are non-conducting or grounded. Contacts, terminals are shielded with suitable protective measures to prevent accidental contact. Test points permanently labeled, color coded. Operating instructions for portable test equipment affixed to unit, lid or compartment. Calibration reminder included with test instructions. Contacts, terminals, etc over 500V are clearly labeled. Reference scale is provided for control adjustment. A simple check shows when equipment is out of calibration.	Sliding, rotating, hinged units open, rotate their full distance, remain in place without hand support. Cover mounting holes large enough to permit attaching screws to pass without perfect alignment. Covers not completely removable are self supporting. Access large enough to insert arm, hand, tools, test equipment. Rubber stripping, welding material located so user will not damage it. Gross (limiting) dimensions based on 95th% (5th%) user: FIG 25.B.1-7. Hand, arm, finger access: FIG 19.B.1. Rectangular (round (oval)) hatch dimensions: FIG 4.B.1 (30" dial (17"x28"). Caps are large enough to be handled with gloves. Requirements to see, work within access determine opening size. Clothed arctic user: FIG 25.B.8. Structural members do not prevent access to components. Replaceable items are not placed in a manner which makes them difficult to remove. Small covers hinge at bottom, open down. Cover latch requires positive force to open, is within capability or 5th% user: FIG 6.C.1. Caps tighten CW, loosen CCW. One man can lift cover. Bullheads, brackets don't interfere with opening, removing covers where work is done. Openings are large enough to permit required operations. Allowance is made for gloved hand in externally located access. Open covers do not interfere with controls, displays. Visual access cover preference: none, transparent, break-resistant glass, quick opening metal. It is obvious when a cover is in place but not obvious when access cover is open. Visual access only for components requiring a visual check. Instructions visible when access cover is open. Openings allow visibility of internal components while operator performs tests. Access provided if frequent maintenance requires removing caps, covers, dismantling components. Access covers are equipped with grasp areas for opening. Physical access cover preference: none, sliding, hinged, quick-opening. Captive fasteners used when periodic removal is required. Cover fasteners self lock for closing with audible snap. Edges, corners on covers, cases are rounded to prevent injury. Hazardous voltage behind access cover is de-energized with an interlock or attached to cover. Access over dangerous mechanical, electrical component has an internal light, warning on door. Pressurized caps are captive. Cover opening method is obvious or instructions are displayed on outside of cover. Accesses are labeled with warning sign advertising of hazards within, precautions needed. Labels indicate function of units behind enclosure, access. Labels, instructions are properly oriented when cover, case, door is open. Labels indicate how service equipment is oriented, connected.	Don't need to disassemble to kube. Replaceable units remain "open" without support; well laid out; readily accessible. Fuses easily accessible. Parts mounted on one plane. Legend screens, indicator covers cannot be interchanged. Similarly shaped items with different function have standard orientation throughout; easily identified; not interchangeable. Blind screwdriver adjustments have mechanical guides. Sensitive adjustments guarded; hand support provided. Weighted limits for one man lift: FIG 14.C.1; if shape is convenient, handles are provided, lift is not repeated, item is not carried. Horizontal push, pull force limits: FIG 14.C.2. Units that are pulled out of item are mounted on rollout racks, slides, hinges. Simple indicator lights have clearance for easy bulb replacement. Large parts do not prevent access to other parts. Check, adjustment, test points; connectors, labels are accessible during maintenance. Enough clearance is provided to replace parts without contacting hardware. Fill points, drains reachable by 5th% user in restrictive, clothing. Timing marks, other adjustable indicators minimize parallax, are readily visible. Reference scales visible. Components visible from maintenance position. Maintenance points contrast with background. Lighted indicators incorporate filament redundancy/filament lamps. Faulty equipment is easily detected, quickly removed, repaired using standard parts, modules. Delicate parts are protected. Lamps replaceable with power on. Critical, low MTBF parts are the most accessible. Common hand tools for field units. Group areas on carried units. Guide pins, rollout racks, interlocks, drawers, hinges, quick-disconnects aid removal, replacement. Inter-locks indicator or alarm. Internal controls located near rotating parts, high volts, other hazards are shielded. Rollout racks: steps provided; CG does not overshift, topple item. Units can be accessed without danger from heat, moving parts, electricity, chemicals, radiation. External parts are grounded. Pressurized components have bleed valve. Parts, components, circuits, assemblies meaningfully labeled. Lube points labeled as to type, frequency. Items exceeding one man lift labeled with weight, limitation. Hoist, jacks, lift points; CG; "no step" weights labeled. Replaceable items coded, keyed. Fuses labeled, rated. Battery terminals marked "+", "-", "Hazard" conspicuously placarded. Grasp areas identified.

Light standing, 30 min. design allows equipment communication. Big labels are 29-11" x 29-11". Location identified, tested, installed with elements in mind. Integral with work test points, etc.

any exceeds 1 hr. min. fitting space: 30x16" FIG 10.B.1-3. dimensions based on fully equipped user only: FIG 25.B.8, 25.B.9, 25.B.10, 25.B.11, 25.B.12, 25.B.13, 25.B.14, 25.B.15, 25.B.16, 25.B.17, 25.B.18, 25.B.19, 25.B.20, 25.B.21, 25.B.22, 25.B.23, 25.B.24, 25.B.25, 25.B.26, 25.B.27, 25.B.28, 25.B.29, 25.B.30, 25.B.31, 25.B.32, 25.B.33, 25.B.34, 25.B.35, 25.B.36, 25.B.37, 25.B.38, 25.B.39, 25.B.40, 25.B.41, 25.B.42, 25.B.43, 25.B.44, 25.B.45, 25.B.46, 25.B.47, 25.B.48, 25.B.49, 25.B.50, 25.B.51, 25.B.52, 25.B.53, 25.B.54, 25.B.55, 25.B.56, 25.B.57, 25.B.58, 25.B.59, 25.B.60, 25.B.61, 25.B.62, 25.B.63, 25.B.64, 25.B.65, 25.B.66, 25.B.67, 25.B.68, 25.B.69, 25.B.70, 25.B.71, 25.B.72, 25.B.73, 25.B.74, 25.B.75, 25.B.76, 25.B.77, 25.B.78, 25.B.79, 25.B.80, 25.B.81, 25.B.82, 25.B.83, 25.B.84, 25.B.85, 25.B.86, 25.B.87, 25.B.88, 25.B.89, 25.B.90, 25.B.91, 25.B.92, 25.B.93, 25.B.94, 25.B.95, 25.B.96, 25.B.97, 25.B.98, 25.B.99, 25.B.100.

ment: 15-21" in 1" x 11" x 11" of how to lift will restrict entry, ram station.

er: 14" had min. x 14" front space 42" with drawer at 42" x 14" each use other side min. 14" had min. 14" for heavy use equipment. 14" x 14" x 14" space for use in 14" heavy clothing, reached upon.

on provided. ergonomics: FIG 10.B.1-3, 10.B.4, 10.B.5, 10.B.6, 10.B.7, 10.B.8, 10.B.9, 10.B.10, 10.B.11, 10.B.12, 10.B.13, 10.B.14, 10.B.15, 10.B.16, 10.B.17, 10.B.18, 10.B.19, 10.B.20, 10.B.21, 10.B.22, 10.B.23, 10.B.24, 10.B.25, 10.B.26, 10.B.27, 10.B.28, 10.B.29, 10.B.30, 10.B.31, 10.B.32, 10.B.33, 10.B.34, 10.B.35, 10.B.36, 10.B.37, 10.B.38, 10.B.39, 10.B.40, 10.B.41, 10.B.42, 10.B.43, 10.B.44, 10.B.45, 10.B.46, 10.B.47, 10.B.48, 10.B.49, 10.B.50, 10.B.51, 10.B.52, 10.B.53, 10.B.54, 10.B.55, 10.B.56, 10.B.57, 10.B.58, 10.B.59, 10.B.60, 10.B.61, 10.B.62, 10.B.63, 10.B.64, 10.B.65, 10.B.66, 10.B.67, 10.B.68, 10.B.69, 10.B.70, 10.B.71, 10.B.72, 10.B.73, 10.B.74, 10.B.75, 10.B.76, 10.B.77, 10.B.78, 10.B.79, 10.B.80, 10.B.81, 10.B.82, 10.B.83, 10.B.84, 10.B.85, 10.B.86, 10.B.87, 10.B.88, 10.B.89, 10.B.90, 10.B.91, 10.B.92, 10.B.93, 10.B.94, 10.B.95, 10.B.96, 10.B.97, 10.B.98, 10.B.99, 10.B.100.

ement does not detectiveness: 10.B.7-8. Limiting X, Y, Z, 1. oned on units that stand. non not exposed to: 15-450° optimal.

ers, limits, toxicity: 10.B.9-10. limits: FIG 10.G.3, 10.G.4, 10.G.5, 10.G.6, 10.G.7, 10.G.8, 10.G.9, 10.G.10, 10.G.11, 10.G.12, 10.G.13, 10.G.14, 10.G.15, 10.G.16, 10.G.17, 10.G.18, 10.G.19, 10.G.20, 10.G.21, 10.G.22, 10.G.23, 10.G.24, 10.G.25, 10.G.26, 10.G.27, 10.G.28, 10.G.29, 10.G.30, 10.G.31, 10.G.32, 10.G.33, 10.G.34, 10.G.35, 10.G.36, 10.G.37, 10.G.38, 10.G.39, 10.G.40, 10.G.41, 10.G.42, 10.G.43, 10.G.44, 10.G.45, 10.G.46, 10.G.47, 10.G.48, 10.G.49, 10.G.50, 10.G.51, 10.G.52, 10.G.53, 10.G.54, 10.G.55, 10.G.56, 10.G.57, 10.G.58, 10.G.59, 10.G.60, 10.G.61, 10.G.62, 10.G.63, 10.G.64, 10.G.65, 10.G.66, 10.G.67, 10.G.68, 10.G.69, 10.G.70, 10.G.71, 10.G.72, 10.G.73, 10.G.74, 10.G.75, 10.G.76, 10.G.77, 10.G.78, 10.G.79, 10.G.80, 10.G.81, 10.G.82, 10.G.83, 10.G.84, 10.G.85, 10.G.86, 10.G.87, 10.G.88, 10.G.89, 10.G.90, 10.G.91, 10.G.92, 10.G.93, 10.G.94, 10.G.95, 10.G.96, 10.G.97, 10.G.98, 10.G.99, 10.G.100.

on moving parts, 1. minimized. 1. simple. 1. storage for use. 1. etc. 1. work surfaces to support. 1. adjacent to test item. 1. special equipment, 1. clearly identified, 1. dates detailed. 1. include warnings 1. hazards of 1. etc.

The conditions applicat

1. User conditions - body
2. Environmental conditions and illuminational levels;
3. Operational conditions detected, isolated and operations (quick fix, r

PERFORM PREVENTIVE MAINTENANCE			
PERFORM ROUTINE SERVICING	INSPECT/CHECKOUT	REPLENISH/RESUPPLY	DET
PURPOSE: Evaluate the design of the item for enabling the technician to perform routine servicing. MAN/ITEM TASKS Clean components. Tighten components. Adjust components. Align components. Calibrate components.	PURPOSE: Evaluate the design of the item in terms of technician performance and safety in conducting inspection and checkout. MAN/ITEM TASK Conduct walk around inspection. Conduct static checkout. Conduct dynamic checkout. Verify readiness.	PURPOSE: Evaluate the design of the item for replenishment and resupply activities. MAN/ITEM TASKS Remove/replace. Attach lines/hoses. Refill. Charge.	PURPOSE: item to en faults and i MAN/ITEM Identify fai Identify af Identify co Identify fai

[illegible]

MATERIEL HANDLERS

1. User conditions - body size, clothing and encumbrances, technician skills;
2. Environmental conditions - weather, temperature, noise, vibration, climate and illumination levels;
3. Operational conditions - use conditions (different types of failures to be detected, isolated and repaired, and different work pieces) and time critical operations (quick fix, rapid troubleshooting, etc.)

PERFORM CORRECTIVE MAINTENANCE			
APPLY	DETECT/ISOLATE FAULTS	PREPARE FOR REPAIR	REPAIR
design of the d resupply oc-	PURPOSE: Evaluate the design of the item to enable the technician to detect faults and perform troubleshooting. MAN/ITEM TASKS - Identify failure. - Identify affected system. - Identify component. - Identify faulty part.	PURPOSE: Evaluate the design of the item for completion of system preparation activities. MAN/ITEM TASKS - Configure system. - Configure component. - Configure part. - Select tools. - Configure support systems.	PURPOSE: Evaluate the design of the item to enable the technician to perform repair activities. MAN/ITEM TASKS - Perform electrical repair. - Perform mechanical repair. - Perform hydraulic repair. - Verify repair. (See "Inspect/Checkout")

DETAILED DESIGN CONSIDERATIONS

[illegible]

TEST FUNCTION

TEST ITEM CLASS IV

OBJECTIVE: Evaluate electronics and signal systems for the ability of the maintainer to effectively and safely perform preventive maintenance as well as to repair or remove and replace any malfunctioning component found during non-scheduled maintenance. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use.

1. User
2. Envi
and
3. One
de
oot

PERFORM PREVENTIVE MAINTENANCE		
SERVICE	INSPECT/CHECKOUT	TRoubleshooting
PURPOSE: Evaluate the design of the item for enabling the technician to perform servicing activities. MAN/ITEM TASKS - Access components. - Tighten components. - Clean components. - Align components. - Adjust components. - Calibrate components. - Remove components. - Replace components.	PURPOSE: Evaluate the item design for visual inspection and checkout. MAN/ITEM TASKS - Acquire checklist. - Access components. - Adjust controls. - Read displays. - Read labels.	PURPOSE: Evaluate the item design for enabling the technician to identify faults to the component. MAN/ITEM TASKS - Activate control. - Acquire performance. - Read displays. - Access test point. - Activate test equipment. - Read signals. - Make decisions.

[illegible]

ELECTRONICS/SIGNALS

1. User conditions - body size, clothing and encumbrances, technician skills;
2. Environmental conditions - weather, temperature, noise, vibration, climate and illumination levels;
3. Operational conditions - use conditions (different types of failures to be detected, isolated and repaired, and different work pieces) and time critical operations (quick fix, rapid troubleshooting, etc.).

12

Aluminum, water, and
some other things, the 1 part
test tube.

Flame, on the way
to the water
on the way, you can
see the red color.

* Estimated from 1984-1985

- **Complex forms** are those based on the **basic form**.
 - **Complex** = consisting of an experimental structure
 - **First** = refers to the most interesting, well-known
 - **Others** are treated as **stable** for experimental reasons, are used by people, however, using it is not so easy as for a child's complex form
- **Stables** are those that have become and its use is generally not so well known.
 - **First** = one of the most interesting things, show that it has an effect of change of use.

[illegible][illegible]

- "I have a question."

- Stand operation or used to test, low
- Lighten (W; lower)

Adm. Serv. Major (M)

Adm. info. given in previous letters, letters, letters of forwarding of documents to be filed in the case.

- 11) tapes visible at

- 13 types visible at volt; near valves, vent
- Flange, tarp, point valves, regulators, check, clean out, intervals & where walls, floors
- Line have, cable

- Polarization of imports, ex

- Fluctuation of imports, controlled by government
- Customs are non-tariff barriers
- Irregular, frequent, & seems removable for
- Customs are not: price
- Subsidies, tariff, and

* Papers, having character

* Papers, having number 1407 (1407) of Bureau
- I had that number and
having number 1407. He

- Multiple conductors

- Multiple conductors
- Colours: labellated on the inside, orange for warm, blue for cold
- 1 cm - labellated on the front, brown, blue
- 10 tapes inside the
- Same color (synthetic)
- F.R. 123.2 (123.6, 9)
- Densities: weight (ph)
- Densities: 100 g

[illegible]

TEST ITEM CLASS V

The conditions

1. User conditions
2. Environmental and illumination
3. Operational conditions detected, isolation operations (quit)

Jul
 Vis
 Re
 Apr
 Apr
 Oct

[illegible]

OPERATIONAL SUPPORT

1. Use conditions - body size, clothing and encumbrances, technician skills
2. Environmental conditions - weather, temperature, noise, vibration, climate and illumination levels
3. Operational conditions - use conditions (different types of failures to be detected, isolated and repaired, and different work pieces) and time critical operations (quick fix, rapid troubleshooting, etc.).

[illegible]

8 10157 A-2

Displays are associated only with the item under test, not with equipment placed in or on it.

12

All
vents
test d
Play
things f
lock
well a

* Controls, displays, etc. are clearly

- Controls, displays, etc. use clearly distinguishable labels except where space is obvious.
- Labels placed on or near items they identify.
- Labels cover other information.
- Labels not behind controls.
- Labels not often obscured.
- All labels not obscured by components on different surfaces; on main control surface in sequence by groups; no overlap required.
- Forward clear labeling right in line.
- Labels too bright determined by distance from horizon of $R = 1.33 \times 10^4$.
- Group labels characters large, like those of controls, displays, which are large and brightly lit, display characters first used by US Navy.
- Lettering, numerical values: $R = 10^4$, 10^3 , 10^2 , 10^1 , 10^0 , 10^{-1} , 10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} , 10^{-7} , 10^{-8} , 10^{-9} , 10^{-10} , 10^{-11} , 10^{-12} , 10^{-13} , 10^{-14} , 10^{-15} , 10^{-16} , 10^{-17} , 10^{-18} , 10^{-19} , 10^{-20} , 10^{-21} , 10^{-22} , 10^{-23} , 10^{-24} , 10^{-25} , 10^{-26} , 10^{-27} , 10^{-28} , 10^{-29} , 10^{-30} , 10^{-31} , 10^{-32} , 10^{-33} , 10^{-34} , 10^{-35} , 10^{-36} , 10^{-37} , 10^{-38} , 10^{-39} , 10^{-40} , 10^{-41} , 10^{-42} , 10^{-43} , 10^{-44} , 10^{-45} , 10^{-46} , 10^{-47} , 10^{-48} , 10^{-49} , 10^{-50} , 10^{-51} , 10^{-52} , 10^{-53} , 10^{-54} , 10^{-55} , 10^{-56} , 10^{-57} , 10^{-58} , 10^{-59} , 10^{-60} , 10^{-61} , 10^{-62} , 10^{-63} , 10^{-64} , 10^{-65} , 10^{-66} , 10^{-67} , 10^{-68} , 10^{-69} , 10^{-70} , 10^{-71} , 10^{-72} , 10^{-73} , 10^{-74} , 10^{-75} , 10^{-76} , 10^{-77} , 10^{-78} , 10^{-79} , 10^{-80} , 10^{-81} , 10^{-82} , 10^{-83} , 10^{-84} , 10^{-85} , 10^{-86} , 10^{-87} , 10^{-88} , 10^{-89} , 10^{-90} , 10^{-91} , 10^{-92} , 10^{-93} , 10^{-94} , 10^{-95} , 10^{-96} , 10^{-97} , 10^{-98} , 10^{-99} , 10^{-100} .

- • bunch tree height determined by class

- Character height determined by display mode, normally 8 K, 16 L.
- Group label characters larger than those of controls; displays which are larger than control; display position characters much by 25% more.
- Letter, numeral styles: K, L, S, A.
- Symbol widths ratio: S_K:S_L=1.1 stroke width; "M" & "W" have S_K:S_L=1.1 & 1.1 are 1 stroke width.
- Stroke width for black (white) characters on light (dark) background 1/6 (1/7 - 1/8) of height.

1000

1000

* Figure 10, the number of hours per a week of

[illegible][illegible]

- Labels change to give a determined brightness level, color.
- Labels easily, accurately read at operational reading distance, view from light levels.
- Labels are sharp with high contrast.
- With illumination above 1000 lux.

* *Unpublished, by permission of the author, and by permission of the publisher.*

- Labels: dimension sheet, material, frequency, time, period, distance, light level, color; criticality of function; consistency of design.
- Labels for prototype equipment: made off and others to be removed.
- Labels not covered by other units.

- Vertical labels used only when labels

- Vertical labels used only when likely to be critical for personnel safety
- Electrical equipment marked with voltage, phase, frequency
- Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards
- Warning color scheme, start to change 25% larger than any following color band
- Placards exposed to hazards

* A demoversion can be downloaded from the Internet.

- A document may *also* be classified (MIL-STD-121) as one of *discovery*.
- Triple numbers, irrelevant only do not require an labeling.
- Single numbers, not redundant.
- Acronymic words likely to be meaningful.
- Words familiar to users.
- Each word, consequently, must be labeled with a *single*, meaningful number, meaning, avoided.

* Display pointers are aligned for

- Display pointers are aligned for common stable values.
- In form filling: user doesn't remove unused underscores; cursor machine positioned and tab key advanced; missing data indicated; protected areas designated.

• 6. 1991

- Low
- Test
- Can

• **Principles**
1998

• **Principles**
1998

- **Action**

- Arise
- (in)
- (in)

• 10

- 10 volt
- 13 volt
- 15 volt
- 18 volt

• New

[illegible]

- **Multi-**

[illegible]

11. ACCESS COVERING, CAPS	12. FASTENERS, CONNECTORS	13. FASTENERS, CONNECTORS	14. FASTENERS, CONNECTORS	15. FASTENERS, CONNECTORS	16. FASTENERS, CONNECTORS	17. FASTENERS, CONNECTORS	18. FASTENERS, CONNECTORS	19. FASTENERS, CONNECTORS	20. FASTENERS, CONNECTORS	21. FASTENERS, CONNECTORS
These openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.	Access openings in an item that allow manipulation of controls, connection and disconnection of fasteners, visual checking of displays or components, utilizing test points, and inserting or removing materials. Included is the access covering, if any.

TEST FUNCTION

OBJECTIVE: Evaluate the item under test for its capacity to be effectively and safely transported, including any special preparations necessary for loading and unloading. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use.

1
2
3

PREPARE FOR TRANSPORT		
PLACE IN TRANSIT CONFIGURATION	PACKAGE	ON
PURPOSE: Travel configurations are of two types. One type is a combat ready status that will allow the item to be fully utilized immediately on off-loading, as with combat vehicles. The other is a routine shipping status, which may involve disassembly, folding, collapsing, or covering of components; coating or filling with preservative; and removal or securing of loose parts. (Airdrop is a special case of the former type.) Evaluate the test item for either or both of the travel configurations, depending on the military characteristics specified for it. MAN/ITEM TASKS Position/lock movable components. Remove/secure loose/projecting components. Apply protective covering. Remove expendable liquids. Connect/remove auxiliary equipment (fording/winterizing kits). Add preservatives.	PURPOSE: Evaluate the test item for ease of packaging including disassembly, preparation for packaging, insertion and securing in the package. (Package here refers to boxes, cartons, canvas and plastic covers and cases, and other containers or covers for the test item.) MAN/ITEM TASKS Disassemble item elements. Obtain/construct package. Insert item into package. Insert shock proofing material. Anchor item. Close package. Apply labeling.	PURPOSE: Evaluate the test item for ease of packaging including disassembly, preparation for packaging, insertion and securing in the package. (Package here refers to boxes, cartons, canvas and plastic covers and cases, and other containers or covers for the test item.) MAN/ITEM TASKS Disassemble item elements. Obtain/construct package. Insert item into package. Insert shock proofing material. Anchor item. Close package. Apply labeling.

INDEX TO DATA

Test Item Components HUMAN FACTORS CONSIDERATIONS	Labels Manuals Markings (1)	Operating Elements (16)	Replaceable Items (21)	Labels Manuals Markings (1)	Fastener Connectors (13)	Operating Elements (16)	Packaging (17)	Fastener Connect (13)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A	A
B. SIZE & SHAPE	B		B	B	B		B	B
C. DIRECTION & FORCE		C	C		C	C	C	C
D. CLEARANCE	D	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H	H

TRANSPORTABILITY

item under test for safety and safety transfer preparations necessary. The HFE subtest of user performance one under conditions cited in actual use.

The conditions applicable to this class includes

1. User conditions - body size, clothing, and number of users;
2. Environmental conditions - weather, climate, terrain and illumination levels;
3. Operational conditions - use conditions (type of preparation, disassembly, packaging for transport) and time critical operations (combat ready, air drop).

	LOAD/UNLOAD	SECURE/UNFASTEN	
	DRIVE/TOW/LIFT ONTO/INTO/OUT OF CARRIER	IMMOBILIZE ITEM	PREPARE FOR USE
est item for disassembly, insertion and 'ackage here canvases and d other con- item.)	PURPOSE: Evaluate the relationship between the test item and standard carriers, to determine whether the design of the test item and/or its packaging is compatible with driving, being towed, lifted, pushed or pulled into or onto planes, ships, trucks, railroad cars and the item's subsequent removal. (The Test Item Components and Human Factors Considerations for the Driving and Towing task are the same as will be found in Operability I A, I C, and III A.) MAN/ITEM TASKS Attach/remove hooks/cables to lifting points on item or package. Engage item with material handling components (forks). Emplace item on/in pallets/cargo nets/slings/other lifting and loading devices. Attach item where required-lifting/sliding/rolling item to do so.	PURPOSE: Evaluate the item for location and usability of tie-down points insofar as they relate to standard tie-down points in carriers. MAN/ITEM TASKS Secure ties to item. Secure ties to carrier. Increase/decrease tension of ties during or after initial task. Check out tie-downs during transit to verify connection/tension. Check wheels/lock tracks.	PURPOSE: Evaluate the test item and package for ease of tasks required for preparation for use under normal (rear echelon) conditions as well as under combat tactical constraints of time and defensive or offensive activity. MAN/ITEM TASKS Open package. Remove item or components. Assemble item. Clean/lubricate/etc. Install/set up/distribute item.

INDEX TO DETAILED DESIGN CONSIDERATIONS

[illegible]

ed for packaging, retention, covers, bases, bags, are not part of the for transport, and storage housed for the item, or tem, and are part of tion.

Reservable fill points and drains for liquids, gases, hydraulic fluids, other liquids, air, gases, etc.
Filters for fuel, oil, air.
Includes vacuum tubes, electronic modules and low MTBF parts.

n units rather than ones.
owed away from en- exhaust pipes.
y apd items secured as or restrained by

- Don't need to disassemble to lub.
- Replaceable units remain "open" without supports well laid out readily accessible.
- Fuses easily accessible.
- Vehicle drain valves, fuel/oil filters, distributors, fuel injectors, fan belts, etc are accessible for inspection, replacement.
- All tire valves accessible.

cessible by 5-95th% S.B.I-7.

- Similarly shaped items with different function have standard orientation throughout; easily identified not interchangeable.
- Positive, negative battery terminals are different sizes.
- Radiator fill neck large enough to accept filter.

- Design Requirements (MIL-STD-1472)
- User-Computer Interface Data (MIL-STD-1472C)
- Guidance Data (MIL-HDBK-759, Etc.)

hese quick releases:

- Blind screwdriver adjustments have mechanical guides.
- Sensitive adjustments guarded hand support provided.
- Weighted limits for one man lifts FIG 14.C.1; If shape is convenient, handles are provided. If not repeated, item is not carried.
- Horizontal push, pull force limits FIG 14.C.2.
- Units that are pulled out of them are mounted on rollout racks, slides, hinges.
- Simple indicator lights have clearance for easy blind replacement.
- Large parts do not prevent access to other parts.
- Check, adjustment, test points; connectors; labels are accessible during maintenance.
- Enough clearance is provided to replace parts without contacting hardware.
- Fill points, drains reachable by 5th % user in restrictive clothing.
- Timing marks, other adjustment indicators minimize parallel, are readily visible.
- Reference scales visible.
- Lighted indicators incorporate filament redundancy/dual lamps.

h larger than units event damage when replacement.
age avoided, for full hand, fin- hen using opening
-erance provided
missiles exceeding r. retainer with e- ar 95th% hand.

a cover is in place package contents

aps are used to
ound equipment
a, use.
state obvious.
part of vehicle,
ments.
and in racks.

- Faulty equipment is easily detected, quickly removed, repaired using standard parts, modules.
- Delicate parts are protected.
- Lamps replaceable with power on.
- Common hand tools for field units.
- Guide pins, rollout racks, interlocks, drawers, hinges, quick-disconnects aid removal, replacement.
- Item failure indicator or alarm.
- Remote handling devices compatible have quick disconnects, captive fasteners, feedback.
- Internal controls located near relating parts, high volts, other hazards are shielded.
- Rollout racks: stops provided; CG does not overshift, topple item.
- Units can be accessed without damage from heat, moving parts, electricity, chemicals, radiation.
- Fuel service equipment has automatic shutoff device.
- External parts are grounded.
- Pressurized components have bleed valves.
- Parts, components, circuits, assemblies unambiguously labeled.
- Lub points labeled as to type, frequency.
- Items exceeding one man lift labeled with weight, limitation.
- Hand, push, lift points CG (heavy) weight labeled.
- Flexible items coded, keyed.
- Fuses labeled, rated.
- Battery terminals marked "+", "-".
- Hazards conspicuously placarded.
- Group areas identified.

covers, cases are
finished to pre-
ary.

and within its cover
ed, tell how to open,
doors, cases,
hazards, dangers
labeled.

TEST PLAN/TEST

OBJECTIVE: Evaluate the item under test for its capacity to be effectively and safely carried or utilized by appropriate personnel. The HFE subtest should consider evaluation of user performance and safety for these functions under conditions representative of those expected in actual use.

The conditions applicable to this c

1. User conditions - body size and etc
2. Environmental conditions - weather
3. Operational conditions - time of day, conditions (noise, vibration, etc)

CARRY/WEAR ITEM			
DON/OFF	WEAR	CARRY ITEM	PERFORM
PURPOSE: Evaluate the design of the test item for ease of mounting on or attaching to the body, for covering the body, or for attaching to other body mounted components, and for the ease of removing or taking it off. MAN/ITEM TASKS Put on/take off shirt/gloves/boots/trousers/protective clothing. Button/snap/tie clothing. Attach/emplace load into/onto pack/load carrier/carrying case. Buckle straps/snap catches/otherwise attach portable gear to body/cartridge belt/pack harness.	PURPOSE: Evaluate the design of the test item for ease, safety, and comfort as it is worn by the individual soldier. MAN/ITEM TASKS Use headwear. Use handwear. Use footwear. Wear clothing. Wear personal equipment items (back-pack/cartridge belt/etc.)	PURPOSE: Evaluate the item for ability of users to effectively, safely, and comfortably carry it during routine, non-combat operations, including walking, mounting/dismounting vehicles, climbing stairs and ladders. MAN/ITEM TASKS Carry item on back/body (no hands). Adjust carrying elements (straps/holders). Carry item in one/both hands. Carry item by one or more men.	PURPOSE: Evaluate the item for ability of user to perform combat or wearing it in normal combat. These include crawling, jumping, throwing, etc. through water obstacles, dig defense, post through, under, entrenching to be evaluated in given under "L Combat Function would be evaluated. MAN/ITEM TASKS Fasten item so flapping/interfere. Discard item vegetation/bar. Disconnect/ratting is a problem. Carry item combat tasks. Eliminate noise relative to the. Cover/modify to insure camouflage.

Test Item Components HUMAN FACTORS CONSIDERATIONS	Head- wear (22)	Hand- wear (23)	Foot- wear (24)	Clothing (25)	Load Carrying Devices (27)	Head- wear (22)	Hand- wear (23)	Foot- wear (24)	Clothing (25)	Load Carrying Devices (27)	Handles (14)	Stepping Gear (26)	Load Carrying Devices (27)	Control Hard- Ware (31)	Head- wear (22)	Hand- wear (23)
A. LOCATION & ARRANGEMENT					A					A	A		A	A		
B. SIZE & SHAPE	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
C. DIRECTION & FORCE					C					C	C		C	C		
D. CLEARANCE	D	D	D	D	D	D	D	D	D	D	D		D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

PORTABILITY/USABILITY

The conditions applicable to this class include:

1. User conditions - body size and clothing;
2. Environmental conditions - weather, terrain, climate (desert, arctic, swamp);
3. Operational conditions - time critical operations (emergency use, removal), combat conditions (noise suppression, blackout, NRC) and use conditions (duration of use).

		UTILIZE ITEM	
M	PERFORM COMBAT FUNCTIONS	PREPARE FOR USE	USE
item for ability safely, and com- routine, non- uding walking, vicles, climbing so hands). (straps/ hold- ds. men.	PURPOSE: Evaluate the item for ability of user to perform routine and contingency combat type tasks while carrying or wearing it in conjunction with the normal complement of combat gear. These include, but are not limited to, crawling, jumping, firing weapons, throwing grenades, running, wading through water, climbing over and under obstacles, digging or otherwise preparing defense positions, and breaking trail through underbrush. The use of an entrenching tool, for example, would be evaluated in accordance with guidance given under "Utilize Item". In "Perform Combat Functions", an entrenching tool would be evaluated <u>only</u> for its portability. MAN/ITEM TASKS Fasten item securely to body to prevent flapping/interference. Discard item in emergency (snagged on vegetation/barbed wire). Disconnect/raise item for wading if wet- ting is a problem. Carry item while performing various combat tasks. Eliminate noise sources caused by or relative to the item. Color/modify visible/reflecting surfaces to insure camouflage.	PURPOSE: Evaluate the test item for ease of preparation for use, including minor assembly or connection, field level alignment or adjustment, gaining access to operating components, uncovering, cleaning or connecting optical components, and other tasks required for final preparation of an item for use. MAN/ITEM TASKS Open access flaps or covers. Remove item from case. Connect components. Extend/fasten collapsible/folding com- ponents. Manipulate adjustment controls. Verify operational status. Clean/adjust optics.	PURPOSE: Evaluate the item for ability of user to perform required tasks easily, safely, and reliably. This task refers only to those items that have a function other than carrying loads, and includes gas masks, goggles, life preserver, en- trenching tool, and flashlight. (For operability of field radios and detection systems, see Operability IV C.) MAN/ITEM TASKS Put on/adjust item (goggles/life pre- server). Use item as designed (dig/illuminate).

DETAILED DESIGN CONSIDERATIONS.

Weapons (1)	Combat Hard- Ware (28)	Head- wear (22)	Hand- wear (23)	Foot- Wear (24)	Clothing (25)	Load Carrying Devices (27)	Sleeping Gear (26)	Load Carrying Devices (27)	Combat Hardware (28)	Labels/ Manuals/ Markings (1)	Load Carrying Devices (27)	Combat Hardware (28)
A	A	B	B	B	B	B	B	a	B	A	A	A
B	B	B	B	B	B	B	B	a	B	B	B	B
C	C	D	D	D	D	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D	D
E	E	F	F	F	F	E	E	E	E	E	E	E
F	F	G	G	G	G	F	F	F	F	F	F	F
G	G	H	H	H	H	G	G	G	G	G	G	G
H	H					H	H	H	H	H	H	H

	24 FOOTWEAR	25 CLOTHING	26 SLEEPING GEAR	27 LOAD CARRYING DEVICES	28 COMBAT HANDWARE
and arctic gloves as special purpose required for election.	Includes standard combat boots, antineuro or spike boots, dress shoes, waterproof and arctic footwear, and "soft" shoes (sneakers). Also encompasses socks, stockings, and shoe and foot inserts.	Includes shirts, trousers, undergarments, jackets, protective clothing (rain, NBC), cold weather clothing, and specialized apparel of various types.	Includes sleeping bags and covers, blankets, air mattresses, and other items utilized for sleeping.	Generally, web equipments carried on the body by an individual soldier into a combat situation, which are used to carry, contain or protect other items. Includes packs, pack frames, harnesses, weapons carried, and carrying cases for combat items (ammunition, first aid kits, binoculars, entrenching tools, field telephones).	A miscellaneous grouping of non-weapon items which are routinely carried into the field, including hygiene items, flashlights, gas mask, canteens, entrenching tool, axes, first aid kits, compasses, etc. Also includes man carried items of a less routine nature, such as binoculars, goggles, and life preservers.
1 for 5th-95th% is sized for 1st-5th%.	- Footwear is sized for 5th-95th% personnel: FIG 25.B.5. - Essential, critical footwear is sized for 1st-99th% personnel. - Clothed ground troop foot size: FIG 25.B.7. - Outside dimensions of boot, shoe are consistent with specs for footholds, ladders. - Socks, stockings fit foot snugly without wrinkles. - Shoes, boots compatible with foot controls.	- Essential, critical clothing is sized for 1st-99th% personnel. - Arctic clothing for 5th-95th% personnel: FIG 25.B.8. - Clothed ground troop body dimensions: FIG 25.B.7. - Ponchos fitted only for length but must be large enough to cover a fully equipped man. - Protective clothing fits snugly at openings.	- Sleeping gear is sized for 5th-95th% personnel: FIG 25.B.13. - Essential critical personnel equipment is sized for 1st-99th% personnel. - Gear is not excessively bulky when rolled, packed.	- Backpacking aids distribute the load over as many muscle groups as possible. - Backpacking aids place the load CG as close to the porter's spine as possible. - Load-carrying minimizes pressure applications to chest or armpits. - Heavy loads placed close to the body. - For rough terrain, climbing heavy items anchored at, near bottom. - Carried equipment is sized for 5th-95th% personnel: FIG 25.B.1-4. - Adjustable items have range of fit for 5th-95th% user. - Maximum use is made of standard load carrying devices. - A single size device can accommodate smallest user in tropic clothing to largest user in arctic clothing.	- Items of sufficient size, weight to interfere with balance have proper placement, type of attachment. - Items are readily accessible.
supplies for personnel tasks or other provided. IG 23.B.1.	- Footwear size allows for expansion due to heat, load carrying. - Shoe, boot fit includes heaviest socks, combination of socks that will be worn. - Shoe, boot inserts considered in fitting.	- Fit of combat clothing is liberate rations sometimes carried in shirts; strenuous combat tasks require free limb movement. - Ponchos, NBCs, large protective garments cover packs, weapons, etc carried by man without detracting from man coverage.	- Design Requirements (MIL-STD-1472) - User-Computer Interface Data (MIL-STD-1472C) - Guidance Data (MIL-HDBK-759, Etc.)	- Load-carrying systems consider the weight, distribution of individual items carried by the user. - Rifleman (other) fighting loads: 40 lb (45 lb max); marching loads: 55 lb max. - Individual portions of equipment may weigh up to 35 lb; its load is balanced, well distributed; it is not necessary to maintain pace of infantry movement. - Two-man carrying stretcher type handles, shoulder support. - Suspension, location of device is such that other man-carried items are readily accessible. - Continuous rather than discrete adjustment of straps is preferred where snug fit is required. - Adjustments can be accomplished while item is in use. - Adjustments maintained by means of friction, catches, snaps.	- Equipment sizing ensures use by 5th-95th% user: FIG 25.B.1-7. - Individual weights of basic rifleman items: FIG 25.B.1. - Gas mask, goggles useable with helmet. - Pack carried items fold, collapse to take up minimum space. - Gas masks, goggles, life preservers are adjustable on personnel, fit snugly.
large enough to specify flexibility of finger weapons operation.	Eyelets, buckles, fasteners have dull finish non-reflective.	- Metallic, plastic components have dull finish non-reflective. - Protective clothing adaptable to various camouflage requirements.	- Inside, outside of bags, liners, covers to be dark, dull colors. - Sleeping bags used in snow have white exterior.	Fasteners, components have dull, non-reflecting finish.	- Survival items brightly colored: life preserver, survival marker. - Combat items have dull finish, non-reflecting surface. - Light source dimmable for blackout or red lens provided.
will finish non-reflective, blind tags.	- Preservative, special protective materials quickly, easily applied. - Non-marking materials used for tents, tents. - Cups, fasteners, buckles open, close silently. - Combat footwear design details use to climb, crawl, run, perform other combat tasks with a minimum of slipping, pinching, rubbing. - Boots are compatible with skin, snowshoes. - Shoes, boots used around heavy equipment have rigid "heel" toe. Externally heated socks cannot shock wearers, especially after rest. - Soles of boots, shoes are slip resistant.	- Special protective clothing comfort micro-climate between 68°F @ 14 mm Hg H₂O vapor pressure & 95°F @ 3 mm Hg H₂O vapor pressure. - Protective clothing used in cold weather remains supple, does not stiffen. - Fasteners open, close silently. - Clothing is evaluated with full combat gear; does not degrade performance in any combat task due to lack of design, fit, comfort. - If snagging, catching with jeopardize more velocity, snags either quick release fasteners used.	- Bags easily turned inside-out for airing, cleaning. - Bag liners provided for ease of cleaning. - Air mattresses provided with easy-to-use patch kit. - Bags have self-contained ties, straps. - Zippers, fasteners operate quietly. - Bags, mattress blankets are integrated with standard carrying device when rolled, packaged. - Zippered bags have both internal, external zipper caps. - Snapped bags have quick release capability. - Snapping bags are designed to prevent any possibility of accidental suffocation.	- One-man back-packed loads over 44 lb are provided with lifting aids for second man assist. - Back-packs do not produce unbalanced loads, shoulder strain interference with walking, crouching, if under movement, body suspension regulation. - Load permits freedom of movement; has no sharp edges, projections. - Catches, snaps operate silently. - Belts, straps easily replaced. - Material milners, not, not proofed. - Loads have a minimum of projections to prevent personnel injury or entanglement in undergrowth. - Heavy load items have quick-release capability for duffing in emergency: drop water, attack, snapping, falling. - Emergency supplies quickly accessed.	- Metal components not proofed, corrosion resistant. - Replacement of expendable components done without tools: breathing canister, batteries. - Leads, straps, chains, other noise producing elements are covered, anchored to reduce noise. - Audible activation of fasteners, connectors is minimized. - Equipment useable with helmet. - Face plates, optics shatterproof. - Sharp edges adequately covered during parades. - Emergency items accessible at all times. - Carrying, wearing these items does not interfere with required combat tasks: performance running, throwing, jumping, climbing, using weapons, crawling, wading. - Eye, face coverings afford man vision, hearing to wearer. - Preparation for use obvious: labeled. - Special use instructions permanently attached.
file with military material with portable protection, have no or have ventilation allow situated on objects is finger grip area.	Core or use obvious, labeled or instructions included.	Core or use obvious, labeled or instructions included.	Core or use obvious, labeled or instructions included.	Core or use obvious, labeled or instructions included on issue.	
are, labeled or					

TEST FUNCTION

OBJECTIVE: Evaluate the item under test for its capacity to be effectively and safely assembled. The HFE subtest should consider evaluation of user performance or safety for this function under conditions representative of those expected in actual use.

SELECT/PREPARE SITE

This is a necessary first step in the construction or erection of a large item. The technique and equipment for performing this task are, however, not a part of the primary test item.

The test engineer in this test situation would merely observe the site preparation operations to insure that the erection site is adequately prepared for the test item involved, in order to enable a valid test to be conducted. Caution should be exercised in that the time, equipment, and people available in a test situation may exceed that which will be available in a real use situation.

Some erection will be conducted in or on mud or sand, on slopes, and in inclement weather. The test should be conducted on terrain similar to that which will exist in the field. If it cannot, the test engineer will have to extrapolate to the predicted situation on the basis of (1) the test situation, (2) experience with similar structures, and (3) formal and informal data generated with regard to similar structures.

The items involved in these tasks are not a part of the test item. Material Handling Devices, Man Operated (Class III A) will account for most of the items used in these tasks. These items include such things as bulldozers, scoops, shovels, earth movers.

PREPARE

LAYOUT/INSPECT

PURPOSE: Evaluate the design of separate components of the test item for ease of handling, reliability of component identification, and ability of man to determine whether components are in satisfactory condition.

MAN/ITEM TASKS

Unpackage/uncover components.

Move components into proper relationship to each other according to S.O.P./technical instructions.

Checkout structural integrity of components as well as status of moving/sliding parts.

PURPOSE: Evaluate the design of the test item for maximum assembly level, control of construction, test item safety, workability, and which platforms.

MAN/ITEM TASKS

Prepare component apply adhesive/sealant.

Join structural elements.

Insert/tighten fasteners.

Align structural parts.

INDEX

	Test Item Components HUMAN FACTORS CONSIDERATIONS	Labels Manuals Markings (1)	Test Elements Tools (18)	Structural Components (29)	Labels Manuals Markings (1)	F C
	A. LOCATION & ARRANGEMENT	A	A	A	A	
	B. SIZE & SHAPE	B	B	B	B	
	C. DIRECTION & FORCE		C	C	C	
	D. CLEARANCE	D	D	D	D	
	E. VISIBILITY	E	E	E	E	
	F. USE CONDITIONS	F	F	F	F	
	G. SAFETY	G	G	G	G	
	H. OPERATING PROCEDURES	H	H	H	H	

ERECTABILITY

The conditions applicable to this class include:

1. User conditions - body size, clothing and number of users;
2. Environmental conditions - weather, climate, terrain and illumination levels;
3. Operational conditions - use conditions (number of personnel, duration of use) and special hazards (height, wind, cold, ice).

INDEX TO DETAILED DESIGN CONSIDERATIONS

[illegible]

GENERAL REQUIREMENTS

A. GENERAL INFORMATION
The purpose of this document is to provide a minimum standard for the design, development, and testing of equipment used in the field. It is intended to be used as a guide for the design and development of equipment, and as a basis for the testing of equipment. It is not intended to be a prescriptive standard, and it is not intended to be used as a basis for the design and development of equipment.

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1. LABELING MATERIALS, MARKINGS

Provide labels for equipment in the form of written material, when necessary, diagrams, illustrations and instruction plates. Make operator aware of hazards. Use special guidance or instruction.

Controls, displays, etc. are clearly, appropriately labeled except where use is obvious. Labels placed on or near items they identify. Do not cover other information. Label not behind control. Label location consistent. ID labels not obscured by components on flat surfaces; on main body, min coverage by grease not easily removed.

Character height determined by distance read, luminance: 10:1, 10:1. Label characters larger than those of controls, displays where larger than control; display position characters: min 1/16 in. (1.6 mm). Letter, numeral styles: 10:1, 10:1. Height/width ratio: 5:1. Stroke width: 1/16 in. (1.6 mm). Stroke width for letters (left): 1/16 in. (1.6 mm). Stroke width for numbers (right): 1/16 in. (1.6 mm). Background: 10:1 (10:1) of height.

Spacing between characters (word): one stroke (character) with min. Line spacing: 1 character height. Counter numeral: low ratio: 10:1 (except 10:1 separation: 10:1 w). Optical projection: all caps, stroke width 1/16 in. (1.6 mm) exceeds 15 minutes read angle. Threshold numeral: low ratio: 10:1 (10:1) stroke width internally (externally) illuminated: 10:1 (10:1). Abbreviations all caps, no periods. Extended caps used lower case. Label characteristics determined by illumination level, color. Labels easily, accurately read of operational reading distance, vibration, light levels, environments. Labels are sharp with high or color contrast. With illumination above 1 ft.-c. black letters, light background. Dark substrates: letters visible, do not interfere with night vision. Contrast readings: 10:1, 10:1.

Label characteristics accuracy required: time available; distance; light level; color; criticality of function; consistency of design. Labels on production equipment are as durable as the equipment. Labels for prototype equipment easily affixed, altered, removed. Labels not covered by other units nor obscured by grease, dirt. Markings, tags are as permanent, washable as equipment. Roman numerals avoided. Vertical labels used only when labels are not critical for personnel safety, performance. Electrical receptacles marked with voltage, phase, frequency. Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards. Warning placards illuminated. Placards adjacent to hazards.

Abbreviations are standard (MIL-STD-122); new OK if obvious. Trade names, irrelevant info do not appear on labeling. Labels cover min redundancy. Abstract symbol only if meaningful. Words familiar to user. Hand grip areas identified.

2. STAIRS, LADDERS, PLATFORMS

Provide a safe way to an accessible area, feet, while climbing or working from outside the vehicle for the temporary placement of loads. Wheels, ladders and structural members used for climbing are examined in ladders. Angle of ascent: ladders: 60°-90°; stair ladders: 60°-75°; stairs: 20°-50°; ramps: 0°-20°; platforms: 0°.

Sequence of stepping points ends with proper foot position. No knee over toe. Step surfaces within, without work space, evenly reached from either direction. Level to ladders to seven feet or level offset of 1/4 in. (6.4 mm) ending level. Self locking, level used on climbing stairs, platforms.

Gross (hand) dimensions based on 25th-75th body dimensions of user: 10:1, 25th-75th. Stair, stair-ladder, fixed-ladder dimensions do not exceed the maximum dimensions: 10:1, 25th-75th. Platform: 2 x 3 min. Stair, ladders, of maximum 25th-75th, user wearing or in clothing: 10:1, 25th-75th.

Folding ladder lift height: 5' min. One man limits to lift, stair ladders: 5' for 20 lb; 6' for 25 lb. Stair, ladders, platforms, ramps with and without combined weight of user plus equipment plus safety factor. Ladders carried, positioned, handled by 2 men max.

Upper clearance is provided in folding stairs, ladders. Step width, spacing useable while wearing boots. Step width, spacing accommodate boots: 10:1, 25th-75th. Folding ladder catches, ladders operable with a cutoff or in lock tests: 10:1, 25th-75th.

Visual obstructions, blind footholds avoided. Treads contrast with structure, conspicuous in dim light. For reduced lighting reflective materials used.

Stair ladders are of metal with the tread rise open at rear. Exterior personnel platforms, work areas: Open metal grating or non-slip surface. Steps useable if wet, icy. 2-use from extension ladders have captive hardware. Wheeled platforms have wheel locks.

Ladders are not provided when equipment is to be hand carried. Fixed ladders over 20' h provide a device to protect from falls. Open personnel platforms have a toe board, screen 3" h min. Elevator, hydraulic work platform control: quick limit stop; fail-safe brake; guard rail, safety bar, chains. Safety mesh under open gratings. Obstructions, sharp edges parked. Ladders located away from moving parts, electrical sources. Elevators, hydraulic work platforms have visible max load signs. Footholds marked, identified. "No Step" markings if applicable. Warning labels for hazards. Procedures listed for slowing, employing ladders, ramps.

Open personnel platforms: guardrails winterized: rails, top rail 42" min rails set back from edge 25" min. Internal grabrails: only use when critical to mechanical function, personnel safety. Handgrip areas: away from cables, lines, hot pipes, other hazards. Inappropriate structures, areas cannot be used as footholds. Handgrip: no projections, sharp.

3. ELECTRICAL, PNEUMATIC

Avoid wires to prevent and enter the stream and to prevent interference. Support, leverage and support for a climbing or working area. These hazards, structural members, etc. used for climbing or balance, are prohibited by standards.

Identify, safety bars, climbing areas, platforms or other openings: 10:1, 25th-75th. Handholds: handholds, where needed, within reach. Adequate: handholds for balance while moving.

Handhold dimensions: 10:1, 25th-75th. Handhold length: 10:1, 25th-75th. Handhold opening: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Stairs, stair-ladders, ramps open on one or both sides have intermediate guard rails. Stair-ladder handrails are non-slip. Handholds useable if wet, icy. Handgrip useable with bare hand in hot climates, high temp. Collapsible handholds: useable while wearing or in mittens.

Open personnel platforms: guardrails winterized: rails, top rail 42" min rails set back from edge 25" min. Internal grabrails: only use when critical to mechanical function, personnel safety. Handgrip areas: away from cables, lines, hot pipes, other hazards. Inappropriate structures, areas cannot be used as footholds. Handgrip: no projections, sharp.

Handholds marked, identified.

13. ELECTRICAL, PNEUMATIC

Avoid wires to prevent and enter the stream and to prevent interference. Support, leverage and support for a climbing or working area. These hazards, structural members, etc. used for climbing or balance, are prohibited by standards.

Identify, safety bars, climbing areas, platforms or other openings: 10:1, 25th-75th. Handholds: handholds, where needed, within reach. Adequate: handholds for balance while moving.

Handhold dimensions: 10:1, 25th-75th. Handhold length: 10:1, 25th-75th. Handhold opening: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Stairs, stair-ladders, ramps open on one or both sides have intermediate guard rails. Stair-ladder handrails are non-slip. Handholds useable if wet, icy. Handgrip useable with bare hand in hot climates, high temp. Collapsible handholds: useable while wearing or in mittens.

Open personnel platforms: guardrails winterized: rails, top rail 42" min rails set back from edge 25" min. Internal grabrails: only use when critical to mechanical function, personnel safety. Handgrip areas: away from cables, lines, hot pipes, other hazards. Inappropriate structures, areas cannot be used as footholds. Handgrip: no projections, sharp.

Handholds marked, identified.

14. ELECTRICAL, PNEUMATIC

Avoid wires to prevent and enter the stream and to prevent interference. Support, leverage and support for a climbing or working area. These hazards, structural members, etc. used for climbing or balance, are prohibited by standards.

Identify, safety bars, climbing areas, platforms or other openings: 10:1, 25th-75th. Handholds: handholds, where needed, within reach. Adequate: handholds for balance while moving.

Handhold dimensions: 10:1, 25th-75th. Handhold length: 10:1, 25th-75th. Handhold opening: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th. Handholds: 10:1, 25th-75th.

Stairs, stair-ladders, ramps open on one or both sides have intermediate guard rails. Stair-ladder handrails are non-slip. Handholds useable if wet, icy. Handgrip useable with bare hand in hot climates, high temp. Collapsible handholds: useable while wearing or in mittens.

Open personnel platforms: guardrails winterized: rails, top rail 42" min rails set back from edge 25" min. Internal grabrails: only use when critical to mechanical function, personnel safety. Handgrip areas: away from cables, lines, hot pipes, other hazards. Inappropriate structures, areas cannot be used as footholds. Handgrip: no projections, sharp.

Handholds marked, identified.

18 DUBLIN WATERS, TOWNS

the bodies of all universities and equipment such as laboratories, plants, power and security, filter bodies and enclosures.

29 SYSTEMS FOR LOCAL COMMUNITY NEEDS

The primary characteristic of these components is that they are initially separate units that must be connected with other components to form sub-assemblies.

Includes such items as a single garden, a pre-assembled motorized unit, a door, a section of pipe, a tent, etc.

are used to control the flow of gas.
A second inlet valve
is located at the rear of the engine.

The engine is driven by a
gasoline motor which is
driven by a belt drive system.

[illegible]

Page 709 of 816
I require you to
answer,
As you are called by
the French, the other
garden of Paris.
[et, and, and, and,
to be one of the
them one.
see C.C. 10

We are now looking at
Bertha's work, her
writing to you.
It is very interesting
and we are going to
analyze it for
with both eyes.

To have something

success die.
 increased the user's
 clothing.
 able in connection
 to.
 and is provided for
 the
 highly distinctive die
 under each open

Minimum connections:
banding signals.
As used where they
are heard; covers
several
number of turns.
As are used.
A connection can be

...connecting
connector does not
age rating cannot be
the receptacle of
testing.
are subject's
to dust covers where
only no other
standard function, over

...ed on to voltage.

receptacles identical.
in three stripes, or
a slanting pin point.
then obvious.
reading direction is
identification: 11.

- Internal (internal) test points are of the jack (stand off) terminal design.
- Test points reflect the sequence for sequential testing.
- Test points for adjustment are close to the controls, displays used.
- Special tool is required for adjustment are with equipment.
- Test points are accessible.
- Test points, built-in meters used to indicate failed unit, module.

- * Limiting body dimensions based on 5th % were for reaching test points: F10, P5, R1.
- * Tables are long enough to check unit in place.
- * Arms as hand hinged assays in working point on.

Calibration, adjustment controls with limited motion have mechanical stops to prevent damage. Stands, centers (wheels, knist-lift-mat) is provided for equipment exceeding 30 lb (10 kg).

Adequate storage provided in portable test equipment case, lid to contain leads, probes, spacers, manuals, tools.

Large parts are not mounted to derive access to smaller ones.

Sufficient space provided for test equipment, tool use without difficulty, hazard.

Indication of equipment power failure provided.
Display provided to show equipment out-of-tolerance, if true.
Test, adjustment, check point and cables, connectors, labels are accessible, visible during maintenance.
Non-visual screwdriver adjustments have mechanical shaft guide.

Enough test points are provided to prevent removing sub-assemblies.
Special tool use minimized.
Knives preferred to screwdriver for frequent adjustment.
Tools provided with rings, eyes compatible with quick-release straps, hooks on tool belts.

- Electrical potentials over 300V are stepped down for test points.
- Tools, test leads used near high voltages are insulated.
- Electrical hand-held tools have 3-wire power with ground or are dou-

Exposed surfaces of electrical hand-held tools are non-conducting or grounded.

- Test points permanently labeled, color coded.
- Operating instructions for portable test equipment affixed to unit, lid or compartment.
- Calibration reminder included with test instructions.
- Contact, terminals, etc over 500V are clearly labeled.

Connection, lifting test points are easily reached before & after mating with other components.

- Component size, shape can also be determined by environments: jungle, slope, swamp, etc.
- Component shaped such that its connection method is obvious.

• Weight limits for one man lift: FIG 1A.C.1; if shape is convenient, handles are provided, lift is not repeated, item is not carried.
Horizontal push, pull force limits FIG 1A.C.2.

• Two-man lift values are twice one-man lift only lift item configuration convenient; neither man exceeds maximum limit.

Components are well spaced both during & after erection so that hand tools can be easily inserted, efficiently utilized. Clearance such that components can be removed, replaced quickly, easily. Components requiring replacement, adjustment, calibration are accessible during erection.

General assembly requirements min
11-C: course, 30; medium, 50; fine,
75; precise, 200.
Blind attachments avoided whenever
possible.

Operating, mechanical, electrical components are tested prior to assembly.

Preservatives, paint, greases applied to components do not hide cracks, breaks in structural members.

Non-sparking tools used in explosive atmosphere.

Sensitive, delicate components are protected against dust, rain, mud during assembly, erection.

Exposed edges (corners) rounded
0.04" (0.5%).
Sharp edges covered, sheathed for
safe handling.
Structural members used for climbing
fit criteria for steps, ladders,
platforms.
If heights are involved: hooks, eyes
are provided for attaching safety
belts, lines.

- ach assembly, component, part is labeled, identified.
- Items exceeding the one-man lift values are labeled with weight, lift limitation.
- or mechanical, power lift: hoist.
- liff points provided, labeled.
- Sequence of assembly is clearly defined, accompanied by illustrations, diagrams.
- Connection, test points labeled.

- Design Requirements (MIL-STD-1472)
- User-Computer Interface Data (MIL-STD-1472C)
- Guidance Data (MIL-STD-1472D, Etc.)

TEST FUNCTION

OBJECTIVE: Evaluate the design of tents, shelters or buildings to enable personnel to live, work and move about safely and effectively. The HFE subtest should consider personnel performance, comfort and safety for such functions as movement through the area and performing on-duty and off-duty activities. The evaluation should also assess these functions under conditions representative of those expected in actual use of this space.

TRANSLATE/TRANSPORT		PERFORM ON
MOVE ABOUT	TRANSPORT MATERIAL	
PURPOSE: Evaluate the design of passageways, ladders, hatches, handholds, footholds to enable personnel to move through the area. MAN/ITEM TASKS Move through hallways. Climb ladders. Move through doors/hatches. Identify location.	PURPOSE: Evaluate the design of passageways, cargo transport devices, and hatches to enable personnel to move cargo through the area. MAN/ITEM TASKS Carry loads. Move loads using transport aid. Move loads to/from storage. Secure/unsecure loads. Monitor loads during transport. Read labels/warnings. Avoid obstacles.	PURPOSE: Evaluate working space for performed. MAN/ITEM TASKS Take position. Stow/unstow equip. Inspect station. Communicate. Move about the bay. Occupy work space. Control work space.

INDEX TO DETAILED DATA

Test Item Components HUMAN FACTORS CONSIDERATIONS	Labels Manuals Markings (1)	Steps Ladders Platforms (2)	Handholds Railings (3)	Doors Hatches Passages (4)	Labels Manuals Markings (1)	Steps Ladders Platforms (2)	Handholds Railings (3)	Doors Hatches Passages (4)	Labels Manuals Markings (1)	Workspace (10)
A. LOCATION & ARRANGEMENT	A	A	A	A	A	A	A	A	A	A
B. SIZE & SHAPE	B	B	B	B	B	B	B	B	B	B
C. DIRECTION & FORCE		C		C		C		C		C
D. CLEARANCE	D	D	D	D	D	D	D	D	D	D
E. VISIBILITY	E	E	E	E	E	E	E	E	E	E
F. USE CONDITIONS	F	F	F	F	F	F	F	F	F	F
G. SAFETY	G	G	G	G	G	G	G	G	G	G
H. OPERATING PROCEDURES	H	H	H	H	H	H	H	H	H	H

HABITABILITY

e design of tents, shelters or buildings to
e, work and move about safely and
test should consider personnel perform-
for such functions as movement through
on-duty and off-duty activities. The
stress these functions under conditions
pected in actual use of this space.

The conditions applicable to this class include:

1. User conditions - body size, clothing and encumbrances
2. Environmental conditions - lighting, noise level and free volume
3. Operational conditions - blackout and emergency conditions.

	PERFORM ON-DUTY ACTIVITIES	PERFORM OFF-DUTY ACTIVITIES	
SERIAL	WORK	PERFORM REST AND RELAXATION	PERFORM LIFE ACTIVITIES
design of post-devices, and men to move	PURPOSE: Evaluate the design of the working space for supporting activities performed.	PURPOSE: Evaluate the design of R & R equipment and facilities of the building or area to accommodate these equipment and facilities.	PURPOSE: Evaluate the design of barracks and facilities for mess, waste disposal, bathing, self care, medical aid, and life supporting/sustaining environments.
	MAN/ITEM TASKS	MAN/ITEM TASKS	MAN/ITEM TASKS
	Take position.	Prepare area.	Stow/unstow items.
aid.	Stow/unstow equipment.	Stow/unstow equipment.	Perform self care.
.	Inspect station.	Control environment.	Perform medical care.
	Communicate.	Sleep/rest.	Perform dental care.
ert.	Move about the building.	Perform solitary activity.	Perform eating.
	Occupy work space.	Perform group activity.	Perform waste elimination.
	Control work space environment.		Modify area decor.

INDEX TO DETAILED DESIGN CONSIDERATIONS

[illegible]

PRIMARY ACTIONS
CONSIDERATIONS

A. LOCATION/ACCESSIBILITY

The positioning of a component as it affects the ability of the operator to reach, use, or manipulate it, including location of openings (access, work, cover, etc.), location of controls (handles, knobs, levers, etc.) as well as its relationship to other components.

B. SIZE/SHAPE

The maximum and/or minimum dimensions of components that are required for adequate man-machine interface, including the effects of anthropometric and special clothing (arctic, PPE, etc.) on reach, and the physical nature of handles, knobs and other controls to enhance both the user's functional use of the component.

C. DIRECTION/CONTROL

The movement and/or force required to operate or manipulate a component (handle, control, fastener, etc.), with emphasis on the direction of motion corresponding to the display, component, total item reaction or intended position as well as the maximum strength required.

D. CLARITY

The unobstructed space surrounding a component which allows the operator to perform required actions, the sequence of which varies as a function of the amount of body movement (stand, crouch, sit, etc.), and, where appropriate, will also include considerations such as lighting, noise, helmets, protective clothing, etc.

E. VISIBILITY

Those aspects of a component that contribute to the operator's ability to see it clearly, including location, size, shape, color, contrast, field of view, viewing distance, reflection, and illumination.

F. USE/OPERATIONS

Those aspects of a component that pertain to its operational status before, during and after use, as well as the maintenance of an acceptable environment in the workspace areas.

G. SAFETY

Those aspects of a component that could cause injury to the operator or other personnel, including preventative aspects for bad weather or reduced visibility, accidental contact with electrical, temperature, chemical, radiation and pressurization hazards, and danger to sight and hearing, particularly under the conditions of alert or battle stress.

H. OPERATING PROCEDURES

Those operational and informational aspects affecting or improving man-machine interface as found in equipment design documents as well as job aids, checklists, training texts, trouble-shooting guides, and repair manuals with due attention to the safety aspects of using the components.

Provide technical guidance in the form of written material, schematics, diagrams, illustrations and instruction sheets.
Give special guidance or instructions.

- Controls, displays, etc. are clearly, appropriately labeled except where use is obvious.
- Labels placed on or near items they identify.
- Do not cover other information.
- Label is not behind control.
- Label location consistent.
- Labels not obscured by components on flat feet surface on main chassis; min coverage by grilles not easily removed.

- Character height determined by distance read, minimum FIG 1.B.1.
- Group label characters larger than those of controls, displays which are larger than control, display position characters each by 25% min.
- Letter, numeral styles FIG 1.B.2.4.
- Height/width ratio: $h = 5/3$; $w = 1$ stroke width; $h/w = 5/3$; $h/w = 5/4$; $h/w = 1$ stroke width.
- Stroke width for black (white) characters on light (black) backgrounds $1/6$ (1/7-1/8) of height.

- Spacing between characters (words) one stroke (character) width min.
- Line spacing: h character height.
- Counter numeral row ratio = 1:1 (except 1); separation = h to h/w .
- Optical projection: all caps, stroke width $1/6$ to $1/8$ h ; exceeds 15 minutes visual angle.
- Thumbwheel numeral row ratio = $3/2$; $h = 5/4$; stroke width internally (externally) illuminated = 10:1 (5:1).
- Abbreviations all caps, no periods.
- Extended copy uses lower case.
- Label characteristics determined by illumination level, color.
- Labels easily, accurately read at operational reading distance, vibration, light levels, environments.
- Labels are sharp with high or color contrast.

- With illumination above 1 ft-cd black letters, light background.
- Dark adaptations letters visible, do not interfere with night vision.
- Numbers, letters, details viewed by TV light on dark background.
- Label characteristics determined by required time available; distance; light level; color; criticality of function; consistency of design.
- Labels on production equipment are as durable as the equipment.
- Labels for prototype equipment easily of used, altered, removed.
- Labels not covered by other units nor obscured by grease, dirt.
- Markings, tags are as permanent, washable as equipment.
- Human numerals provided.
- Vertical labels used only when labels are not critical for personnel safety, performance.

- Electrical receptacles marked with voltage, phase, frequency.
- Pipe, hose, tube lines clearly labeled as to contents, pressure, temperature, hazards.
- Warning placards illuminated.
- Placards adjacent to hazards.
- Abbreviations are standard (MIL-STD-12); new OK if obvious.
- Trade names, irrelevant info do not appear on labeling.
- Labels concise; min redundancy.
- Abstract symbol only if meaningful.
- Words familiar to user.
- Print group items identified.
- Handed info directly usable; min of decoding, interpretation.

Provide a surface to accommodate user's feet while climbing or conducting routine checks and for the temporary placement of loads.
Wheels, hubs and structural members used for climbing are evaluated as ladders.
Angle of ascent: definition ladders, 75°-90°; stake ladders, 50°-75°; stairs, 70°-90°; ramps, 0°-20°; platforms, 0°.

- Sequence of stepping points ends with proper man orientation to door or entryways.
- Step surfaces within, without work-space easily reached from either direction.
- Fixed ladders between several levels offset at each succeeding level.
- Self-latching device used on elevating stands, platforms.
- Simultaneous two-way traffic uses separate up, down ladders.

- Gross (limiting) dimensions based on 95th (5th%) body dimensions of users FIG 2.B.1.1-7.
- Stair, stair-ladder, fixed-ladder dimensions do not exceed the max. min dimensions FIG 2.B.1.1.
- Stairs, ladders accommodate 5th-10th percentile wearing arctic clothing FIG 2.B.1.8.

- Folding ladder lift height: 5' max.
- One man limits to lift, store ladder: 5' for 20 lb; 6' for 25 lb.
- Stairs, ladders, platforms, ramps: withstand heaviest combined weight of user plus equipment plus safety factor.

- Finger clearance is provided in folding steps, ladders.
- Step width, spacing useable while wearing boots.
- Folding ladder catches, lock operable with cold/wet arctic mittens: FIG 2.B.1.1.
- Step width, spacing accommodate boots FIG 2.B.1.8.

- Stairway, illuminations: 10 ft-cd min.
- Visual obstructions, blind footholds avoided.
- Treads contrast with structure, conspicuous in dim light.
- For reduced lighting reflective materials used.

- Stair-ladders are of metal with the tread rise open at rear.
- Exterior personnel platforms, work areas: Open metal grating or non-skid surface.
- Steps useable if wet, icy.
- Rung ladders not used for frequent passage.
- 2-section extension ladders have captive hardware.
- Wheeled platforms have wheel locks.
- Provide access between areas.

- Ladders are not provided when equipment is to be hand-carried.
- Open personnel platforms have a toe board, screen 3" h min.
- Elevators, hydraulic work platforms: control guards; limit stops fail-safe brakes guard rail, safety bars, chains.
- Safety mesh under open gratings.
- Obstructions, sharp edges are padded.
- Movable ladders non-slip feet.

- Elevators, hydraulic work platforms have visible max load signs.
- Footholds marked, identified.
- "No Step" markings if applicable.
- Warnings labels for hazards.
- Procedures listed for stowing, emptying ladders, ramps.

Assist users to mount and enter the item and to maintain balance.
Supply leverage and support to a climbing or working man.
Door handles, structural members, etc. used for gripping or balance, are evaluated as handholds.

- Handrails, safety bars, chains around platforms or stair openings: 42" above standing surface.
- Handholds furnished where needed, within easy reach.
- Handholds integrated with doors, entryways for stability.
- Adequate handholds for balance while moving.
- Pedestrian ramps have handrails.

- Handrail dimensions: FIG 2.B.1.1.
- Handhold length: 6" min.
- Handhold opening: 6" x 4" min.

- Handholds do not intrude into work-space.
- Handhold accommodates arctic gloves FIG 2.B.1.1.

- Handholds clearly visible from inside and out prior to grasping.
- Color coded to enhance visibility, prevent grasping error.

- Stairs, stair-ladder, ramps open on one or both sides have intermediate guard rails.
- Stair-ladder handrails are non-slip.
- Handholds useable if wet, icy.
- Handgrip useable with bare hands in hot climates, high temp.
- Pedestrian ramps have handrails.
- Collapsible handholds useable while wearing arctic mittens.

- Open personnel platforms guardrails w/intermediate rails; top rail 42" min rails set back from edge 2" min.
- Handgrip areas away from cables, lines, hot pipes, other hazards.
- Inappropriate structures, wires cannot be used as handholds.
- Railings: no projections, snags.

- Handholds marked, identified.

Provide a means for entering and leaving the workspace.
Provide openings for loading or unloading material.
Components are evaluated for both normal and emergency use.
Some doors serve dual purpose and must also be evaluated as steps, ramps or platforms.

- Wall hatches flush with floor where structurally possible.
- Latch handles can be reached from normal approach position.
- Handgrips, footstaps help user reach hatch easily.
- Overhead hatches: latch to hold open inside padded; 1 hand operation.
- Handles can be reached, operated by troops in bulky clothing.

- Circular hatches: 30" min dia.
- Overhead hatches: 12" x 28" min.
- Trailer vans, portable shelters with one man use: 6" h, 30" w min.
- Passageway width: FIG 4.B.1.2.
- Doors: 80-84" h; 32-34" w.

- Match handle unlatching force: 20 lb max.
- Overhead hatches: opening force, 50 lb max; operable by user with 5th% arm, hand strength: FIG 4.B.1.
- Match opening force: 50 lb max.
- Handles operable with gloves.

- Fixed equipment is located 3" min from swept area of door.
- Gross (limiting) dimensions based on 95th (5th%) fully equipped users: FIG 2.B.1.1-7.
- Corridor width based on: peak load traffic flow; number, size of entrances.
- Wall escape hatches in vehicle mounted shelters clear all obstructions.
- Floor escape hatches: 22" min dia, 18" above ground.
- Passageway illuminations: 10 ft-cd min.

- Hatches open with a single motion of hand, foot.
- If "step down" through a top access exceeds 27", appropriate foot rests, toeboards, etc.
- Latch handles do not freeze up.
- Doors lockable from inside.
- Handles uniform in operation.
- Corridors have non-skid floors.

- Sliding doors are not installed as the only personnel exit.
- Doors, emergency exits are easily reached, unobstructed, quick opening 3 sec max, 10-30 lb. operating force.
- Lance openings: smooth-edged, no obstructions, permit passage with survival equipment.
- Glass in doors shatterproof.
- No hazards or obstructions in entryways or on either side.

- Color of latch handle different from that of door.
- Correct movement of latch handle diagrammed, labeled.
- Exit instructions are legible, brief, clearly worded.
- Hallway boundaries clearly marked.

The area within which the equipment is located, space for equipment, electrical, etc. and windows on walls, consoles and units.
Provides storage for personal gear, weapons.
Provides space for equipment, storage space.

- Work space is height 6' 6" seated, 29 1/2" 1/2".
- Component design must allow, grand in.
- Desk tops, writing surfaces: 29 1/2" and min.
- Equipment designed, workspace requirements.

- Seats: 1st, suitable for use without restraints.
- Arm rests: 28 1/2" min.
- Back, seat have 11 1/2" min. of space between ceiling height 78" min.
- Vertical work surface: 24 1/2" and min.
- Standard console: 42" high (5th% 5th% body).
- Gross (limiting) dimensions: 95th (5th%) body: FIG 2.B.1.1-7. Area: Adjustable dimensions.
- Vertical seat adjustment: max. 10" min.
- Seat, backrest recline: parts torso so user within 2" of level line.
- Seat adjusts fore, aft.
- Operator does not have to adjust seat.

- Adjustable work surface: 24 1/2" min.
- Arm rests: 28 1/2" min.
- Back, seat have 11 1/2" min. of space between ceiling height 78" min.
- Vertical work surface: 24 1/2" and min.
- Standard console: 42" high (5th% 5th% body).
- Gross (limiting) dimensions: 95th (5th%) body: FIG 2.B.1.1-7. Area: Adjustable dimensions.
- Vertical seat adjustment: max. 10" min.
- Seat, backrest recline: parts torso so user within 2" of level line.
- Seat adjusts fore, aft.
- Operator does not have to adjust seat.

- Adjustable work surface: 24 1/2" min.
- Arm rests: 28 1/2" min.
- Back, seat have 11 1/2" min. of space between ceiling height 78" min.
- Vertical work surface: 24 1/2" and min.
- Standard console: 42" high (5th% 5th% body).
- Gross (limiting) dimensions: 95th (5th%) body: FIG 2.B.1.1-7. Area: Adjustable dimensions.
- Vertical seat adjustment: max. 10" min.
- Seat, backrest recline: parts torso so user within 2" of level line.
- Seat adjusts fore, aft.
- Operator does not have to adjust seat.

- Illuminations: 10 ft-cd min.
- Surf. color: white or light gray.
- Lettering: FIG 1.B.1.

- Heating, A/C for the detail work areas: 55° F, does not disturb.
- Ventilation: 30 cfm per person 100° min max.
- Effective temperature: 60° F (120° F) if handle.
- Exposed edges (radius 0.04" (0.5" min radius).
- Guards provided on moving hazards.
- Station sheets limits.
- Adequate, visible signals, worksheets, etc.
- Standards have work space manuals, etc.
- Elevators, hydraulic: load sign visible.
- Compass: pins into equipment hazardous.
- Areas requiring special clothing are specified.
- Emergency procedures.
- Instructions kept simple.
- Push-out escape windows.

- Exposed edges (radius 0.04" (0.5" min radius).
- Guards provided on moving hazards.
- Station sheets limits.
- Adequate, visible signals, worksheets, etc.
- Standards have work space manuals, etc.
- Elevators, hydraulic: load sign visible.
- Compass: pins into equipment hazardous.
- Areas requiring special clothing are specified.
- Emergency procedures.
- Instructions kept simple.
- Push-out escape windows.

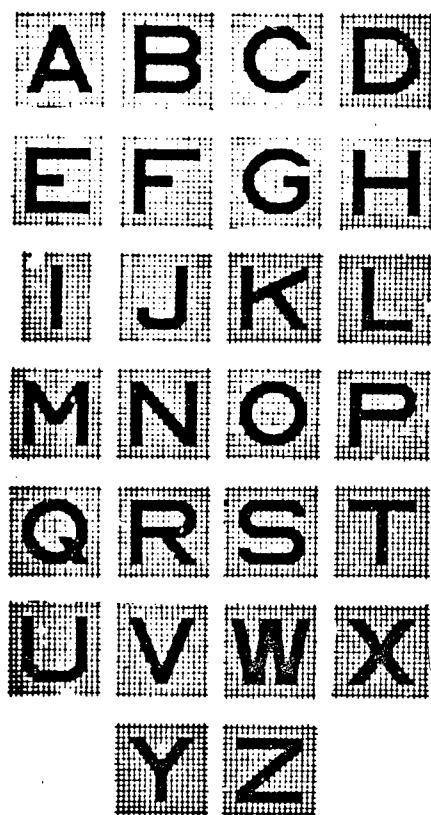
- Exposed edges (radius 0.04" (0.5" min radius).
- Guards provided on moving hazards.
- Station sheets limits.
- Adequate, visible signals, worksheets, etc.
- Standards have work space manuals, etc.
- Elevators, hydraulic: load sign visible.
- Compass: pins into equipment hazardous.
- Areas requiring special clothing are specified.
- Emergency procedures.
- Instructions kept simple.
- Push-out escape windows.

MARKINGS	HEIGHT*	
	BELOW 1 ft-L (3.5 cd/m ²)	ABOVE 1 ft-L (3.5 cd/m ²)
FOR CRITICAL MARKINGS, WITH POSITION VARIABLE (e.g., NUMERALS ON COUNTERS AND SETTABLE OR MOVING SCALES):	0.20 - 0.31 in. (5 - 8 mm)	0.12 - 0.20 in. (3 - 5 mm)
FOR CRITICAL MARKINGS, WITH POSITION FIXED (e.g., NUMERALS ON FIXED SCALES, CONTROLS, AND SWITCH MARKINGS, OR EMERGENCY INSTRUCTIONS):	0.16 - 0.31 in. (4 - 8 mm)	0.10 - 0.20 in. (2.5 - 5 mm)
FOR NONCRITICAL MARKINGS (e.g., IDENTIFICATION LABELS, ROUTINE INSTRUCTIONS, OR MARKINGS REQUIRED ONLY FOR FAMILIARIZATION):	0.06 - 0.20 in. (1.3 - 5 mm)	0.06 - 0.20 in. (1.3 - 5 mm)

* VALUES ASSUME A 26 in. (710 mm) VIEWING DISTANCE. FOR A DISTANCE, D, OTHER THAN 26 in. (710 mm) MULTIPLY THE ABOVE VALUES BY D/26 in. (D/710 mm).

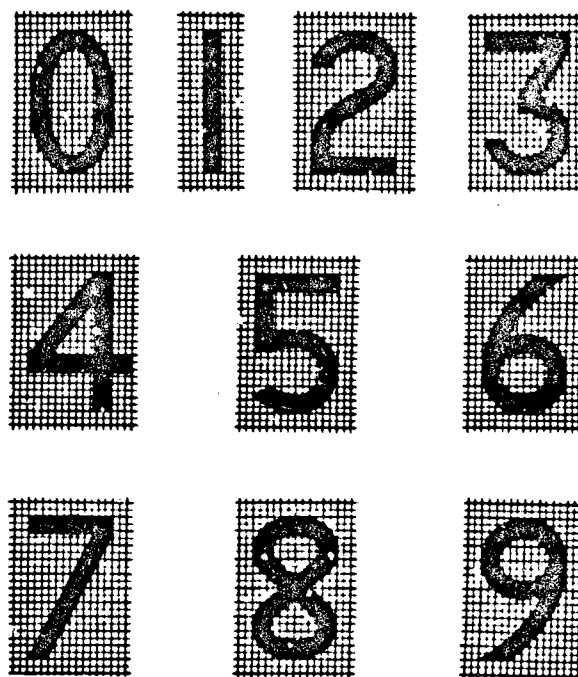
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FIGURE 1.B.1 LABEL SIZE VERSUS LUMINANCE



MIL-M-18012

FIGURE 1.B.2 PREFERRED LETTER FONT



MIL-M-18012

FIGURE 1.B.3 PREFERRED NUMERICAL FONT

FONTS FOR ENGRAVING

LETTERS

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

GORTON EXTENDED

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

GORTON NORMAL

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

GORTON CONDENSED

NUMBERS

1 2 3 4 5 6 7 8 9 0

GORTON EXTENDED

1 2 3 4 5 6 7 8 9 0

GORTON MODERNE

FONTS FOR PRINTING

LETTERS

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 a b c d e f g h i j k l m n o p q r s t u v w x y z ; , : ; - ? ! " - () [] . \$ &

AIRPORT SEMIBOLD

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 a b c d e f g h i j k l m n o p q r s t u v w x y z ; , : ; - ? ! " - () [] . \$ &

FUTURA DEMIBOLD

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 a b c d e f g h i j k l m n o p q r s t u v w x y z ; , : ; - ? ! " - () [] . \$ &

VOGUE MEDIUM

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 a b c d e f g h i j k l m n o p q r s t u v w x y z ; , : ; - ? ! " - () [] . \$ &

LINING GOTHIC No 66

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 a b c d e f g h i j k l m n o p q r s t u v w x y z ; , : ; - ? ! " - () [] . \$ &

ALTERNATE GOTHIC No 3

NUMBERS

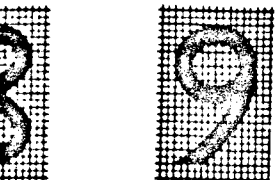
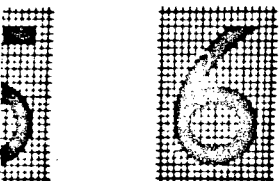
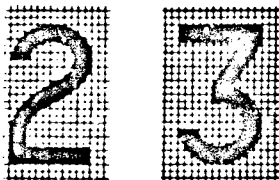
1 2 3 4 5 6 7 8 9

FUTURA MEDIUM

1 2 3 4 5 6 7 8 9

FUTURA TEMPO BOLD

MIL-M-18012

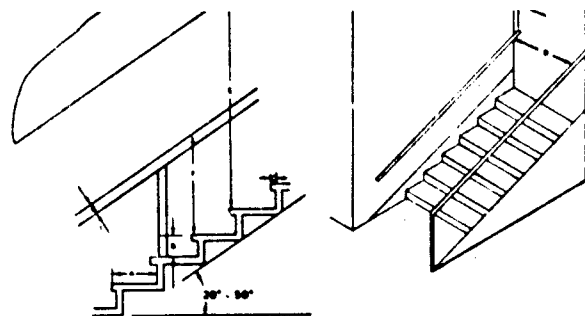


8012

TRED NUMERICAL FONT

FIGURE 1. B. 4 OTHER ACCEPTABLE FONTS

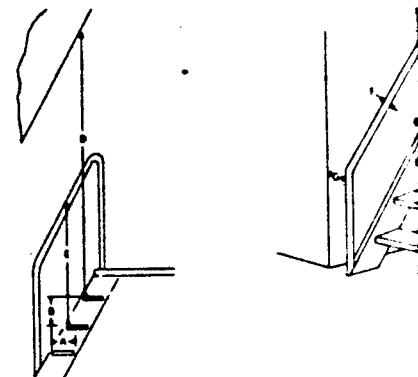




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DIMENSION	MINIMUM	MAXIMUM	RECOMMENDED
A Tread depth (including nosing)	9 5/8" (248mm)	12 0/8" (308mm)	11 0/8" 12 0/8" (280-300mm)
B Riser height	5 0/8" (128mm)	6 0/8" (200mm)	5 5/8" 7 0/8" (166-188mm)
C Depth of nosing (where applicable)	0 7/8" (25mm)	1 5/8" (38mm)	1 0/8" (25mm)
D Width (handrail to handrail)			
One way stairs	36 0/8" (918mm)	...	36 0/8" (918mm)
Two way stairs	48 0/8" (1220mm)	...	51 0/8" (1300mm)
E Overhead clearance	76 0/8" (1920mm)	...	78 0/8" (1980mm)
F Height of handrail (from leading edge of tread)	36 0/8" (918mm)	36 0/8" (918mm)	33 0/8" (840mm)
G Handrail diameter	1 2/5" (32mm)	3 0/8" (75mm)	1 5/8" (38mm)
H Rail clearance from wall	1 7/8" (45mm)	...	3 0/8" (75mm)

FIGURE 2.B.1 STAIR DIMENSIONS

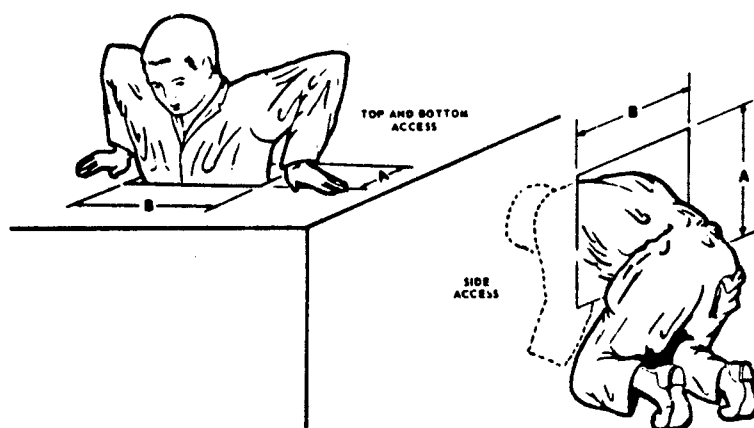


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DIMENSION	MINIMUM	MAXIMUM
A Tread depth ramp		
For 50° run	6 0/8" (150mm)	10 0/8" (250mm)
For 75° run (open leaders only)	3 0/8" (75mm)	5 5/8" (140mm)
B Riser height	7 0/8" (180mm)	12 0/8" (300mm)
C Width (handrail to handrail)	21 0/8" (530mm)	24 0/8" (610mm)
D Overhead clearance	76 0/8" (1920mm)	...
E Height of handrail (from leading edge of tread)	34 0/8" (860mm)	37 0/8" (940mm)
F Handrail diameter	1 2/5" (32mm)	3 0/8" (75mm)
G Rail clearance from wall	2 0/8" (50mm)	...

*Whenever the distance D is less than 74 0/8" (1880 mm), the overhead clearance shall be yellow and black stripes.

FIGURE 2.B.2 STAIR-LADDER DIMENSIONS

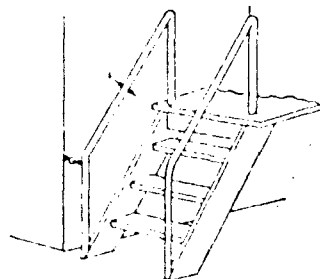


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DIMENSIONS	A. DEPTH		B. WIDTH	
CLOTHING	LIGHT	BULKY	LIGHT	BULKY
TOP AND BOTTOM ACCESS	13" (330mm)	18" (460mm)	23" (580mm)	27" (680mm)
SIDE ACCESS	20" (500mm)	25" (640mm)	30" (760mm)	34" (860mm)

NOTE: DIMENSIONS SHOWN BASED ON MALE DATA.

FIGURE 4.B.1 WHOLE BODY ACCESS OPENING

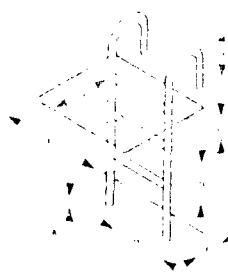


[MIL-STD-1472]

	MINIMUM	MAXIMUM	RECOMMENDED
width	6'00" (1830mm)	10'00" (3048mm)	8'50" (2591mm)
depth	3'00" (914mm)	5'50" (1676mm)	4'00" (1219mm)
height	7'00" (2134mm)	12'00" (3658mm)	9'00" (2743mm)
clearance	21'00" (6401mm)	24'00" (7315mm)	22'00" (6706mm)
clearance	*6'00" (1830mm)		7'60" (2317mm)
clearance	34'00" (10400mm)	37'00" (11281mm)	35'00" (10668mm)
clearance	1'25" (381mm)	3'00" (914mm)	1'50" (508mm)
clearance	2'00" (610mm)		3'00" (914mm)

If clearance is less than 74'50" (22710mm), the overhead obstruction should be painted black.

RE 2.B.2 STAIR-LADDER DIMENSIONS



[MIL-STD-1472]

DIMENSION	MINIMUM	MAXIMUM	RECOMMENDED
A RUNG THICKNESS			
WOOD	1 1/8 in. (32 mm)	1 1/2 in. (38 mm)	1 3/8 in. (35 mm)
PROTECTED METAL	3/4 in. (19 mm)	1 1/2 in. (38 mm)	1 3/8 in. (35 mm)
COMPOSITE METAL	1 in. (25 mm)	1 1/2 in. (38 mm)	1 1/8 in. (35 mm)
B RUNG SPACING	9 in. (230 mm)	15 in. (380 mm)	12 in. (300 mm)
C HEIGHT RUNG TO LANDING	8 in. (150 mm)	15 in. (380 mm)	15 in. (380 mm)
D WIDTH BETWEEN STRINGERS	12 in. (310 mm)		18 21 in. (460-529 mm)
E CLIMBING CLEARANCE WIDTH	24 in. (610 mm)		30 in. (760 mm)
F CLEARANCE DEPTH			
F IN BACK OF LADDER	6 in. (150 mm)		8 in. (200 mm)
G ON CLIMBING SIDE (RANGE)		36 in. (910 mm) for 75° to 30 in. (760 mm) for 90°	
H HEIGHT OF STRINGER ABOVE LANDING	33 in. (840 mm)		36 in. (910 mm)
J HEIGHT FROM LOWER ELEVATION TO BOTTOM RUNG		15 in. (380 mm)	

*For male use exclusively use 16'00" (4877mm)

FIGURE 2.B.3 FIXED-LADDER DIMENSIONS

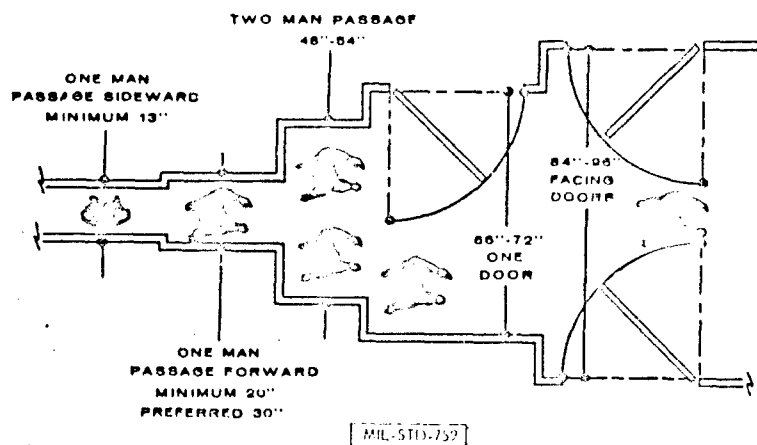
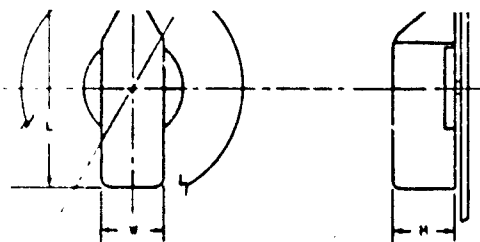


FIGURE 4.B.2 DOORWAY AND PASSAGEWAY DIMENSIONS



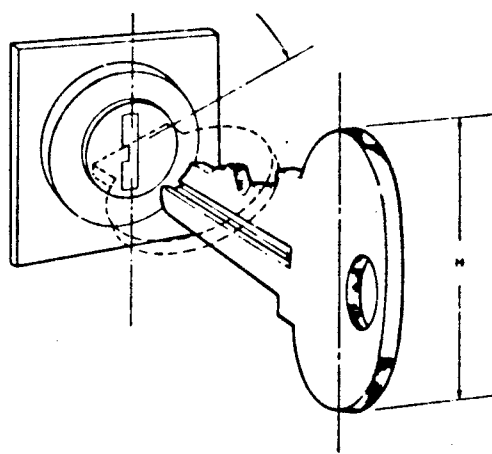
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	DIMENSIONS			RESISTANCE
	LENGTH	WIDTH	DEPTH	
MINIMUM	1 in. (25 mm)	1 in. (25 mm)	7/8 in. (19 mm)	1 in.-lb. (113 mm)
MAXIMUM	4 1/4 in. (110 mm)	1 in. (25 mm)	3 in. (76 mm)	5 in.-lb. (500 mm)

	DISPLACEMENT		SEPARATION	
	A	B	ONE HAND RANDOM	TWO-HAND OPERATION
MINIMUM	15° (262 mrad)	30° (520 mrad)	1 in. (25 mm)	3 in. (76 mm)
MAXIMUM	60° (1050 mrad)	90° (1570 mrad)	—	—
PREFERRED	—	—	2 in. (50 mm)	5 in. (125 mm)

* FOR FACILITATING PERFORMANCES
 ** WHEN SPECIAL ENGINEERING REQUIREMENTS DEMAND LARGE SEPARATION OR WHEN
 TACTUALLY BLIND POSITIONED CONTROLS ARE REQUIRED

FIGURE 6. B. 1 ROTARY SELECTOR SWITCH



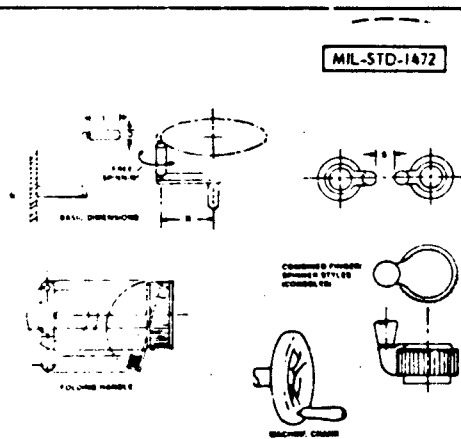
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	DISPLACEMENT (A)	HEIGHT (H)	RESISTANCE
MINIMUM	30° (520 mrad)	1 1/2 in. (38 mm)	1 in.-lb. (113 mm)
MAXIMUM	90° (1570 mrad)	3 in. (76 mm)	5 in.-lb. (500 mm)

FIGURE 6. B. 2 KEY-OPERATED SWITCH

	DIAMETER
MINIMUM	1 1/2 in. (38 mm)
MAXIMUM	3 in. (76 mm)

FIGURE 6



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LOAD	SPECIFICATION	HANDLE				TURNING RADIUS			
		L. LENGTH		D. DIAMETER		RATE BELOW 100 RPM		RATE ABOVE 100 RPM	
		IN	MM	IN	MM	IN	MM	IN	MM
LIGHT LOADS Less than 5 lb. (22 N) max. and torque requirements	MINIMUM	1	25	3/8	10	1 1/2	38	1 1/2	38
	PREFERRED	1 1/2	38	1/2	13	3	76	3 1/2	89
	MAXIMUM	3	75	5/8	16	5	125	6 1/2	163
HEAVY LOADS More than 5 lb. (22 N) max. (torque requirements)	MINIMUM	3	75	1	25	7 1/2	188	5	125
	PREFERRED	3 3/4	90	1 1/2	38	—	—	5	125
	MAXIMUM	—	—	—	—	—	—	—	—

5 SEPARATION BETWEEN ADJACENT CONTROLS 3" (75 mm) MINIMUM

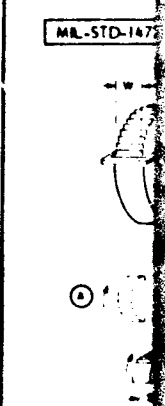
FIGURE 6. B. 5 CRANKS

CONFIGURATION	APPLICABLE SYSTEMS	DISPLACEMENT		SEPARATION
		MIN. DISPL.	MAX. DISPL.	
CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	15° (262 mrad)	90° (1570 mrad)	1 in. (25 mm)
CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	15° (262 mrad)	90° (1570 mrad)	1 in. (25 mm)
CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	15° (262 mrad)	90° (1570 mrad)	1 in. (25 mm)

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CONFIGURATION	APPLICABLE SYSTEMS	DISPLACEMENT		SEPARATION
		MIN. DISPL.	MAX. DISPL.	
CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	15° (262 mrad)	90° (1570 mrad)	1 in. (25 mm)
CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	15° (262 mrad)	90° (1570 mrad)	1 in. (25 mm)
CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	CONTINUOUS ADJUSTMENT FOR ALTERNATE POSITIONS	15° (262 mrad)	90° (1570 mrad)	1 in. (25 mm)

FIGURE 6. B. 6 HANDWHEELS



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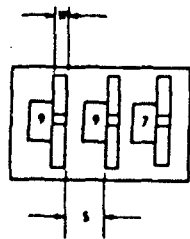
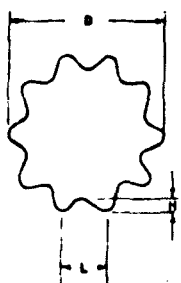
	DIAMETER
MINIMUM	1 1/2 in. (38 mm)
MAXIMUM	6 in. (150 mm)

* PREFERRED SOME MIN.

FIGURE 6



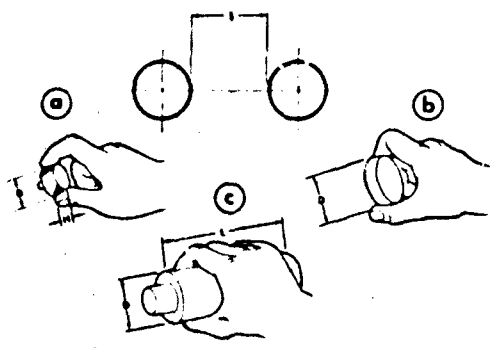
ANCE
40-40
40-40



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	D DIAMETER	L TROUGH DISTANCE	W WIDTH	H HEIGHT	S SEPARATION	RESISTANCE
MINIMUM	1.50 in. (38 mm)	770 in. (11 mm)	1/8 in. (3 mm)	1/8 in. (3 mm)	1.000 in. (25.4 mm)	0.05 (1.7 N)
MAXIMUM	3 in. (75 mm)	3/4 in. (19 mm)	1/4 in. (6 mm)	1/4 in. (6 mm)	1/4 in. (6 mm)	30.0 (8.5 N)

FIGURE 6.B.3 DISCRETE THUMBWHEEL CONTROL



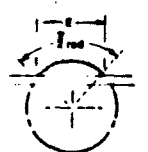
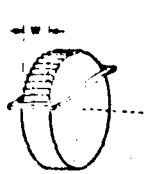
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DIMENSIONS				
	Finger Grip	Thumb and Finger Encircled	Palm Grip	
	H Height	D Diameter	D Diameter	L Length
MINIMUM	0.5" (13 mm)	0.375" (9.5 mm)	1.0" (25 mm)	1.5" (38 mm)
MAXIMUM	1.0" (25 mm)	4.0" (100 mm)	3.0" (75 mm)	3.0" (75 mm)
TORQUE			SEPARATION	
			One Hand Individually	Two Hands Simultaneously
MINIMUM			1.0" (25 mm)	2.0" (50 mm)
MAXIMUM	4.5 in. oz. (12.7 mN m)	8.0 in. oz. (20.0 mN m)	2.0" (50 mm)	3.0" (75 mm)

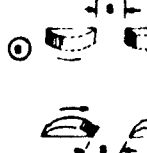
*To and including 1.0 in. (25 mm) diameter knobs
**Greater than 1.0 in. (25 mm) diameter knobs

FIGURE 6.B.4 CONTINUOUS ADJUSTMENT ROTARY CONTROL KNOBS

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CONTINUOUS
SETTING



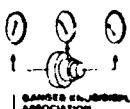
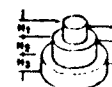
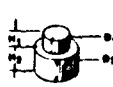
ARROWS INDICATE
INCREASING
VALUE

	H HEIGHT	W WIDTH	S SEPARATION		RESISTANCE
			A	B	
MINIMUM	1" (25 mm)	1/8" (3 mm)	1" (25 mm) ADD 1/2" (13 mm) FOR GLOVES	2" (50 mm) ADD 1" (25 mm) FOR GLOVES	TO MINIMIZE EFFECTS OF INADVERTENT INPUT IF OPERATOR SUBJECT TO MOTION
MAXIMUM	6" (150 mm)	7/8" (22 mm)	N/A	N/A	2.5 N (12 oz.)

* PREFERRED SOME MINIMUM APPLICATIONS MAY REQUIRE LESS

FIGURE 6.B.7 THUMBWHEEL ADJUSTMENT CONTROLS

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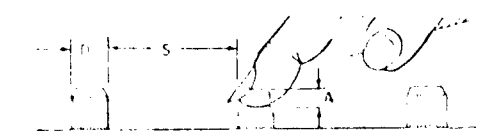


GANGED KNOB/SLIDER
ASSOCIATION

DIMENSIONS									
TWO KNOB ASSEMBLY (PREFERRED)					THREE KNOB ASSEMBLY (MAXIMUM)				
	H1	H2	D1	D2	H1	H2	H3	D1	D2
MINIMUM	0.5" (13 mm)	1/2" (13 mm)	1/2" (13 mm)	1/2" (13 mm)	1/2" (13 mm)	1/2" (13 mm)	1/2" (13 mm)	1/2" (13 mm)	1/2" (13 mm)
MAXIMUM	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)	1.0" (25 mm)
TORQUE					SEPARATION				
					ONE HAND INDIVIDUALLY		TWO HANDS SIMULTANEOUSLY		
					SAFE	GLOVED	SAFE	GLOVED	GLOVED
MINIMUM					1" (25 mm)	3 1/2" (89 mm)	2" (50 mm)	3 1/2" (89 mm)	3 1/2" (89 mm)
MAXIMUM	22 in. oz. (5.5 N m)	22 in. oz. (5.5 N m)	22 in. oz. (5.5 N m)	22 in. oz. (5.5 N m)	2" (50 mm)	3 1/2" (89 mm)	2" (50 mm)	3 1/2" (89 mm)	3 1/2" (89 mm)

* TO AND INCLUDING 1" (25 mm) DIAMETER KNOBS
** GREATER THAN 1" (25 mm) DIAMETER KNOBS

FIGURE 6.B.8 GANGED KNOBS

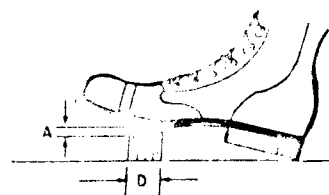


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STROKE		RESISTANCE			
	INDEX FINGER	THUMB OR PALM	SINGLE FINGER	DIFFERENT FINGERS	THUMB OR PALM
MINIMUM	5/16 in (8 mm)	3/4 in (19 mm)	2.8 N (10 oz)	1.8 N (5 oz)	2.8 N (10 oz)
MAXIMUM	1/4 in (6 mm)		11 N (40 oz)	5.6 N (20 oz)	23 N (80 oz)
DISPLACEMENT					
		FINGER TIP	THUMB OR PALM		
MINIMUM		5/16 in (8 mm)	1/8 in (3 mm)		
MAXIMUM		1/4 in (6 mm)	1 1/2 in (38 mm)		
OPERATION					
		SINGLE FINGER	SINGLE FINGER SEQUENTIAL	DIFFERENT FINGERS	THUMB OR PALM
MINIMUM		1/2 in (13 mm)	1/4 in (6 mm)	1/8 in (3 mm)	1/4 in (6 mm)
PREFERRED		2/3 in (16 mm)	1/2 in (13 mm)	1/2 in (13 mm)	8/32 in (16 mm)

NOTE: AN ALTERNATE BARTHAND APPLICATION FOR GLOVED HAND OPERATION MINIMA SHOULD BE CONSIDERED.

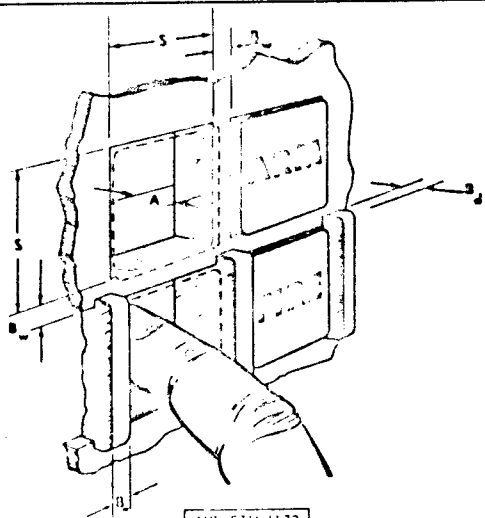
FIGURE 6.B.9 PUSHBUTTONS (FINGER OR HAND OPERATED)



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	DIAMETER D	RESISTANCE		DISPLACEMENT			
		Foot Will Not Rest On Control	Foot Will Rest On Control	Normal Operation	Heavy Boot Operation	Ankle Flexion Only	Total Leg Movement
Minimum	0.50" (13mm)	40 lb (18N)	100 lb (45N)	0.50" (13mm)	1.0" (25mm)	1.0" (25mm)	1.0" (25mm)
Maximum	-	200 lb (90N)	200 lb (90N)	2.5" (65mm)	2.5" (65mm)	2.5" (65mm)	4.0" (100mm)

FIGURE 6.B.10 PUSHBUTTONS (FOOT OPERATED)



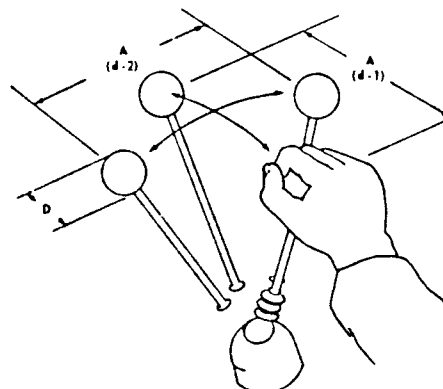
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	S SIZE	A DISPLACEMENT	BARRIERS ¹		RESISTANCE
			B ₁	B ₂	
MINIMUM	3/8 in (10 mm)	1/8 in (3 mm)	1/8 in (3 mm)	5/16 in (8 mm)	10 N (2.5 lb)
MAXIMUM	1 1/2 in (38 mm)	1/4 in (6 mm)	1/4 in (6 mm)	1 1/4 in (32 mm)	40 N (9 lb)

¹ BARRIERS SHALL HAVE ROUNDED EDGES.
² 3/8 IN IS MINIMUM PREFERRED POSITION IN SWITCHES.
 1/2 IN IS MAXIMUM FOR USE IN MOVING VEHICLES.

NOTE: B₂ ALSO REFERS TO SWITCH SEPARATION.

FIGURE 6.B.13 LEGEND SWITCH



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	DIAMETER		RESISTANCE		
	FINGER GRASP	HAND GRASP	ONE HAND	TWO HANDS	ONE HAND
MINIMUM	1/2 in (13 mm)	1/2 in (38 mm)	2 lb (9 N)	2 lb (9 N)	2 lb (9 N)
MAXIMUM	1 1/2 in (38 mm)	3 in (75 mm)	30 lb (135 N)	50 lb (220 N)	20 lb (90 N)
DISPLACEMENT					
		FORWARD (d 1)	LATERAL (d 2)	SEPARATION	
		A		ONE HAND RANDOM	TWO HAND SIMULTANEOUS
MINIMUM		-	-	2 in (50 mm)	3 in (75 mm)
PREFERRED		-	-	4 in (100 mm)	5 in (125 mm)
MAXIMUM		14 in (360 mm)	38 in (970 mm)	-	-

FIGURE 6.B.14 LEVER

ELEMENT	
Ankle Flexion Only	Total Leg Movement
1.0" (25mm)	1.0" (25mm)
2.5" (63mm)	4.0" (100mm)

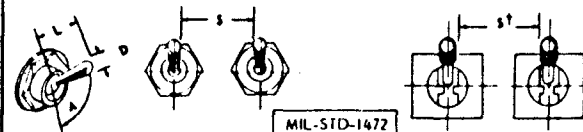
	Dimensions Diameter D*		Resistance		
	Bare-handed	Arche-montage**	Numeric	Alpha-numeric	Dual Function
Minimum	0.396"	0.75"	3.5 oz	9.9 oz	0.9 oz
Maximum	0.75"		14.0 oz	5.3 oz	5.3 oz
Preferred	0.6"	0.75"			
	Displacement			Separation	
	Numeric	Alpha-numeric	Dual Function	(between adjacent key tops)	
Minimum	0.03"	0.05"	0.03"	0.25"	
Maximum	0.19"	0.25"	0.19"		
Preferred				0.25"	

	Dimensions Diameter D*		Resistance		
	Bare-handed	Arche-montage**	Numeric	Alpha-numeric	Dual Function
Minimum	10mm	18mm	1N	250 mN	250 mN
Maximum	18mm		4N	1.5 N	1.5 N
Preferred	13mm	18mm			
	Displacement			Separation	
	Numeric	Alpha-numeric	Dual Function	(between adjacent key tops)	
Minimum	0.8mm	1.3mm	0.8mm	6.4mm	
Maximum	4.8mm	6.3mm	4.8mm		
Preferred				6.4mm	

*See Figure 6.B.7
**Trigger finger type

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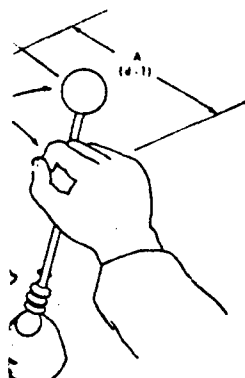
FIGURE 6.B.11 KEYBOARDS



	DIMENSIONS		RESISTANCE	
	ARM LENGTH	D CONTROL TIP	SMALL SWITCH	LARGE SWITCH
MINIMUM	1/2 in (13 mm)	1-1/2 in (38 mm)	16 oz (2.8 N)	10 oz (2.8 N)
MAXIMUM	2 in (50 mm)	2 in (50 mm)	16 oz (4.5 N)	40 oz (11 N)
	DISPLACEMENT BETWEEN POSITIONS			
	2 POSITIONS		3 POSITIONS	
MINIMUM	30° (525 mrad)		17° (295 mrad)	
MAXIMUM	80° (1400 mrad)		45° (790 mrad)	
DESIRABLE	...		25° (430 mrad)	
	SEPARATION			
	SINGLE FINGER OPERATION	S SINGLE FINGER SEQUENTIAL OPERATION	SIMULTANEOUS OPERATION BY DIFFERENT FINGERS	
MINIMUM	3/4 in (19 mm)	1 in (25 mm)	1/2 in (13 mm)	6.0 in (150 mm)
OPTIMUM	2 in (50 mm)	2 in (50 mm)	1 in (25 mm)	34 in (860 mm)

*USE BY BARE FINGER **USE WITH HEAVY HANDWEAR †USING A LEVER LOCK TOGGLE SWITCH

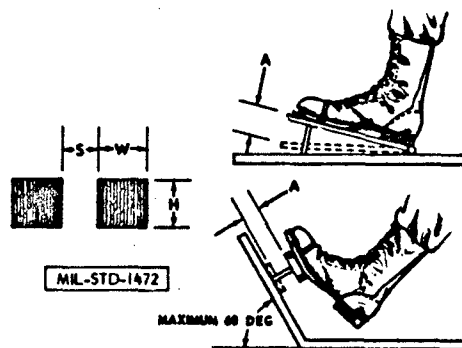
FIGURE 6.B.12 TOGGLE SWITCHES



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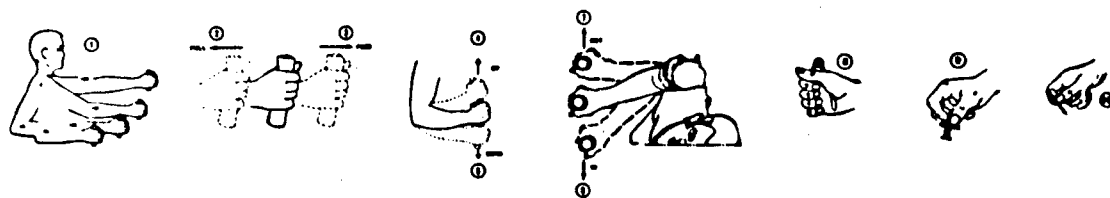
RESISTANCE			
(M 1)	TWO HANDS	ONE HAND	(M 2) TWO HANDS
	2 lb (9 N)	2 lb (9 N)	2 lb (9 N)
	50 lb (220 N)	20 lb (90 N)	30 lb (135 N)
SEPARATION			
ONE HAND RANDOM		TWO HANDS SIMULTANEOUSLY	
2 in (50 mm)		3 in (75 mm)	
4 in (100 mm)		5 in (125 mm)	

6.B.14 LEVER



	DIMENSIONS		DISPLACEMENT			
	N	W	A			
	Height	Width	Normal Operation	Heavy Boots	Ankle Flexion	Total Leg Movement
Minimum	1.8" (45mm)	3.5" (75mm)	8.5" (13mm)	1.8" (45mm)	1.8" (45mm)	1.8" (45mm)
Maximum	-	-	2.5" (65mm)	2.5" (65mm)	2.5" (65mm)	7.8" (195mm)
RESISTANCE						
	Foot Not Resting on Pedal		Foot Resting on Pedal		Ankle Flexion Only	Total Leg Movement
Minimum	4 lb (18N)		10 lb (45N)		-	10 lb (45N)
Maximum	20 lb (90N)		20 lb (90N)		10 lb (45N)	100 lb (2000N)
SEPARATION						
	One Foot Random			One Foot Sequential		
Minimum	4.8" (100mm)			2.8" (50mm)		
Preferred	6.6" (160mm)			4.8" (100mm)		

FIGURE 6.B.15 PEDALS



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ARM STRENGTH (Lb)													
(1)	(2)		(3)		(4)		(5)		(6)		(7)		
DEGREE OF ELBOW FLEXION (deg)	PULL		PUSH		UP		DOWN		IN		OUT		
	L	R*	L	R	L	R	L	R	L	R	L	R	
100	56	52	42	50	9	14	12	17	13	20	9	14	
150	42	56	30	42	15	10	10	20	15	20	9	16	
120	34	42	26	36	17	24	21	26	22	10	10	16	
90	27	17	22	34	17	20	21	20	16	10	10	16	
60	16	24	22	34	15	20	10	20	17	20	12	17	

HAND AND THUMB-FINGER STRENGTH (Lb)													
	(8)		(9)		(10)		(11)		(12)		(13)		
	HAND GRIP		THUMB-FINGER GRIP (PALM CR)		THUMB-FINGER GRIP (TIPS)		THUMB-FINGER GRIP (TIPS)		THUMB-FINGER GRIP (TIPS)		THUMB-FINGER GRIP (TIPS)		
	L	R	L	R	L	R	L	R	L	R	L	R	
MOMENTARY HOLD	56	50	13	13	13	13	13	13	13	13	13	13	
SUSTAINED HOLD	33	35	8	8	8	8	8	8	8	8	8	8	

* L - LEFT, R - RIGHT

FIGURE 6. C. 1 ARM, HAND, AND THUMB-FINGER STRENGTH (5th PERCENTILE MALE DATA)

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ARM STRENGTH (IN)													
(1)	(2)		(3)		(4)		(5)		(6)		(7)		
DEGREE OF ELBOW FLEXION (deg)	PULL		PUSH		UP		DOWN		IN		OUT		
	L	R*	L	R	L	R	L	R	L	R	L	R	
#	222	231	167	222	40	62	60	76	50	60	30	62	
90 #	167	240	123	167	67	80	80	80	67	80	30	67	
120 #	161	167	116	160	76	107	80	116	80	80	40	67	
150 #	142	160	80	160	76	80	80	116	71	80	45	71	
180 #	116	167	80	161	67	80	80	80	76	80	50	76	
HAND AND THUMB-FINGER STRENGTH (IN)													
	(8)				(9)				(10)				
	HAND GRIP				THUMB-FINGER GRIP (PALMER)				THUMB-FINGER GRIP (TIPS)				
	L	R	L	R	L	R	L	R	L	R	L	R	
MOMENTARY HOLD	200	200			60	60			60	60			
SUSTAINED HOLD	140	150			35	35			35	35			

* ELBOW ANGLE SHOWN IN RADIANS

** L - LEFT, R - RIGHT

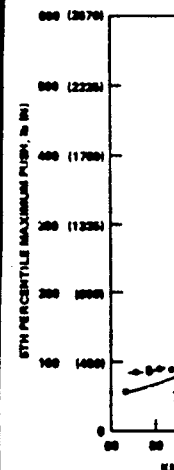


FIGURE 6. C. 2 LEG

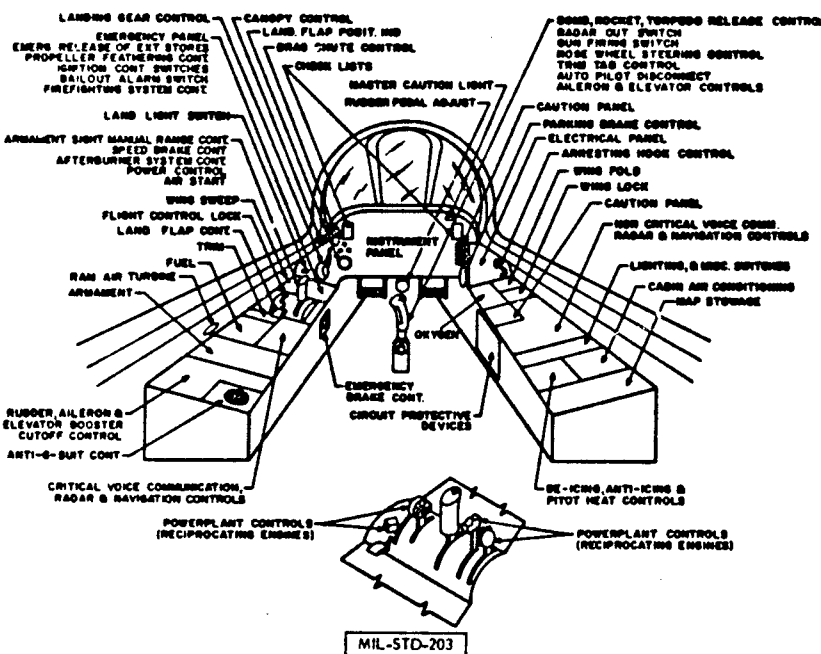


FIGURE 7. A. 1 SINGLE PILOT-TANDEM PILOT EQUIPMENT ARRANGEMENT

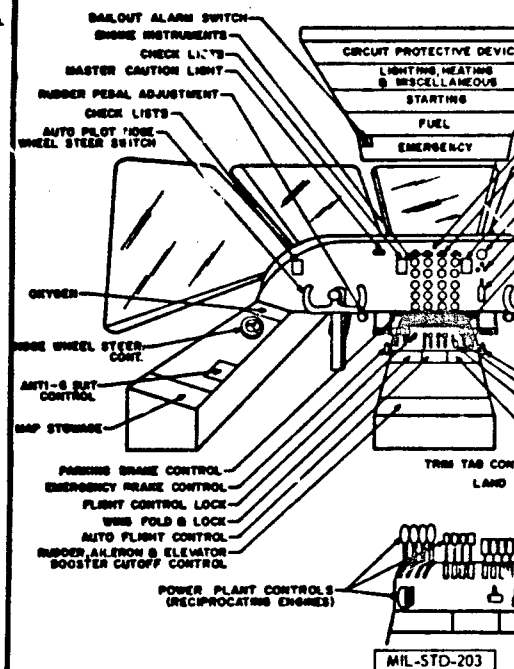


FIGURE 7. A. 2 SIDE-BY-SIDE PILOT EQUIPMENT ARRANGEMENT



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FUNCTION	CONTROL ACTION
ON	UP, RIGHT, FORWARD, CLOCKWISE, PULL
OFF	DOWN LEFT, REARWARD, COUNTERCLOCKWISE, PUSH
RIGHT	CLOCKWISE, RIGHT
LEFT	COUNTERCLOCKWISE, LEFT
RAISE	UP
LOWER	DOWN
RETRACT	UP, REARWARD, PUSH
EXTEND	DOWN, FORWARD, PUSN
INCREASE	FORWARD, UP, RIGHT, CLOCKWISE
DECREASE	REARWARD, DOWN, LEFT, COUNTERCLOCKWISE

	TOGGLE SWITCHES	*PUSH-BUTTONS	CONTINUOUS ROTARY CONTROLS	ROTARY SELECTOR SWITCHES	DISCRETE THUMBWHEEL CONTROLS
TOGGLE SWITCHES	FIG 6.B.10	0.5"(13 mm)	0.75"(19 mm)	0.75"(19 mm)	0.5"(13 mm)
*PUSH-BUTTONS	0.5"(13 mm)	FIG 6.B.7	0.5"(13 mm)	0.5"(13 mm)	0.5"(13 mm)
CONTINUOUS ROTARY CONTROLS	0.75"(19 mm)	0.5"(13 mm)	FIG 6.B.4	1.0"(25 mm)	0.75"(19 mm)
ROTARY SELECTOR SWITCHES	0.75"(19 mm)	0.5"(13 mm)	1.0"(25 mm)	FIG 6.B.1	0.75"(19 mm)
DISCRETE THUMBWHEEL CONTROLS	0.5"(13 mm)	0.5"(13 mm)	0.75"(19 mm)	0.75"(19 mm)	FIG 6.B.3

All values are for one hand operation. Distances are measured in inches and are measured from edge to edge of each control.

FIGURE 6.D.1 MINIMUM SEPARATION DISTANCES FOR CONTROLS.



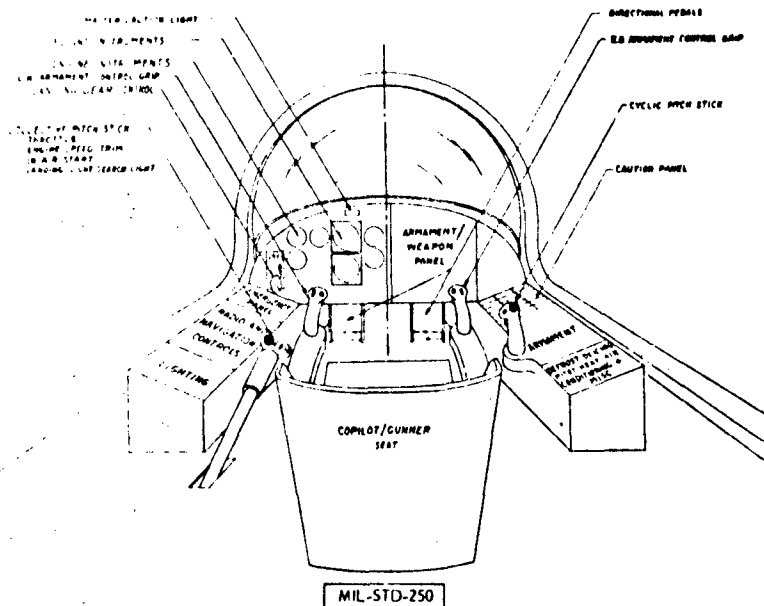


FIGURE 7. A. 4 COPILOT/GUNNER EQUIPMENT ARRANGEMENT

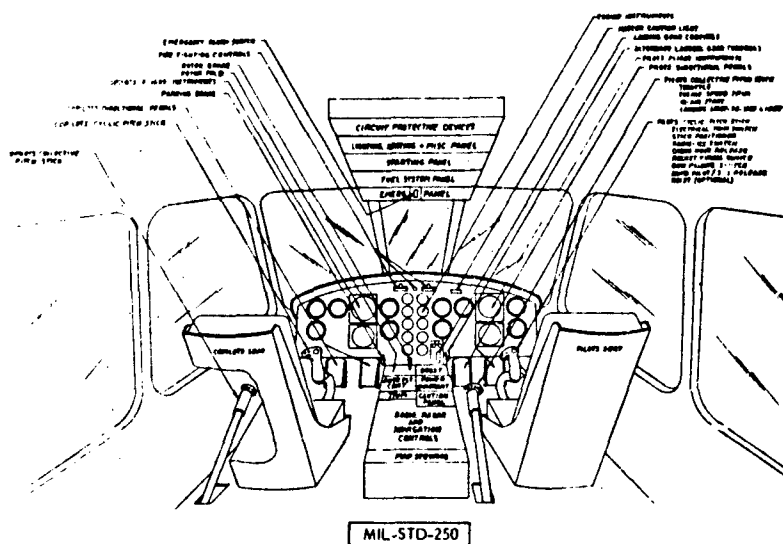


FIGURE 7. A. 5 SIDE-BY-SIDE PILOT EQUIPMENT ARRANGEMENT

CONTROL	ACTUATION
Rudder	Conventional*
Rudder Pedal Adjustment	Motion to extend pedals is clockwise, push or lift conventional
Aileron and Elevator	Conventional
Rudder, Aileron, Elevator Booster	Performance related
Flight Control Lock	Restricts throttles
Autopilot	Conventional
Rudder, Aileron, Elevator Trim	Conventional
Landing Gear	Conventional
Landing Flaps	Conventional
Speed Brake	Aft motion for braking
Tail Wheel Lock	Upward or forward or both for lock
Arresting Hook	Normal: Motion corresponds to hook movement Emergency: Push button or hook shaped switch
Wing Folding	Forward or outboard to spread; aft or inboard to fold
Wing Locking	Forward or outboard to lock, aft or inboard to unlock
Wing Sweep	Conventional
Wheel Brake	Conventional
Parking Brake	Pull to actuate; push pedals to release
Emergency Brake	Pull to apply
Canopy	Forward or down to close, aft or up to open
Canopy Jettison	Conventional
Nose Wheel Steering	Conventional, push button to engage
Thermal Cockpit Closure	Positive action latches for open, intermediate, closed
Drag Chute	Handle: pull to deploy (non-rotatable); rotate either way to jettison
Launch Bar	Forward to extend; aft to retract
Power: Reciprocating	Standard
Turboprop	Performance related
Turbojet	Performance related
Reverse Thrust: Shaft Power	Motion aft through a stop that employs a "lift to reverse" type of control mechanism
Turbojet	Aft motion
Fluid Injection Systems	Performance related
Afterburner	Automatically actuated by power control
Super or Turbocharger	Forward or up for low blower
Assisted Takeoff	Performance related
Cool Flaps, Inter-coolers, Oil Coolers, etc.	Forward, upward or clockwise for increased cooling
Carburetor Heat Air Filter, Alternate Air and Turbopass	Performance related

ITEM	COMMENTS	CONTROL	ACTUATION	COMMENTS
ational*		Induction System	Performance related	
n to extend pedals in clock- push or lift conventional		Anti-icing		
ational		Fuel system selector	Conventional	"Off" position is protected by a safety device/ If fuel is supplied from several tanks, a diagrammatic fuel system is provided around the selector(s)
ance related				
icts throttles		Fuel system	Conventional	
ational	Electrical disconnect on stick or manual control on autopilot	Ignition Switch(es): Reciprocating	Clockwise rotation produces the following sequence: "Off", "Left", "Right", "Both"	Switches are separated electrically and mechanically
atio al	Inadvertent action guarded against/ Position and range of adjustment indicated/ Only wheel, knob or switch used (not crank)	Turboprop or jet	Performance related	If switch is not integral with power lever, it functions as an ignition arming switch
ation l	Proper knob shape/ Handle light illuminates when gear is inconsistent with handle position/ Labeled	Air Start Switch(es)	Performance related	
ntional		Propeller Feathering	Push to feather	A light is provided to indicate power failure or feathering action
otion for braking		Vector Thrust	Aft movement changes direction downward to vertical	
l or forward or both for		Ram Air Turbine	Pull to release	
l Motion corresponds to movement		Firefighting System	Pull to actuate	A single control for each engine or critical area plus one agent discharge switch/ Control knob illuminates when that system is actuated/ Control knob is of proper shape
ncys: Push button or hook switch		Master Electrical	Conventional	
l or outboard to spread; aft ward to fold		Lighting and Miscellaneous	Performance related	For carrier aircraft, a master exterior light switch is near the throttle
l or outboard to lock; aft ward to unlock		Landing Light and Searchlight	Performance related	
ntional		Circuit Breakers	Conventional	Only those which affect the safety of the flight need be accessible
ntional	With dual brakes, simultaneous braking is possible	Primary Voice Communications and Intercommunications	Performance related	Primary communications transmitter switch is on the power lever for control wheel for side-by-side pilots)
o actuate; push pedals to		Navigation	Performance related	
o apply		Radar Identification	Performance related	
o or down to close, aft or open		Armament-General	Performance related	
ntional		Guns and Associated Items:		
ational, push button to		Gun Firing	Squeeze to fire	
ve action latches for open, mediate, closed		Armament Sight	Turn clockwise or press for closing range	
o pull to deploy (non- able); rotate either way to son		Manual Range	Performance related	
o to extend; aft to retract		Radar Out	Performance related	
ard	Power controls arranged left-to-right: throttle(s); propeller control(s) (shorter than throttle); mixture control(s) (shorter than propeller control)	Gun Charging	As marked	
ance related		Bomb, Rocket, Torpedo and External Stores:		
ance related		Normal Release	Press to release or fire preselected components	
l aft through a step that is a "lift to reverse" type ontrol mechanism		Emergency Release	Master electrical jettisoning: push to release	Guarded plunger type switch in addition to electrical jettisoning switch
otion			Mechanical release: pull to release	
ance related		Anti-G Suit	Performance related	
itically actuated by power il		Cabin Air Conditioning	Conventional	
o or up for low blower		Shoulder Harness	Forward to lock	
ance related		Seat Adjustment	Movement corresponds to seat motion	
o, upward or clockwise for med cooling		Deicing and Anti-icing and Pitot Heat	Performance related	
ance related		Bail-out Alarm	Conventional	Appropriately guarded

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* Conventional indicates all controls are actuated in accordance with established custom or in the direction of flight as applicable.

FIGURE 7. C. 1 CONTROL ACTUATION FOR FIXED WING AIRCRAFT

Anti-Torque Pedals	Conventional*	
Anti-Torque Pedal Adjustment	Control motion to extend pedals is clockwise, push or lift	
Cyclic Pitch Stick	Conventional	Separate controls for each pilot/ Grip provides: electric trim, force trim, radio, release, rocket firing, gun firing, autopilot
Collective Pitch Stick	Conventional	Separate controls for each pilot/ Adjustable friction device for pilot-in-command only
Control System Power Boost	Performance related	
Autopilot	Performance related	An emergency cut-off switch is located on the cyclic pitch stick grip
Trim	Performance related	Safeguarded against inadvertent action/ Position and range of adjustment indicated/ Electrical trim is a four-way "Chinese hat"
Force Trim	Performance related	
Landing Gear	Performance related	Proper knob shape/ Indicator light is steady "On" when gear position does not correspond with gear control selection/ Emergency override control has safety device
Alternate Landing Gear Actuation	A separate and distinct motion from normal operation	
Wheel Brake	Conventional	With dual brakes, simultaneous braking is possible
Parking Brake	Pull to actuate; press pedals to release	
Wheel Centering Lock	Upward or forward, or both, to lock; reverse action to unlock	
Rotor Brake	Performance related	Safety device to prevent rotor from starting with brake on/ Inadvertent operation prevented
Rotor Blade Folding	Forward for spread; aft for fold	Positive interlocks prevent premature or accidental engagement and prevent rotor head rotation during folding
Reciprocating Engines: Rotary Power	Clockwise to increase power (viewed from free end of stick)	Maximum grip rotation: 150 degrees/ Adjustable friction device operable without moving hand from throttle and on pilot's control only
Turbine Engines: Engine Conditioner	Clockwise actuation (viewed from free end of stick)	Maximum grip rotation: 150 degrees from "Off"/ Positive stops for each function/ Safety feature to prevent inadvertent rotation to next function/ Friction control operable without removing left hand from stick/ Markings show control function and direction of rotation
Engine(s) Speed Trim	Momentary (beep) switch: forward to increase engine rpm and aft to decrease rpm	Markings show increase and decrease rpm positions
Beta	Clockwise actuation (viewed from free end of stick) for increased pitch; counter clockwise for decreased pitch; positive detent for neutral	120 degree rotation/ Friction control operable without removing left hand/ Markings show position and direction of rotation
Pitch Trim Speed, Range	Forward for high range; aft for low range	Switch position marked
Engine Oil Temperature	Switch forward of automatic stop detent increases cooling; switch aft, decreases cooling	Switch position marked
Engine Oil Cooler Flap	Performance related	Markings show position
Carburetor Heat, Air Filter	Performance related	
Induction System Anti-icing	Performance related	
Fuel System Selector	Mechanical rotary or lever-type control(s) or electrical switch selector(s) are forward or up for "On" and aft or down for "Off"	Safety device prevents inadvertent cutoff/ If fuel is supplied from several tanks, a diagrammatic fuel system is provided around the selector

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FIGURE 7.C.2 CONTROL ACTUATION FOR ROTARY WING AIRCRAFT

Ignition Switch(es): Reciprocating	Clockwise rotation produces the following sequence: "Ignition", "Start", "Normal"	Ind for are, muel
Ground Start Switch	Conventional	Com fun
Stop Switch	Conventional	Cle tior
In-Air Start Switch	Press for ignition and spring return for "Off"	Pill rem piti Ina on
Firefighting System	Pull to actuate	A e or dis ill act shd
Master Electrical	Performance related	
Lighting and Miscellaneous	Performance related	
Landing Light and Searchlight	Performance related	Act to pit com
Circuit Breakers	Conventional	Onk of
Radio, Radar and Navigation	Performance related	Rad swi sta rad be
Weapon(s) Firing Switch	Squeeze to fire	Saf art
Armament Sight and Range	Conventional	
External Stores: Release Switch	Press to release	If or swi rel
Emergency Release Switch	Pull to release	In Em has
Oxygen System	Conventional	
External Tow Cable or Cargo Release Switch	Push to release	Swi tes
Cargo Emergency Release	Push foot pedal or pull hand control	In Has ped
Moist Control Switch	Performance related; spring return to "Off" when released	
Defrosting, Deicing, Pilot Heat, Cockpit Air Conditioning, Windshield	Performance related	
Ventilating	Conventional	
APU	Momentary forward to start, center is run, aft is stop	
Shoulder Harness	Forward to lock	
Seat Adjustment	Movement corresponds to seat motion	
Emergency Alarm	Performance related	Cur tid

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* Conventional indicates all controls are actuated in accordance in the direction of flight as applicable.

FIGURE 7.C.2 (CONTINUED)

CTION	COMMENTS
rise rotation produces the ing sequence: "Ignition", ", "Normal"	Individual switches have provision for emergency aborting/ Switches are separated electrically and mechanically
tional	Combines starter and ignition function
itional	Clearly marked/ Inadvertent actua- tion prevented
for ignition and spring for "Off"	Pilot can operate switch without removing his hand from collective pitch stick/ Properly marked/ Inadvertent operation has no effect on engine operation
o actuate	A single control for each engine or critical area plus one agent discharge switch/ Control knob illuminates when that system is actuated/ Control knob is of proper shape
ance related	
ance related	
ance related	Actuation does not require pilot to remove left hand from collective pitch stick/ Searchlight slew control is a four-way "Chinese hat"
tional	Only those which affect the safety of the flight need be accessible
ance related	Radio ICS switch is a 3-position switch on cyclic pitch stick/ With stabilization system, other radio, radar, and navigation controls may be on the right side console
to fire	Safety guard prevents inadvertent actuation
ional	
o release	If serving a dual purpose of stores or cargo hook release, a selector switch is provided/ Inadvertent release protected against
release	In addition to electrical switch/ Emergency markings on control handle
ional	
release	Selector switch provided/ Inadvert- ent actuation guarded against
or pedal or pull hand	In addition to electrical switch/ Markings show emergency use/ Foot pedal requires positive action
ance related, spring to "Off" when released	
ce related	
ional	
try forward to start, center aft is stop	
to lock	
it corresponds to seat	
ance related	Guarded against inadvertent actua- tion
MIL-STD-250	
ontrols are actuated in accordance with established custom or is applicable.	

FIGURE 7.C. 2 (CONTINUED)

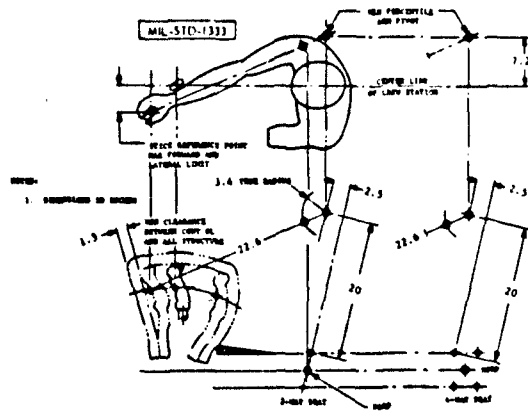


FIGURE 7.D. 1 PITCH AND ROLL CONTROL-STICK TYPE 2-WAY AND 4-WAY SEAT

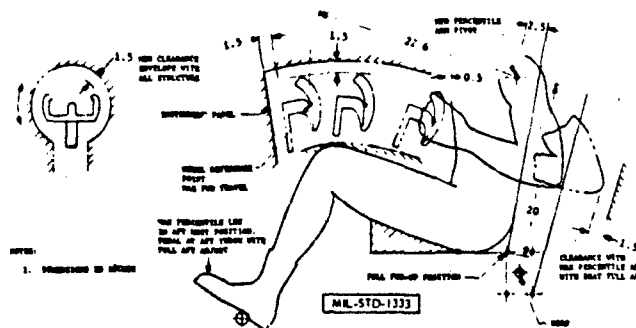


FIGURE 7.D. 2 PITCH AND ROLL CONTROL - WHEEL TYPE

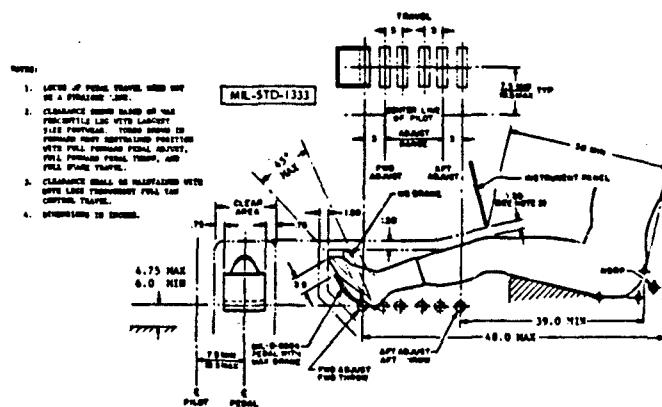


FIGURE 7.D. 3 YAW CONTROL PEDALS

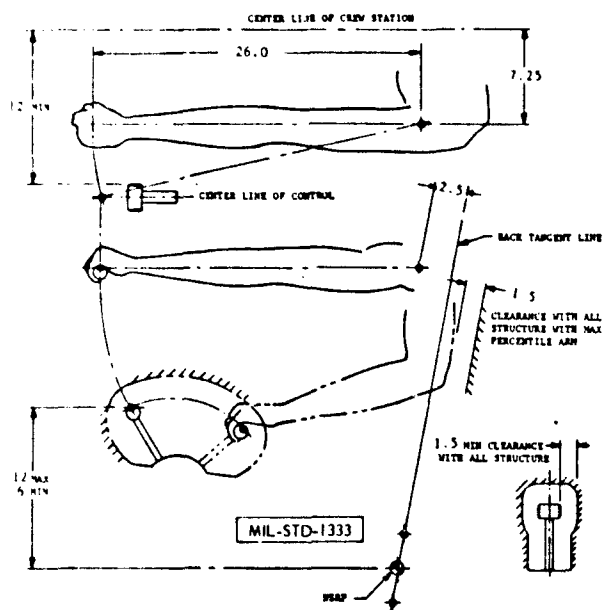


FIGURE 7.D.4 PROPULSION CONTROL GEOMETRY

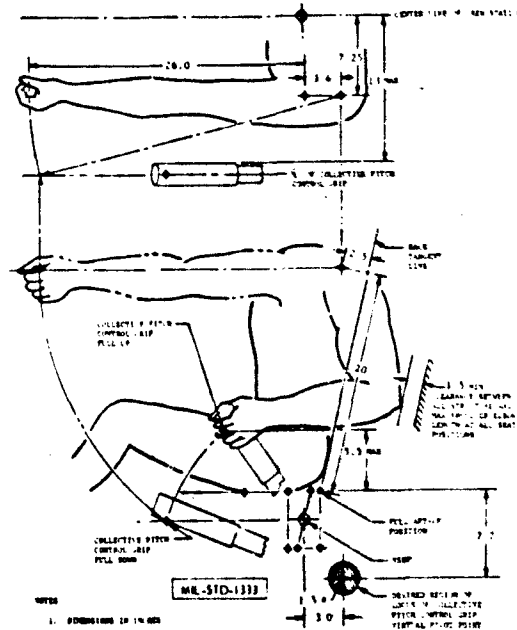
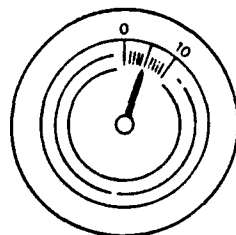
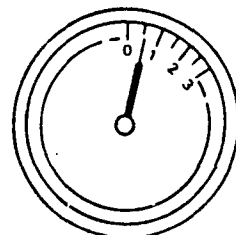


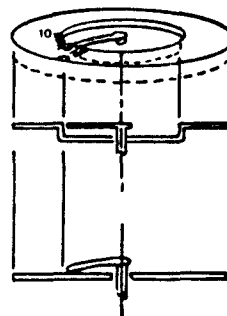
FIGURE 7.D.5 COLLECTION CONTROL GEOMETRY



20% MAXIMUM READING ACCURACY
THIS PICTURE IS AN EQUAL DISTANCE -
4 MIN. (0.0310.061 in (0.8-1.6 mm) -
FROM ALL SCALE MARKS, NEVER
OVERLAPPING ANY MARK OR NUMERAL)



ALTERNATE FORMAT FOR GROSS
READING OF NUMBERS



TO PREVENT OR MINIMIZE
VISUAL PARALLAX

MIL-STD-1472

RELATIVE POSITION OF SCALE MARKS,
NUMERALS, AND POINTERS ON CIRCULAR DIALS

FIGURE 8.B.2 CIRCULAR DIALS

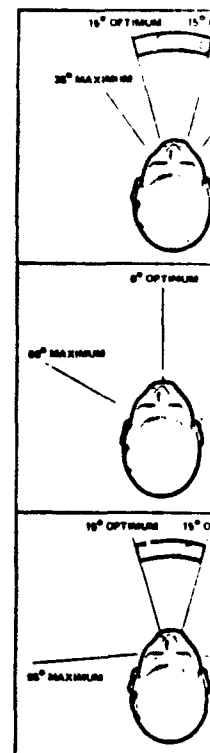


FIGURE 8.E.1 VISUAL FIELD

	MECHANICAL COUNTERS	FLAGS	PRINTERS	PLOTTERS
APPLICATION	QUANTITATIVE DATA WHEN CONTINUOUS TREND IS NOT REQUIRED & WHEN QUICK, POSITIVE INDICATION IS REQUIRED	QUALITATIVE, NON-EMERGENCY CONDITIONS	VISUAL RECORD OF DATA IS REQUIRED	VISUAL RECORD OF CONTINUOUS GRAPHIC DATA IS DESIRED
MARKINGS	HEIGHT TO WIDTH RATIO OF NUMERALS IS 1:1 (EXCEPT NUMBER "1" WHICH IS ONE STROKE WIDTH). HORIZONTAL SEPARATION BETWEEN NUMERALS IS 1/4 - 1/2 NUMERAL WIDTH. CONTRAST BLACK ON WHITE OR WHITE ON BLACK	MINIMUM OF 50% CONTRAST BETWEEN FLAGS & BACKGROUNDS UNLESS ALL EXPECTED AMBIENT LIGHTING CONDITIONS	PRESENTED IN DIRECTLY USABLE FORM. PRINT NOT OBLSCURED. MINIMUM OF 50% LUMINANCE CONTRAST BETWEEN PRINTED MATERIAL & BACKGROUND	PLOTTING POINTS VISIBLE AND NOT OBSTRUCTED BY PEN ASSEMBLY OR ARM. MINIMUM OF 50% LUMINANCE CONTRAST BETWEEN PLOTTED FUNCTION & BACKGROUND
MOVEMENT	SNAP ACTION, NOT FASTER THAN 2 SEC/COND IF NUMBERS MUST BE READ CONSECUTIVELY	SNAP ACTION	AS REQUIRED	AS REQUIRED
ILLUMINATION	SELF-ILLUMINATED WHEN AMBIENT PROVIDES BELOW 3.5 cd/m ² DISPLAY LUMINANCE	AMBIENT	SELF-ILLUMINATION IF REQUIRED	SELF-ILLUMINATION IF REQUIRED
OTHER	MOUNTED CLOSE TO PANEL SURFACE TO MINIMIZE VIEWING ANGLE & MINIMIZE SHADOWS. MATTE COATING DRUM AND SURROUND TO MINIMIZE SHADOWS & MAXIMIZE VIEWING ANGLE	MOUNTED CLOSE TO PANEL SURFACE. MALFUNCTION INDICATION PARTIALLY OBSCURES VIEW OF MALFUNCTIONING DISPLAY. TEST PROVISION AVAILABLE	QUICK & EASY INSERTION & REMOVAL OF PRINTING MATERIALS. TAKE-UP DEVICE PROVIDED. ANNOTATION PROVISION AVAILABLE WHERE APPLICABLE	TAKEUP DEVICE PROVIDED WHERE APPLICABLE. ANNOTATION PROVISION FURNISHED WHERE APPLICABLE. JOB AIDS PROVIDED WHERE NEEDED, BUT DO NOT OBSCURE OR DISTORT DATA

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FIGURE 8.B.1 COUNTERS, FLAGS, PRINTERS, AND PLOTTERS

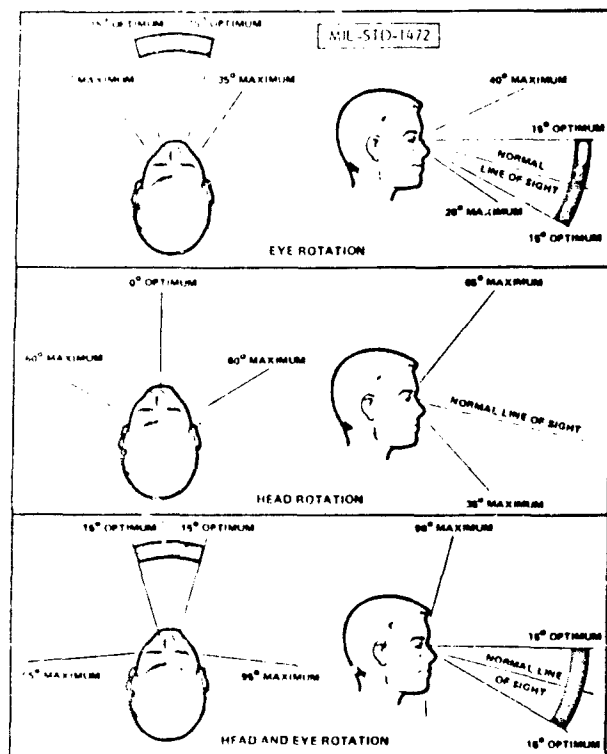


FIGURE 8.E.1 VERTICAL AND HORIZONTAL VISUAL FIELD

FACTOR	OPTIMUM	PREFERRED LIMITS	ACCEPTABLE LIMITS
RATIO OF VIEWING DISTANCE SCREEN DIAGONAL	4	3-6	2-8
* IMAGE LUMINANCE (NO FILM IN OPERATING PROJECTOR)	10 fL (35 cd/m ²)	5-14 fL (27-65 cd/m ²)	5-30 fL (27-79 cd/m ²)
LUMINANCE VARIATION ACROSS SCREEN (RATIO OF MAXIMUM TO MINIMUM LUMINANCE)	1	1.5	2.0
LUMINANCE VARIATION AS A FUNCTION OF VIEWING LOCATION (RATIO OF MAXIMUM TO MINIMUM LUMINANCE)	1	2.0	4.0
RATIO OF AMBIENT LIGHT BRIGHTEST PART OF IMAGE	0	0.005-0.01	0.1 max **

* FOR STILL PROJECTIONS HIGHER VALUES MAY BE USED
** FOR PRESENTATIONS NOT INVOLVING GRAY SCALE OR COLOR (e.g., LINE DRAWINGS, TABLES)
0.2 MAY BE USED.

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FIGURE 8.E.2 GROUP VIEWING OF OPTICAL PROJECTION DISPLAYS

Indicator reading, dark adaptation necessary	Red, Red, indirect, or both, with operator choice	0.02-0.1 (0.07-0.34)	Continuous throughout range
Indicator reading, dark adaptation not necessary, but desirable	Red or low color-temperature white flood, indirect, or both, with operator choice	0.02-1.0 (0.07-3.43)	Continuous throughout range
Indicator reading, dark adaptation not necessary	White flood	1.0-20.0 (3.4-68.5)	Flood or continuous
Panel monitoring, dark adaptation necessary	Red edge lighting, red or white flood, or both, with operator choice	0.02-1.0 (0.07-3.43)	Continuous throughout range
Panel monitoring, dark adaptation not necessary	White flood	1.0-20.0 (3.4-68.5)	Flood or continuous
Possible exposure to bright flashes, restricted daylight	White flood	1.0-20.0 (3.4-68.5)	Flood
Chart reading, dark adaptation necessary	Red or white flood with operator choice	0.1-1.0 (0.34-3.43) (on white portion of chart)	Continuous throughout range
Chart reading, dark adaptation not necessary	White flood	5.0-20.0 (17.1-68.5)	Flood or continuous

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FIGURE 8.E.3 RECOMMENDATIONS FOR DISPLAY LIGHTING

FIGURE 8.E.4 LEGIBILITY OF DATA ON LARGE SCREEN OPTICAL PROJECTION DISPLAYS

CHARACTERISTIC	CONDITION	LIMITS
LETTER/NUMERAL STYLE	GENERAL APPLICATIONS EXTENDED COPY	CAPITALS STANDARD
STROKE WIDTH/HEIGHT	DARK MARKINGS LIGHT MARKINGS	1/8 - 1/8 1/16
LETTER & NUMERAL HEIGHT	REQUIRED FROM LOWEST ANTICIPATED VIEWING DISTANCE DESIRED FROM LOWEST ANTICIPATED VIEWING DISTANCE	3.0 BRAD VIS ANGLE (MINIMUM) 4.8 BRAD VIS ANGLE (MINIMUM)
LUMINANCE RATIO	OPTIMAL LIGHTING CHARTS, PRINTING, LINEWORK LIMITED SHADOWS & DETAIL FULL RANGE COLORS OR GRAYS	80:1 (PREFERRED) 5:1 (MINIMUM) 25:1 (MINIMUM) 100:1 (MINIMUM)

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1/2 INCH (12mm) DIAMETER or SMALLER/STEADY	Malfunction, action stopped, failure, stop action
1 INCH (25mm) DIAMETER or LARGER/STEADY	Master summation (system or subsystem)
1 1/2 INCH (38mm) DIAMETER or LARGER/FLASHING (3 Hz 5/sec.)	Emergency condition (impending personnel or equipment disaster)

FIGURE 8.F.1 CODE

FUNCTION	TYPE OF SIGNAL		
	TONES (Periodic)	COMPLEX SOUNDS (Non-Periodic)	SPEECH
QUANTITATIVE INDICATION	POOR Minimum of 6 to 8 tones absolutely recognizable.	POOR Interpretation between signals uncertain.	GOOD Minimum tones and error in obtaining exact value in terms of acceptable code response.
QUALITATIVE INDICATION	POOR TO FAIR Difficult to judge approximate value and direction of deviation from null setting unless presented in close temporal sequence.	POOR Difficult to judge approximate value deviation from desired value.	GOOD Information concerning displacement, direction, and rate presented in form compatible with required response.
STATUS INDICATION	GOOD Short and sharp tones. Continuous information where rate of change of input is low.	GOOD Separately suitable for irregularly occurring signals (e.g., alarm signals).	POOR Inefficient, more easily misread, provides of readability.
TRACKING	FAIR Not positive multi-measured, problems of signal-response compatibility.	POOR Required continuous continuous difficult to provide.	GOOD Missing element in signal.
GENERAL	Good for automatic non-continuous of interest information. Warning must be learned. Early presented.	Some sounds available with common meaning (e.g., fire bell). Early generated.	Most effective for rapid that are unimportant non-continuous information. Warning system to signal and control when understood. Minimum of non-learning required.

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FIGURE 8.F.3 FUNCTIONAL EVALUATION OF AUDIO SIGNALS

DISPLAY	CONDITION
LIGHT EMITTING DIODES	COLOR CODING LAMP TEST
DOT MATRIX/SEGMENTED	SYMBOL DEFINITION SYMBOL HEIGHT SYMBOL HEIGHT FOR FLIGHT DISPLAYS LETTER STYLE VIEWING ANGLE COLOR OF MONOCHROMATIC EMITTERS (IN ORDER OF PREFERENCE)
ELECTROLUMINESCENT	SYMBOL HEIGHT SYMBOL HEIGHT FOR FLIGHT DISPLAYS

FIGURE 8.F.4 OTHER DISPLAYS

DIAMETER or SMALLER STEADY	shaped failure stop action	redback	reference, acceptable ready	physical position, action in progress
1 INCH (25mm) DIAMETER or LARGER STEADY	Master summation (system or subsystem)	Extreme caution (impending danger)	Master summation (system or subsystem)	
1 INCH (25mm) DIAMETER or LARGER FLASHING (3 to 5 sec)	Emergency caution (impending personnel or equipment disaster)			

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FIGURE 8.F.1 CODING OF SIMPLE INDICATOR LIGHTS

QUANTITATIVE INFORMATION	May be difficult to read while pointer is in motion	May be difficult to read while scale is in motion	Minimum time and error for exact indicated value	Minimum time and error for exact indicated value. Parameter reference results	N/A
QUALITATIVE INFORMATION	GOOD Location of pointer easy. Numerical and scale need not be read. Parameter change easily detected.	POOR Difficult to judge direction and magnitude of difference without reading numbers and scale.	POOR Numbers not to be read. Parameter change not easily detected.	POOR Numbers must be read. Parameter change not easily detected.	GOOD Easily detected & measured of value.
SETTING	GOOD Simple and direct relation of motion of pointer to motion of setting knob. Parameter change into monitoring.	FAIR Relation to motion of setting knob may be ambiguous. No pointer position change to aid monitoring. Not readable during rapid setting.	GOOD Most accurate monitoring of numerical setting. Relation to motion of setting knob less direct than for moving pointer. Not read while during rapid setting.	N/A	N/A
TRACKING	GOOD Pointer position readily associated and monitored. Brightest relation to numerical setting motion.	FAIR No pointer change to aid monitoring. No relation to numerical motion associated indication.	POOR No gross relation change to aid monitoring.	N/A	N/A
GENERAL	Requires largest segment and is illuminated only on panel. Scale length limited unless multiple pointers used.	Some panel space. Only small section of scale need be exposed and illuminated. Use of tape where long scale.	Most convenient of scale and if illuminated. Scale length limited only by number of indicator dials.	Limited application.	Limited application.

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FIGURE 8.F.2 APPLICATION OF VARIOUS TYPES OF MECHANICAL DISPLAYS

CONDITION	LIMIT
COLOR CODING	SAME AS FIGURE 8.F.1
LAMP TEST	NOT REQUIRED IF 100 K HRS. MTBF MINIMUM
SYMBOL DEFINITION	5 BY 7 (MINIMUM) 7 BY 9 (PREFERRED)
SYMBOL HEIGHT	4.7 MRAD VISUAL ANGLE (MINIMUM)
SYMBOL HEIGHT FOR FLIGHT DISPLAYS	7.0 MRAD VISUAL ANGLE (MINIMUM)
LETTER STYLE	UPPER CASE
VIEWING ANGLE	610 MRAD OFF AXIS (MAXIMUM)
COLOR OF MONOCHROMATIC EMITTERS (IN ORDER OF PREFERENCE)	GREEN (555 NM) YELLOW (575 NM) ORANGE (585 NM) RED (660 NM)
SYMBOL HEIGHT	4.5 MRAD VISUAL ANGLE (MINIMUM)
SYMBOL HEIGHT FOR FLIGHT DISPLAYS	7.0 MRAD VISUAL ANGLE (MAXIMUM)

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FIGURE 8.F.4 OTHER DISPLAYS

LOCATION (CRITICAL FUNCTIONS)	WITHIN 15 DEG OF NORMAL LINE OF SIGHT (FIGURE 8.E.1)
LUMINANCE MINIMUM	10% GREATER THAN SURROUND
LUMINANCE MAXIMUM	300% GREATER THAN SURROUND
WITHIN - INDICATOR CONTRAST	50% MINIMUM FIGURE-GROUND RELATIONSHIP
COLORS GENERAL	TYPE I - AVIATION COLORS, MIL-C-25050
TRAINING EQUIPMENT	MIL-T-23991
AIRCREW STATION SIGNALS	MIL-STD-411
COLOR CODING	SEE FIGURE 8.F.1

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FIGURE 8.F.5 TRANSILLUMINATED DISPLAYS

Prohibited Types of Signals - The following types of signals should not be used as warning devices where possible confusion might result because of the operational environment:

- Modulated or interrupted tones that resemble navigation signals or coded radio transmissions.
- Steady signals that resemble hisses, static, or sporadic radio signals.
- Trains of impulses that resemble electrical interference whether regularly or irregularly spaced in time.
- Simple warbles which may be confused with the type made by two carriers when one is being shifted in frequency (beat-frequency-oscillator effect).
- Scrambled speech effects that may be confused with cross modulation signals from adjacent channels.
- Signals that resemble random noise, periodic pulses, steady or frequency modulated simple tones, or any other signals generated by standard countermeasure devices (e.g., "bagpipes").
- Signals similar to random noise generated by air conditioning or any other equipment.
- Signals that resemble sounds likely to occur accidentally under operational conditions.

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FIGURE 8.G.1 PROHIBITED TYPES OF SIGNALS

NOMENCLATURE	LEGEND
Bail Out	Bail Out
Cabin Pressurization Failure	Cabin Press
Control Launch Bar Malfunction	Launch Bar
Emergency Fuel Failure	Fuel Fail
Emergency Fuel Regulator	Fuel Reg
Engine Overheated	Eng Hot
Fire Engine Compartment	Fire Eng
Fire Nose Section	Fire Nose
Fire Engine	Fire Eng
Fuel System Left Failure	L Fuel
Fuel System Right Failure	R Fuel
Instrument Power Off or Failure	Inst Pwr
Instrument Inverter Off or Failure	Inst Inv
Landing Gear	Gear
Low Altitude Warning	Alt Low
Master Warning Light	Master Warn
Nose Warning	Nose Warn
Tail Warning	Tail Warn
Wheels	Wheels

MIL-STD-411

FIGURE 9.H.1 LEGEND FOR WARNING SIGNALS

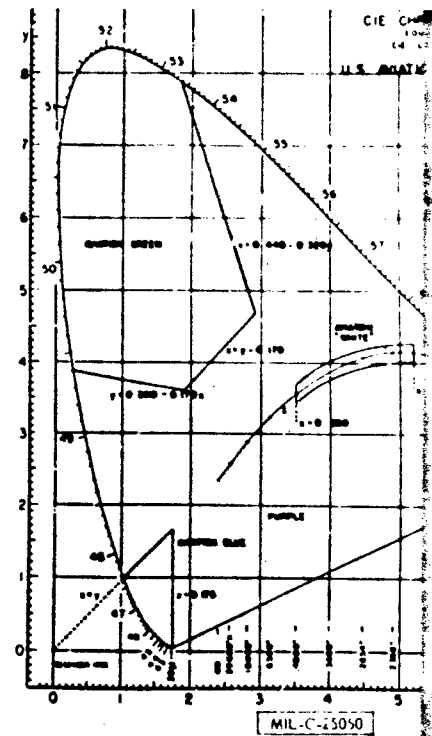
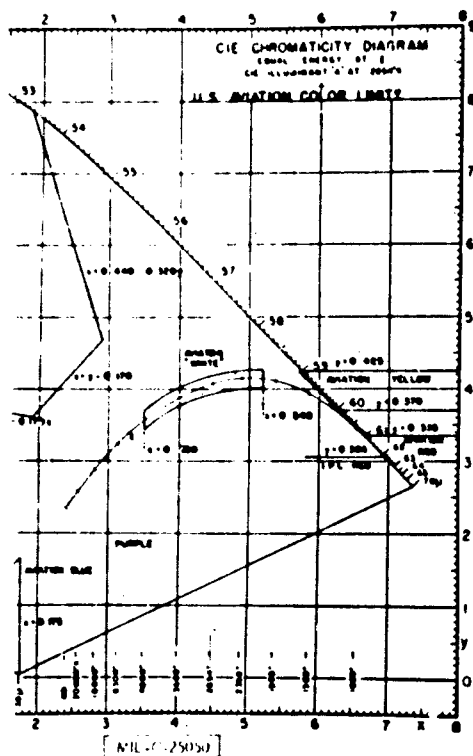


FIGURE 9.E.1 C.I.E. MIXTURE DIAGRAM SHOWING

NOMENCLATURE
Aileron Trim Failure
Automatic Power Control Off
Auxiliary Alternating Current Power
Anti-Skid Off
Automatic Feather Out
Automatic Pilot Failure
Auxiliary Power Unit Off
Boost Off
Constant Speed Drive Failure
Defroster Failure
Direct Current Generator Off or Failure
Door Open
Engine Icing
Engine Negative Thrust Control Failure
Fuel Icing
Fuel Low
Generator # - Inoperative or Out
Guide Vane Icing
Heat and Vent Overheated
Helium Warning
Hydraulic Pressure Low
Hydraulic Pump Failure
Left Alternate Current Bus Off
Left Auxiliary Fuel Tank Low



ning equipment colors can be approximate)

I.E. MIXTURE DIAGRAM SHOWING AVIATION COLOR LIMITS

NOMENCLATURE	LEGEND	NOMENCLATURE	LEGEND
Failure	All Trim	Left Rectifier Failure	L Rect
Air Control Off	APC Off	Mach Warning	Mach Warn
Rating Current Power	Aux AC Pwr	Master Caution	Master Caution
	Anti-Skid	Nozzle Failure	Nozzle
Over Out	Auto Feeth	Oil Overheated	Oil Hot
Failure	Auto-Pilot	Oil Pressure Low	Oil Press
or Unit Off	Aux Pwr Unit	Oxygen Quantity Low	Oxy Low
	Boost Off	Oxygen Regulator Failure	Oxy Reg
Drive Failure	Cat Spd Dr	Pitch Damper Failure	Pitch Dmp
are	Defrost	Power Inverter Off or Failure	Pwr Inv
Generator Off or Failure	DC Gen	Radar Inoperative	Radar Out
	Door Open	Range Limit - Left Tank	L Tank Lmt
	Eng Ice	Range Limit - Right Tank	R Tank Lmt
Thrust Control Failure	Neg Thrust	Rectifier # - Out	# - Rect
	Fuel Ice	Right Alternate Current Bus Off	R AC Bus
	Fuel Low	Right Auxiliary Fuel Tank Low	R Aux Fuel Low
Inoperative or Out	# - Gen	Right Rectifier Failure	R Rect
Wg	Vane Ice	Rotor Brake On	Rotor Brake On
Overheated	Heat & Vent Hot	Surface Overheated	Surface Hot
Helium	Helium	Transmission Oil Hot	Trans Oil Hot
Hyd Press	Hyd Press	Winch Drive Failure	Winch Dr
Failure	Hyd Pump	# - Alternator Out	# - Alter
Current Bus Off	L AC Bus	# - Propeller Reversed	# - Prop Revr
Fuel Tank Low	L Aux Fuel Low		

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FIGURE 9. H. 2 LEGEND FOR CAUTION SIGNALS

MASTER

A non-verbal audio master warning signal shall produce an output with the following frequency and interruption rates

- Fundamental audio output frequency shall sweep from 700 Hz to 1,700 Hz in 0.85 second.
- Interruption interval 0.12 second.
- The cycle shall be repeated until the signal generator is deenergized.

BAIL OUT

The audio bail-out signal for use in troop carriers, cargo transport, and all other multi-crew aircraft shall be a bell. The bell shall strike at a continuous rate of 5 to 6 beats per second and shall be audible during flight to all aircrew members and passengers.

WHEELS-UP

When a non-verbal audio wheels-up signal is used, it shall have the following tone

Frequency 250 $\pm$ 50 Hz, fundamental tone interrupted at 5.0 $\pm$ 0.5 Hz with a 50 $\pm$ 10 percent on-off cycle.

ANGLE OF ATTACK / AIR SPEED / STALL

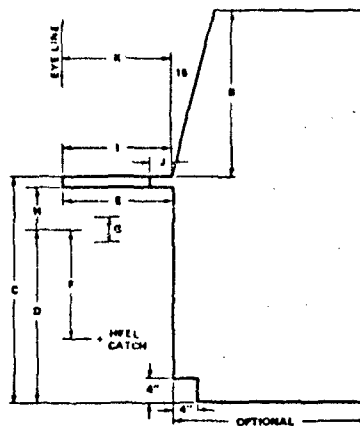
ANGLE OF ATTACK	AIR SPEED	TONE SIGNAL	MIL-STD-411
Low	Fast	1,600 tone interrupted at a rate of 1 to 10 Hz, the rate increasing linearly with decreasing angle of attack/increasing air speed.	
Safe Low	Safe fast	900 Hz steady tone, plus 1,600 Hz tone interrupted at a rate of zero to 1 Hz, the rate increasing linearly with decreasing angle of attack/increasing air speed.	
Correct	Correct	900 Hz steady tone.	
Safe high	Safe low	900 Hz steady tone, plus 400 Hz tone interrupted at a rate of zero to 1 Hz, the rate increasing linearly with increasing angle of attack/decreasing air speed.	
High	Slow	400 Hz tone interrupted at a rate of 1 Hz to 10 Hz, the rate increasing linearly with increasing angle of attack/decreasing air speed (stall warning).	

FIGURE 9. F. 1 NON-VERBAL WARNING SIGNALS

SYMBOL/NOTATION	LEGEND
AC	Alternating Current
DC	Direct Current
Ext Power	External Power
Marker Beacon	Marker Beacon
Radar	Radar
Trimmed for Take Off	T/O Trim

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FIGURE 9.H.3 LEGEND FOR ADVISORY SIGNALS



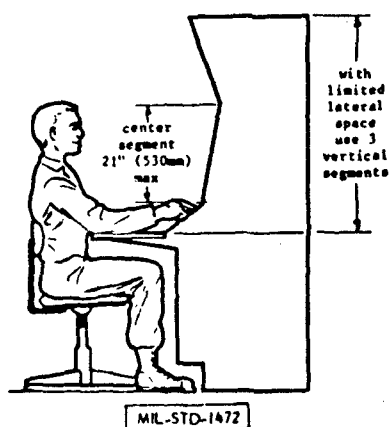
TYPE OF CONSOLE	TOTAL CONSOLE HEIGHT (INCHES)	VERT (INCHES)
1. SIT (W/ VISION OVER TOP)	47.5 in (1210 mm)	2
2. SIT (W/ VISION OVER TOP)	54.0 in (1370 mm)	2
3. SIT (W/ VISION OVER TOP)	61.5 in (1560 mm)	2
4. STAND (W/ VISION OVER TOP)	62.0 in (1570 mm)	2
5. STAND (W/ VISION OVER TOP)	72 in (1830 mm)	2

*THE RANGE IN "A" IS PROVIDED TO ALLOW LATITUDE
RELATIONSHIP TO "C" AND "D".

KEY	DIMENSIONS	IN	MM
A	MAXIMUM TOTAL CONSOLE HEIGHT FROM STANDING SURFACE	SEE TABLE	SEE TABLE
B	SUGGESTED VERTICAL DIMENSION OF PANEL IN J. SILL	16	(400)
C	WRITING SURFACE SHELF HEIGHT FROM STANDING SURFACE	18	(450)
D	SEAT HEIGHT FROM STANDING SURFACE AT MIDPOINT OF "G"	6	(150)
E	MINIMUM KNEE CLEARANCE	7.5	(190)
F	FOOT SUPPORT TO SITTING SURFACE**	16	(400)
G	SEAT ADJUSTABILITY	4	(100)
H	MINIMUM THIGH CLEARANCE AT MIDPOINT OF "G"	16	(400)
I	WRITING SURFACE DEPTH INCLUDING SHELF	4	(100)
J	MINIMUM SHELF DEPTH	16	(400)
K	EYE LINE TO CONSOLE FRONT DISTANCE	16	(400)

NOTE: A SHELF THICKNESS OF 1 in. (25 mm) IS ASSUMED. FOR OTHER SHELF THICKNESSES,
SUITABLE ADJUSTMENTS SHOULD BE MADE.

NOT APPLICABLE
TO CHAIRS

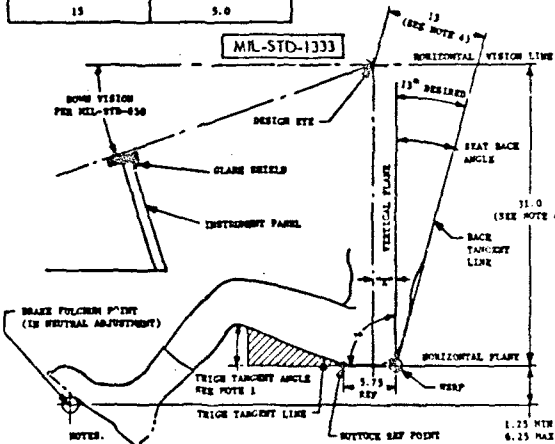
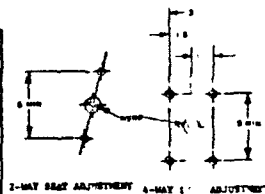


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FIGURE 10.B.3 EXAMPLE OF
VERTICAL/STACKED SEGMENTS

DISTANCE FROM DESIGN EYE POSITION TO VERTICAL PLANE OF
CENTRAL SEAT REFERENCE POINT FOR VARIOUS SEAT
BACK ANGLES

SEAT BACK ANGLE (DEGREES)	"X" (INCHES)
10	7.7
11	7.4
12	7.1
13	6.8
14	6.5
15	6.2
16	5.9
17	5.6
18	5.3
19	5.0



1. TRIG TANGENT ANGLE SHALL BE A MINIMUM OF 3° AND A MAXIMUM OF 10°. FOR HELICOPTERS, THE MINIMUM OF 10° SHALL APPLY.
2. THE SEAT ADJUSTMENTS SHOWN ARE FOR THE 5TH THROUGH 95TH PERCENTILE PILOT POPULATION.
3. THE VERTICAL DIMENSION RANGE FROM SEAT TO INSTRUMENT PANEL DOES NOT INCLUDE VERTICAL SEAT ADJUSTMENT DIMENSIONS.
4. DIMENSIONS BASED ON 11° SEAT BACK ANGLE.

FIGURE 10.B.4 AIRCREW SEATING GEOMETRY

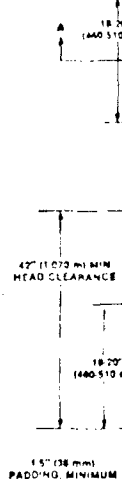
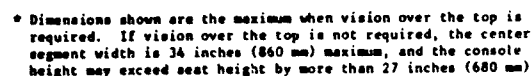


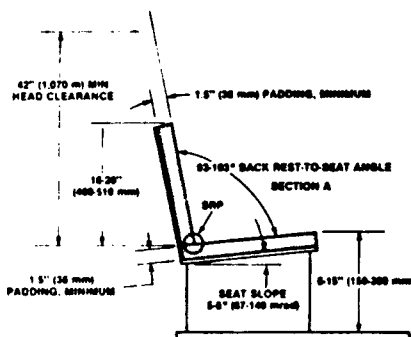
FIGURE 10.B.5

IS PROVIDED TO ALLOW LATITUDE IN THE VOLUME OF THE LOWER PART OF THE CONSOLE; NOTE "C" AND "D".



ICKNESSES

*NOT APPLICABLE TO CONSOLE TYPES 4 AND 5 OF TABLE.
**SINCE THIS DIMENSION MUST NOT BE EXCEEDED, A HEEL CATCH MUST BE ADDED TO THE CHAIR IF "D" EXCEEDS 18 in. (460 mm).



- 1 WEIGHT - CLOTHES (KILOGRAMS)
- 2 STATURE - CLOTHES
- 3 FUNCTIONAL REACH
- 4 FUNCTIONAL REACH, EXTENDED
- 5 OVERHEAD REACH HEIGHT
- 6 OVERHEAD REACH BREADTH
- 7 GENT TORSO HEIGHT
- 8 GENT TORSO BREADTH
- 9 OVERHEAD REACH, SITTING
- 10 FUNCTIONAL LEG LENGTH
- 11 KNEELING HEIGHT
- 12 KNEELING LEG LENGTH
- 13 MENT KNEE HEIGHT, SUPINE
- 14 HORIZONTAL LENGTH, KNEES BENT

- 1 WEIGHT - CLOTHES (POUNDS)
- 2 STATURE - CLOTHES
- 3 FUNCTIONAL REACH
- 4 FUNCTIONAL REACH, EXTENDED
- 5 OVERHEAD REACH HEIGHT
- 6 OVERHEAD REACH BREADTH
- 7 BENT TORSO HEIGHT
- 8 BENT TORSO BREADTH
- 9 OVERHEAD REACH SITTING
- 10 FUNCTIONAL LEG LENGTH
- 11 KNEELING HEIGHT
- 12 KNEELING LEG LENGTH
- 13 BENT KNEE HEIGHT SUPINE
- 14 HORIZONTAL LENGTH, KNEES BENT



PERCENTILE VALUES IN CENTIMETERS			
50th PERCENTILE		85th PERCENTILE	
MALE	WOMEN	MALE	WOMEN
50.0	46.0	89.2	74.8
100.0	118.0	100.0	170.7
72.0	65.0	94.0	79.0
50.0	72.5	107.2	90.0
300.0	400.0	300.0	274.1
35.2	39.0	41.0	37.0
1100.0	1107.0	1100.0	1100.0
127.0	117.0	140.0	130.0
210.0	210.0	277.7	250.0
121.0	114.0	100.0	100.0
60.0	50.0	70.0	70.0
40.0	40.0	40.0	40.0
100.0	100.0	177.0	105.0

PERCENTILE VALUES IN INCHES			
50th PERCENTILE		85th PERCENTILE	
MALE	WOMEN	MALE	WOMEN
100.1	107.0	100.0	100.0
91.0	74.0	74.0	70.0
30.0	30.0	30.0	31.1
30.0	30.0	30.0	30.0
70.0	70.0	80.0	80.7
12.0	12.0	10.0	10.0
40.0	40.0	50.0	50.0
10.1	10.0	10.0	10.1
40.0	40.0	50.0	50.0
40.0	40.0	50.0	50.0
30.0	30.0	30.0	30.0
17.0	10.0	21.1	10.0
50.0	50.0	50.1	50.0

	DIMENSIONS (mm)		
	MINIMUM	PREFERRED	ARCTIC CLOTHED
A. TWO MEN PASSING ABREAST	1.80m	1.37m	1.53
B. TWO MEN PASSING FACING	700	610	610
CATWALK DIMENSIONS			
C. HEIGHT	1.80m	1.80m	1.81m
D. SHOULDER WIDTH	600	610	610
E. WALKING WIDTH	300	300	300
F. VERTICAL ENTRY MATCH			
SQUARE	600	600	610
ROUND	600	610	—
G. HORIZONTAL ENTRY MATCH			
1. SHOULDER WIDTH	636	610	610
2. HEIGHT	300	610	610
H. CRAWL THROUGH PIPE			
ROUND OR SQUARE	636	700	610
SUPINE WORK SPACE			
I. HEIGHT	610	610	600
J. LENGTH	1.80m	1.81m	1.90
SQUATTING WORK SPACE			
K. HEIGHT	1.20m	—	1.20m
L. WIDTH	600	610	—
OPTIMUM DISPLAY AREA	600	1.00m	—
OPTIMUM CONTROL AREA	485	600	—
STOOPING WORK SPACE			
M. WIDTH	600	1.00m	1.12m
OPTIMUM DISPLAY AREA	610	1.22m	—
OPTIMUM CONTROL AREA	610	600	—
KNEELING WORK SPACE			
N. WIDTH	1.00m	1.22m	1.27m
O. HEIGHT	1.42m	—	1.60m
P. OPTIMUM WORK POINT	—	600	—
OPTIMUM DISPLAY AREA	610	600	—
OPTIMUM CONTROL AREA	610	600	—
KNEELING CRAWL SPACE			
Q. HEIGHT	700	610	600
R. LENGTH	1.50m	—	1.70m
PRONE WORK OR CRAWL SPACE			
S. HEIGHT	430	610	610
T. LENGTH	2.00m	—	—

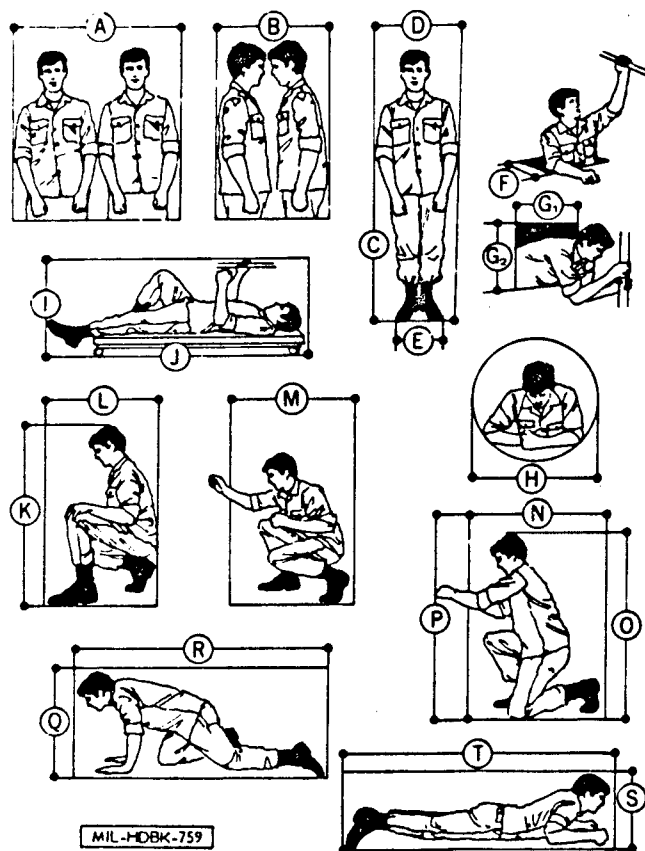


FIGURE 10.D.2 MOBILE WORKSPACE DIMENSIONS

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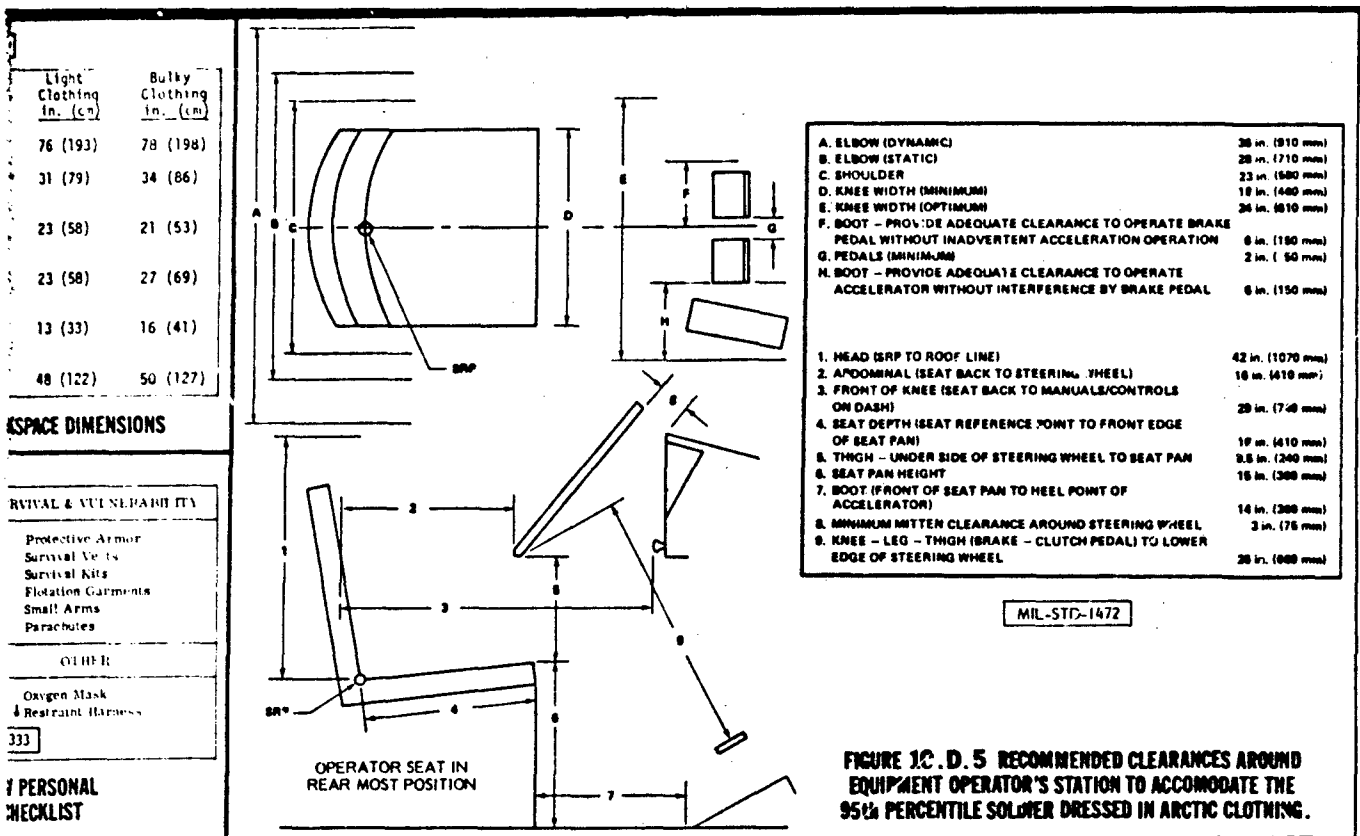
	Light Clothing In. (cm)	Bulky Clothing In. (cm)
Minimum height allowance for standing	76 (193)	78 (198)
Minimum height allowance for crawling	31 (79)	34 (86)
Maximum depth of objects which must be reached into	23 (58)	21 (53)
Minimum width allowance for passing body	23 (58)	27 (69)
Minimum thickness allowance for passing body	13 (33)	16 (41)
Minimum height allowance for bending or kneeling	48 (122)	50 (127)

FIGURE 10.D.3 AIRCREW WORKSPACE DIMENSIONS

PROTECTIVE GARMENTS	FOOTWEAR	SURVIVAL & VULNERABILITY
Anti-Exposure Anti-G Cold Weather Pressure Ventilation Flight Suit	Shoes Flight Boots Survival Boots Cold Weather	Protective Armor Survival Vests Survival Kits Flotation Garments Small Arms Parachutes
HEADGEAR	HANDWEAR	OTHER
Protective Pressure Windblast Anti-Radiation	Lightweight Cold Weather	Oxygen Mask Restraint Harness

FIGURE 10.D.4 AIRCREW PERSONAL & SURVIVAL EQUIPMENT CHECKLIST

WORK AREA OR TYPE OF TASK	ILLUMINATION LEVELS	
	MIL-STD-1472	FOOTCANDLES* (LUX)
	RECOMMENDED	MINIMUM
Assembly, missile components	100 (1075)	50 (540)
Assembly, general		
coarse	50 (540)	30 (325)
medium	75 (810)	50 (540)
fine	100 (1075)	75 (810)
precision	200 (2150)	200 (2150)
Bench work		
rough	50 (540)	30 (325)
medium	75 (810)	50 (540)
fine	100 (1075)	75 (810)
extra fine	200 (2150)	200 (2150)
Business machine operation (calculator, digital, input, etc.)	100 (1075)	50 (540)
Console surface	50 (540)	30 (325)
Corridors	20 (215)	10 (110)
Circuit diagram	100 (1075)	50 (540)
Dials	50 (540)	30 (325)
Electrical equipment testing	50 (540)	30 (325)
Emergency lighting		3 (30)
Gages	50 (540)	30 (325)
Hallways	20 (215)	10 (110)



FOOT CANDLES* (LUX)	WORK AREA OR TYPE OF TASK		FOOT CANDLES* (LUX)		WORK AREA OR TYPE OF TASK	FOOT CANDLES* (LUX)		
	RECOMMENDED	MINIMUM	RECOMMENDED	MINIMUM		RECOMMENDED	MINIMUM	
100 (1075)	50 (540)	30 (325)	Inspection tasks, general:		Scales	50 (540)	30 (325)	
			rough	50 (540)				30 (325)
			medium	100 (1075)				50 (540)
			fine	200 (2155)				100 (1075)
			extra fine	200 (2155)	200 (2155)			
50 (540)	30 (325)	15 (810)	Machine operation, automatic		Service areas, general	20 (215)	10 (110)	
			75 (810)	50 (540)				
			100 (1075)	75 (810)				
			200 (2155)	200 (2155)				
50 (540)	30 (325)	15 (810)	Motors		Stairways	20 (215)	10 (110)	
			75 (810)	50 (540)				
			100 (1075)	75 (810)				
			200 (2155)	200 (2155)				
50 (540)	30 (325)	15 (810)	Machines:		Storage:	5 (55)	3 (30)	
			repair and servicing	100 (1075)				50 (540)
			storage areas	20 (215)				10 (110)
			general inspection	50 (540)				30 (325)
100 (1075)	50 (540)	30 (325)	Office work, general		live, rough or bulk	10 (110)	5 (55)	
			75 (810)	50 (540)				
			150 (1615)	100 (1075)				
			200 (2155)	200 (2155)				
100 (1075)	50 (540)	30 (325)	Ordinary sewing tasks		live, medium	30 (325)	20 (215)	
			75 (810)	50 (540)				
			150 (1615)	100 (1075)				
			200 (2155)	200 (2155)				
50 (540)	30 (325)	15 (810)	Panels:		Switchboards	50 (540)	30 (325)	
			front	50 (540)				30 (325)
			rear	20 (215)				10 (110)
20 (215)	10 (110)	5 (55)	Passageways		Tanks, rustproof	20 (215)	10 (110)	
			75 (810)	50 (540)				
			150 (1615)	100 (1075)				
			200 (2155)	200 (2155)				
50 (540)	30 (325)	15 (810)	Reading:		Testing:	50 (540)	30 (325)	
			large print	20 (215)				10 (110)
			newspaper	50 (540)				30 (325)
			handwritten reports, in pencil	70 (755)				50 (540)
50 (540)	30 (325)	15 (810)	small type		extra fine	200 (2155)	100 (1075)	
			prolonged reading	70 (755)				50 (540)
20 (215)	10 (110)	5 (55)	Recording		Transcribing and tabulation	100 (1075)	50 (540)	
			75 (810)	50 (540)				
			150 (1615)	100 (1075)				
			200 (2155)	200 (2155)				
50 (540)	30 (325)	15 (810)	Report work:		NOTE: Some unusual inspection tasks may require up to 1,000 ft-c (10,000 lux)			
			general	50 (540)				30 (325)
			instrument	200 (2155)				100 (1075)

*As measured at the task object or 30 inches (760mm) above the floor.

FIGURE 10.E.1 SPECIFIC TASK ILLUMINATION REQUIREMENTS

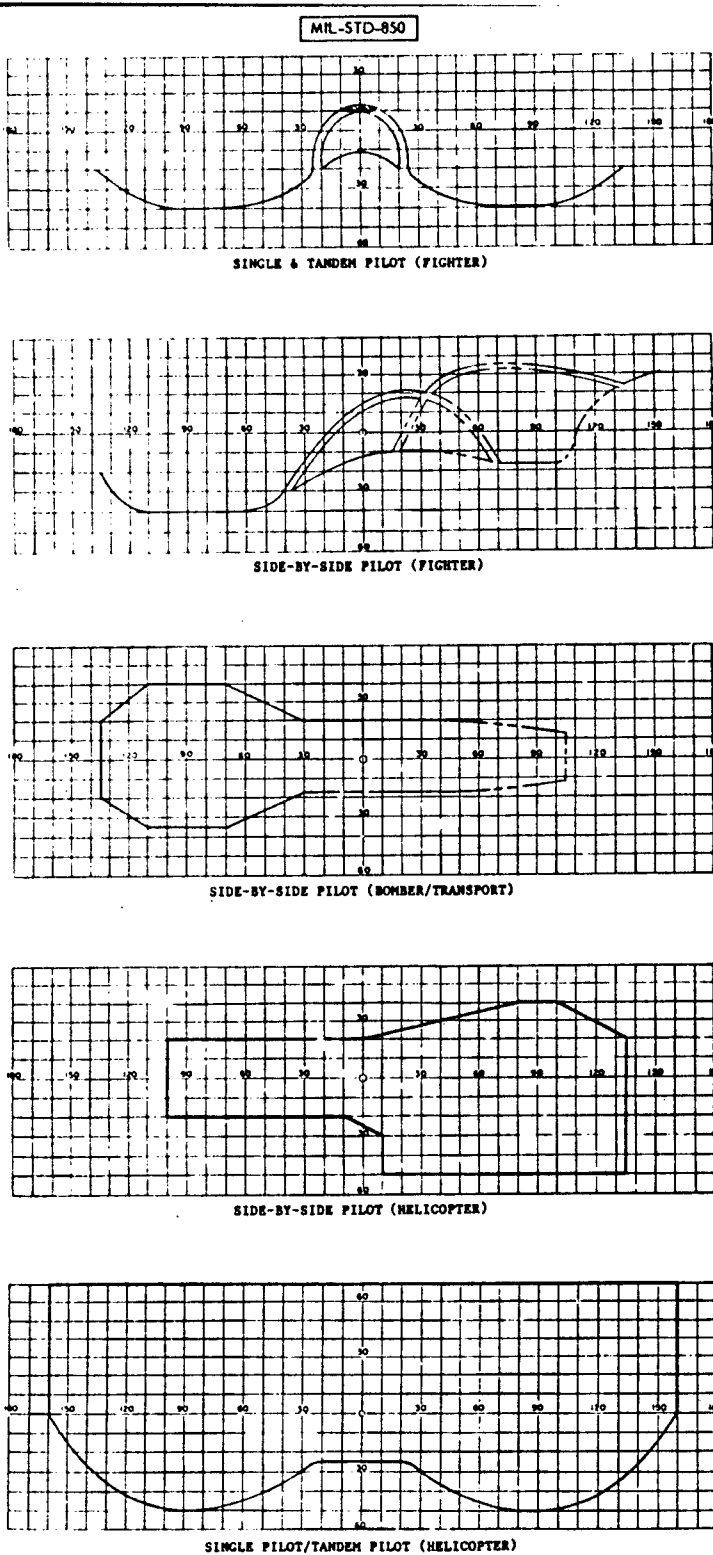


FIGURE 10 E 2 PILOT VISION PLOTS

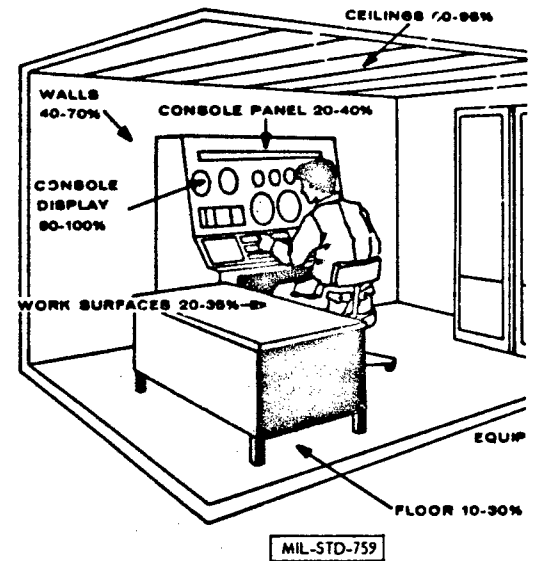


FIGURE 10.E.3 WORKSPACE REFLECTANCE VALUE

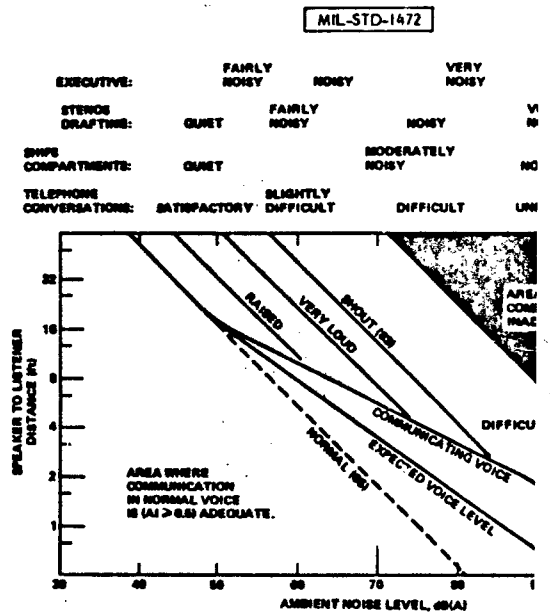
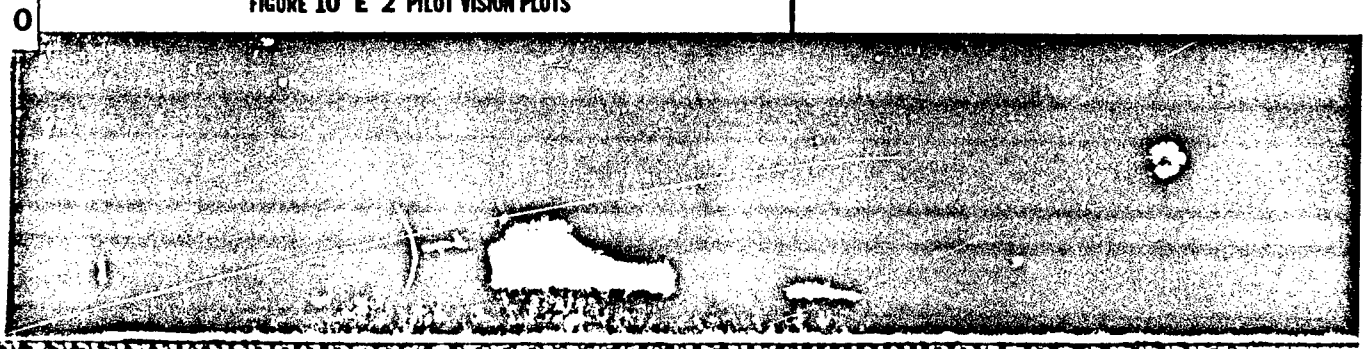
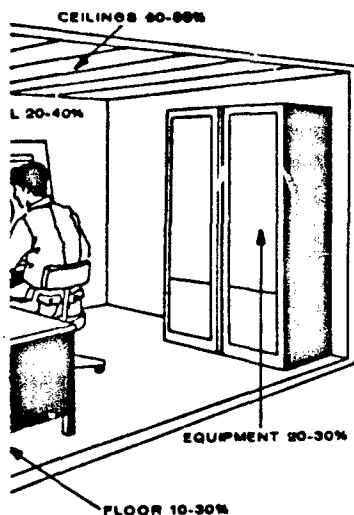


FIGURE 10.F.2 PERMISSIBLE DISTANCE BETWEEN A SPEAKER SPECIFIED VOICE LEVELS AND AMBIENT NOISE L





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SPACE REFLECTANCE VALUES

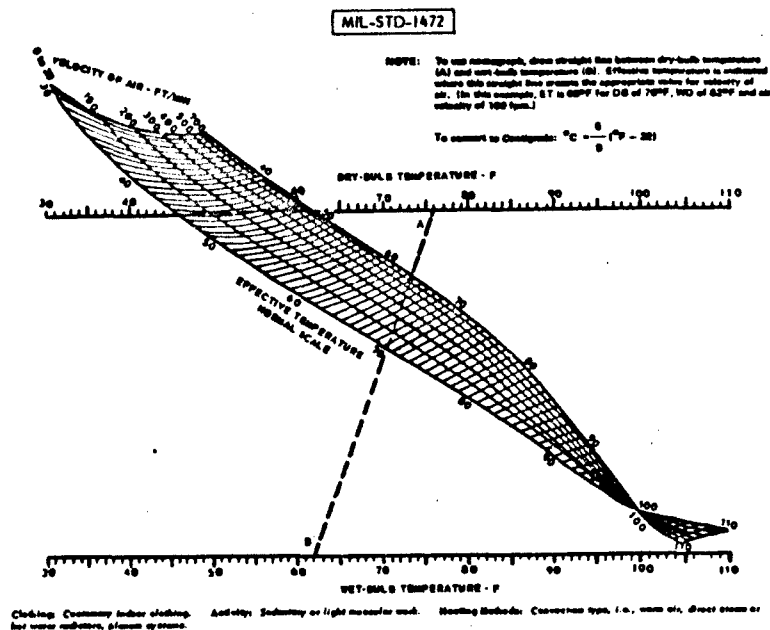
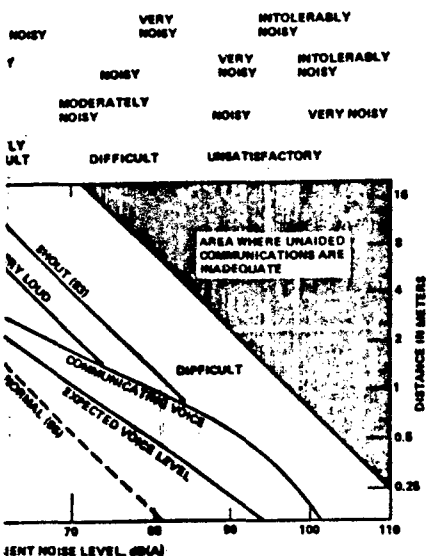


FIGURE 10.F.1 EFFECTIVE TEMPERATURE

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STANCE BETWEEN A SPEAKER AND LISTENERS FOR LEVELS AND AMBIENT NOISE LEVELS

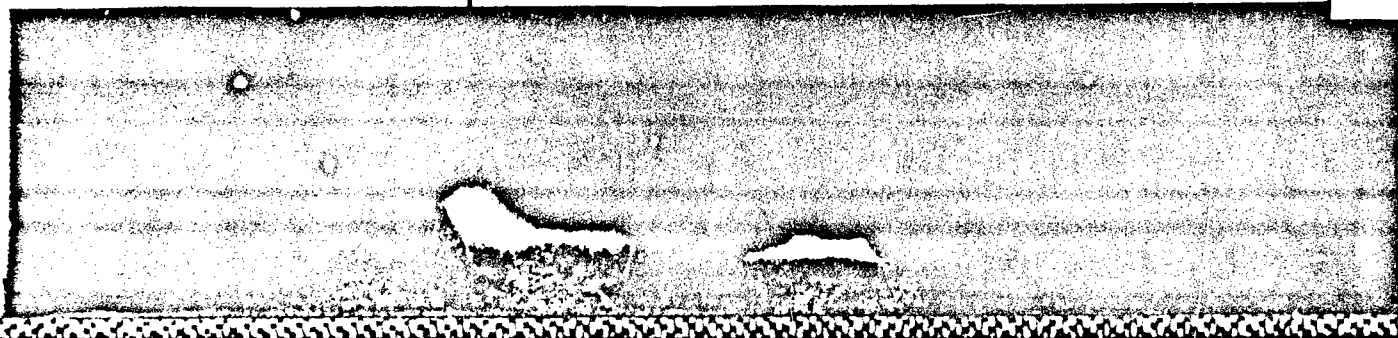
SYSTEM REQUIREMENT	CATEGORY
NO DIRECT PERSON-TO-PERSON VOICE COMMUNICATION REQUIRED. MAXIMUM DESIGN LIMIT. HEARING PROTECTION REQUIRED.	A
SYSTEM REQUIREMENT FOR ELECTRICALLY AIDED COMMUNICATION VIA ATTENUATING HELMET OR HEADSET. NOISE LEVELS ARE HAZARDOUS TO UNPROTECTED EARS.	B
NO FREQUENT DIRECT PERSON-TO-PERSON VOICE COMMUNICATION REQUIRED. OCCASIONAL SHOUTED COMMUNICATION MAY BE POSSIBLE AT A DISTANCE OF ONE FOOT. HEARING PROTECTION REQUIRED.	C
NO FREQUENT DIRECT PERSON-TO-PERSON VOICE COMMUNICATION REQUIRED. OCCASIONAL SHOUTED COMMUNICATION MAY BE POSSIBLE AT A DISTANCE OF TWO FEET. (LEVELS IN EXCESS OF CATEGORY D REQUIRE HEARING PROTECTION.)	D
OCCASIONAL TELEPHONE USE OR OCCASIONAL DIRECT COMMUNICATION AT DISTANCES UP TO FIVE FEET REQUIRED. (EQUIVALENT TO NC-70.)	E*
FREQUENT TELEPHONE USE OR FREQUENT DIRECT COMMUNICATION AT DISTANCES UP TO FIVE FEET REQUIRED. (EQUIVALENT TO NC-60)	F*

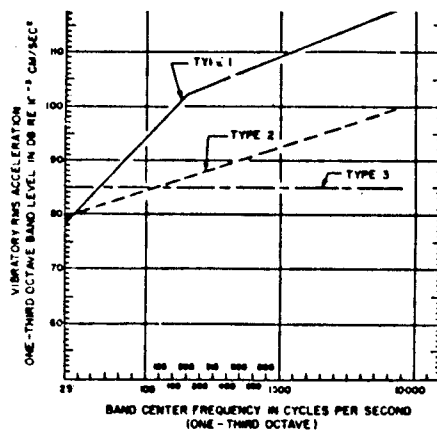
* FOR DESIGN OF MOBILE OR TRANSPORTABLE SYSTEMS. FOR FIXED-PLANT FACILITIES, SEE M'L-STD-1472.

(NOTE: CATEGORIES A, B, C, AND D ARE BASED PRIMARILY ON HEARING CONSERVATION PRIORITIES, WHILE THE REMAINING CATEGORIES ARE BASED PRIMARILY ON COMMUNICATION REQUIREMENTS.)

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FIGURE 10.F.3 STEADY-STATE NOISE LIMITS FOR CATAGORIES OF PERSONNEL OCCUPIED AREAS





CORRECTION FACTORS

FOR FUNDAMENTAL FREQUENCIES BELOW 250 Hz, EXTRAPOLATE TO THE REQUIRED LEVEL.

FOR TYPE 2 NON-SEA CONNECTED PUMP, ADD 500 TO THE STATED ACCEPTANCE CRITERIA.

FOR SOLIDLY MOUNTED EQUIPMENT, SUBTRACT 2000 FROM THE CURVES.

LIFE SUPPORT EQUIPMENT (I.E. OXYGEN GENERATOR, CO₂ SCRUBBER, H₂-CO BURNER AND DISTILLING UNITS), SUBTRACT 2000 FROM TYPE 3.

FOR VIBRAAL PANS, SHALL BE AT THE FOLLOWING ACCEPTANCE CRITERIA:
FOR LESS THAN 2HP SUBTRACT 25DB FROM TYPE 3
FOR 2HP UP TO 10HP SUBTRACT 15DB FROM TYPE 3
ABOVE 10HP SUBTRACT 5DB FROM TYPE 3

Type 1 equipment. - All compressors and internal combustion engines

Type 2 equipment. - All pumps

Type 3 equipment. - All other equipment

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FIGURE 10.F.4 SHIP STRUCTUREBORNE NOISE ACCEPTANCE LEVELS

Airborne Noise Category	Center frequencies of standard octave bands (c.p.s.)									SIL value
	32	63	125	250	500	1000	2000	4000	8000	
A	115	110	105	100	SIL value requirement 85	85	85	85	85	64
B	90	86	79	76	73	71	70	69	68	--
C	85	78	72	68	65	62	60	58	57	--
D	115	110	105	100	90	85	85	85	85	--
E	115	110	105	100	SIL value requirement 85	85	85	85	85	72
F	115	110	105	100	SIL value requirement 85	85	85	85	85	63

Airborne Noise Categories

Category A: Spaces, other than Category E spaces, where intelligible speech communication is necessary.

Category B: Spaces where comfort of personnel in their quarters is normally considered to be an important factor.

Category C: Spaces where it is essential to maintain especially quiet conditions.

Category D: Spaces or areas where a higher noise level is expected and where deafness avoidance is a greater consideration than intelligible speech communication.

Category E: High noise level areas where intelligible speech communication is necessary.

Category F: Topside operating stations on weather decks where intelligible speech communication is necessary.

Speech Interference Level (SIL)

Measure of the effect of airborne background noise on intelligible speech communication. Numerically, it is the arithmetical average of the sound pressure level, in decibels, in the octave bands with center frequencies of 500, 1000, and 2000 c.p.s.

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FIGURE 10.F.7 AIRBORNE NOISE LEVELS FOR SHIP COMPARTMENTS (IN DECIBELS)

type	DEFINITION	examples
General Workspaces	Areas requiring occasional telephone use or occasional direct communications at distances up to five feet. (1.520 m).	Maintenance shops and shelters, garages, ke punch areas, shipboard engineering areas.
Operational Areas	Areas requiring frequent telephone use or frequent direct communication at distances up to five feet. (1.520 m).	Operation centers, mobile command and communication shelters, combat information centers, computer room word processing centers.
Large Workspaces	Areas requiring no difficulty with telephone use or requiring occasional direct communication at distances up to five feet. (4.570 m).	Drafting rooms, shop offices, laboratories.
Small Office Spaces/Special Areas	Areas requiring no difficulty with direct communication.	Conference rooms, libraries, offices, command and control centers.
Extreme Quiet Areas	Areas requiring unusually extreme quiet.	Recording studios.

dB(A) - The A-weight network of a sound meter.

PSIL-4 - The arithmetic mean of sound pressure levels in the four frequencies of 500, 1000, 2000, and 4000 Hz.

PSIL - The arithmetic means of sound pressure levels in the center frequencies of 500, 1000 and 2000 Hz.

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FIGURE 10.F.5 NON-HAZARDOUS WORKSPACE I

MAXIMUM ACCEPTABLE NOISE LEVEL IN AIRCRAFT CONTINUOUS POWER

PREFERRED			Max. acceptable noise level (db)	Frequency band (cps)
Frequency (cps)				
Band	Center			
Overall		113	Overall	
22.4 - 45	31.5	111		
45 - 90	63	111	37.5 - 71	
90 - 180	125	111	75 - 154	
180 - 355	250	111	150 - 304	
355 - 710	500	105	300 - 604	
710 - 1400	1000	99	600 - 1204	
1400 - 2800	2000	93	1200 - 2404	
2800 - 5600	4000	87	2400 - 4804	
5600 - 11200	8000	87	4800 - 9604	

MAXIMUM ACCEPTABLE NOISE LEVEL IN AIRCRAFT UNDER CONDITIONS (LESS THAN 5 MINUTES)

PREFERRED			Max. acceptable noise level (db)	Frequency band (cps)
Frequency (cps)				
Band	Center			
Overall		120	Overall	
22.4 - 45	31.5	118		
45 - 90	63	118	37.5 - 71	
90 - 180	125	118	75 - 154	
180 - 355	250	118	150 - 304	
355 - 710	500	112	300 - 604	
710 - 1400	1000	106	600 - 1204	
1400 - 2800	2000	100	1200 - 2404	
2800 - 5600	4000	94	2400 - 4804	
5600 - 11200	8000	94	4800 - 9604	

Occasional noise at five feet.	Maintenance shops and shelters, garages, key punch areas, shipboard engineering areas	75dB	67dB	68dB
Frequent noise at five feet.	Operation centers, mobile command and com- munication shelters, combat information centers, computer rooms, word processing centers.	65dB	57dB	58dB
Diffi- culty use noise at five feet.	Drafting rooms, shop offices, laboratories	55dB	47dB	48dB
Diffi- culty com- munication	Conference rooms, libraries, offices, command and control centers.	45dB	37dB	48dB
Usually	Recording studios	35dB	27dB	28dB

a sound meter.

und pressure levels in the four octave bands with center
2000, and 4000 Hz.

sound pressure levels in the three octave bands with
1000 and 2000 Hz.

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NON-HAZARDOUS WORKSPACE NOISE

Airborne grade	Sound power levels, ref. 10 ⁻¹² watts per center frequency of standard octave bands Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
A					Numerical average of 500, 1000 and 2000 Hz bands - 71 db				
B	97	91	86	82	79	78	77	76	75
C	92	84	79	74	71	68	67	65	64
D	122	117	113	107	97	92	92	92	92

Grade A equipment. - Grade A equipment is any item of equipment which will be placed in spaces
where intelligible speech communication is frequently required and minimum vocal effort by the speaker is a
consideration.

Grade B equipment. - Grade B equipment is any item of equipment which will be placed in spaces
where comfort of personnel in their quarters is the principle consideration.

Grade C equipment. - Grade C equipment is any item of equipment which will be placed in spaces
where function requires minimum annoyance to working personnel.

Grade D equipment. - Grade D equipment is any item of equipment which will be placed in spaces
where distress avoidance is the prime consideration and intelligible speech communication is not normally
required.

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FIGURE 10.F.6 AIRBORNE NOISE ACCEPTANCE LEVELS
FOR SHIP EQUIPMENT (IN DECIBELS)

ACCEPTABLE NOISE LEVEL IN AIRCRAFT AT MAXIMUM CONTINUOUS POWER

FD	MAXIMUM		
	Max. accept- able noise level (db)	Frequency bands (cps)	Max. accept- able noise level (db)
5	113	Overall	113
	111		
	111	37.5 - 75	111
	111	75 - 150	111
	111	150 - 300	111
	105	300 - 600	105
	99	600 - 1200	99
	93	1200 - 2400	93
	87	2400 - 4800	87
	87	4800 - 9600	87

MAXIMUM ACCEPTABLE NOISE LEVEL WITH PROTECTIVE HELMETS OR DEVICES

PREFERRED				MAXIMUM	
Frequency (cps)		Max. accept- able noise level (db)		Frequency bands (cps)	Max. accept- able noise level (db)
Band	Center				
Overall		106		Overall	106
22.4 - 45	31.5	104		37.5 - 75	104
45 - 90	63	104		75 - 150	104
90 - 180	125	104		150 - 300	104
180 - 355	250	104		300 - 600	96
355 - 710	500	96		600 - 1200	90
710 - 1400	1000	90		1200 - 2400	86
1400 - 2800	2000	86		2400 - 4800	75
2800 - 5600	4000	75		4800 - 9600	75
5600 - 11200	8000	75			

MAXIMUM ACCEPTABLE NOISE LEVEL IN AIRCRAFT UNDER SHORT DURATION CONDITIONS (LESS THAN 5 MINUTES)

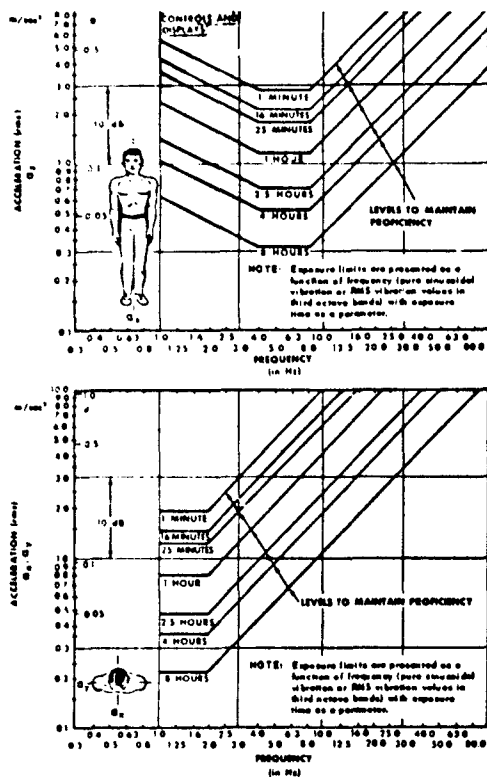
FD	MAXIMUM		
	Max. accept- able noise level (db)	Frequency bands (cps)	Max. accept- able noise level (db)
5	120	Overall	120
	118		
	118	37.5 - 75	118
	118	75 - 150	118
	118	150 - 300	118
	112	300 - 600	112
	106	600 - 1200	106
	100	1200 - 2400	100
	94	2400 - 4800	94
	94	4800 - 9600	94

MAXIMUM ACCEPTABLE NOISE LEVEL AT NORMAL CRUISE POWER

PREFERRED				MAXIMUM	
Frequency (cps)		Max. accept- able noise level (db)		Frequency bands (cps)	Max. accept- able noise level (db)
Band	Center				
Overall		113		Overall	113
22.4 - 45	31.5	111		37.5 - 75	111
45 - 90	63	111		75 - 150	111
90 - 180	125	111		150 - 300	111
180 - 355	250	111		300 - 600	106
355 - 710	500	106		600 - 1200	106
710 - 1400	1000	106		1200 - 2400	100
1400 - 2800	2000	100		2400 - 4800	94
2800 - 5600	4000	94		4800 - 9600	94
5600 - 11200	8000	94			

MIL-A-8806

FIGURE 10.F.8 AIRCRAFT NOISE LEVELS



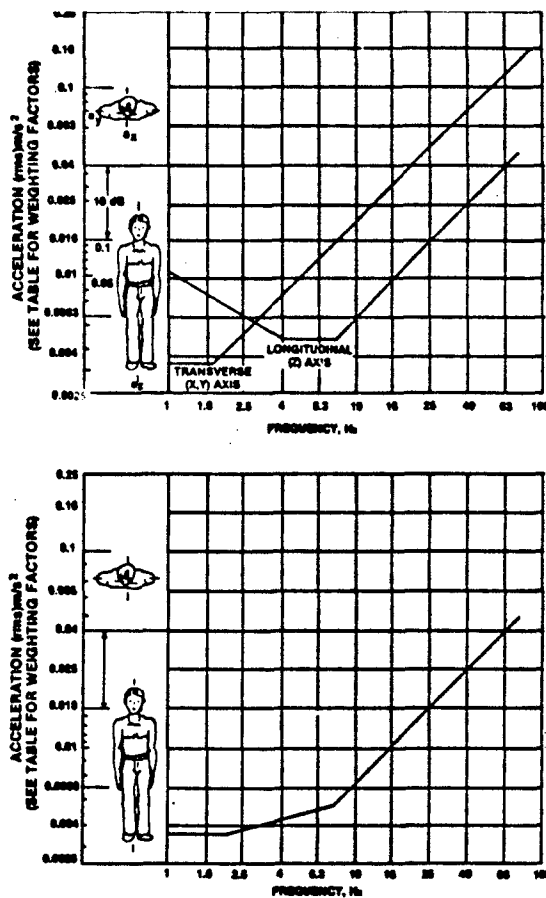
If comfort is to be maintained, these acceleration values are divided by 3.15.
To protect human health, whole body vibration does not exceed twice (6 dB) the acceleration values shown for the time and frequencies indicated.

FIGURE 10.F.9 VIBRATION EXPOSURE CRITERIA FOR LONGITUDINAL (UPPER CURVE) AND TRANSVERSE (LOWER CURVE) DIRECTIONS WITH RESPECT TO BODY AXIS

Impulse noise levels. The impulse noise levels associated with the operation of the escape system, and measured at the ears of a 50th percentile aircrewman seated with his eyes at the design eye position in each aircrew station, shall not exceed the damage risk criterion proposed in the Report of Working Group 87, National Academy of Sciences - National Research Council, Council Committee on Hearing Bioacoustics, and Biomechanics (CHABA), July 1968, for impulse noise of B-duration type. Since the probable maximum exposure of any aircrewman to repeated-impulse noise is limited to a minimal number of impulses occurring during the operation of the escape system, the damage risk criterion may be corrected to permit an additional 10dB. If all crewmen will be equipped with APH-6 or APH-6 helmet with Gentax Sonic ear cups for ear protection deemed by the G. verment procuring activity to be equivalent, an additional correction may be made to the damage risk criterion to permit an increase of 20dB.

MIL-S-18471

FIGURE 10.F.10 EJECTION SYSTEM IMPULSE NOISE LEVELS



PLACE	TIME	CONTINUOUS OR INTERMITTENT VIBRATION AND REPEATED IMPULSIVE SHOCK	IMPULSIVE SHOCK EXCITATION WITH APPROXIMATELY THREE OCCURRENCES/DAY
HOSPITAL OPERATING THEATRE AND CRITICAL WORKING AREAS	DAY NIGHT	1 1	1 1
RESIDENTIAL (MINIMUM COMPLAINT LEVEL)	DAY NIGHT	2 1.4	18 7.4
OFFICE	DAY NIGHT	4 4	120 120
WORKSHOP	DAY NIGHT	5 3	120 120

WEIGHTING FACTORS FOR ACCEPTABLE BUILDING VIBRATION WITH RESPECT TO HUMAN RESPONSE

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FIGURE 10.F.11 BUILDING VIBRATION EXPOSURE CRITERIA FOR LONGITUDINAL AND TRANSVERSE (UPPER CURVE) AND COMBINED (LOWER CURVE) DIRECTIONS WITH RESPECT TO BODY AXIS. WEIGHTING FACTORS FOR ACCEPTABLE BUILDING VIBRATION WITH RESPECT TO HUMAN RESPONSE

* A SIN NON IMPUL REPE IMPUL
** HIGH OTHE

PEAK PRESSURE LEVEL
(dB re 20 µPa)

FIGURE 10.G

MEASURED DISTANCE (METERS)

1-1/4
2
3
4
6
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

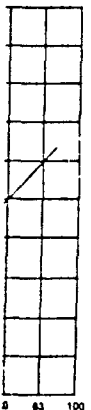
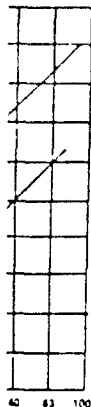
FIGURE 10.G

Dur.

These values of whether exposure is considered following

exceeds un threshold specified permitted

FIGURE 10.H



	PROTECTION	OR MUFFS	AND MUFFS
1000	W	X	Y
100	W	Y	Z
5	W	Z	Z**

* A SINGLE EXPOSURE CONSISTS OF EITHER (a) A SINGLE PULSE FOR NON-REPETITIVE SYSTEMS (SYSTEMS PRODUCING LESS THAN ONE IMPULSE PER SECOND), OR (b) A REPEITIVE SYSTEM (SYSTEM PRODUCING MORE THAN ONE IMPULSE PER SECOND), e.g., AUTOMATIC WEAPON.

** HIGHER LEVELS THAN CURVE Z NOT PERMITTED DUE TO POSSIBILITY OF OTHER NON-AUDITORY PHYSIOLOGICAL INJURY

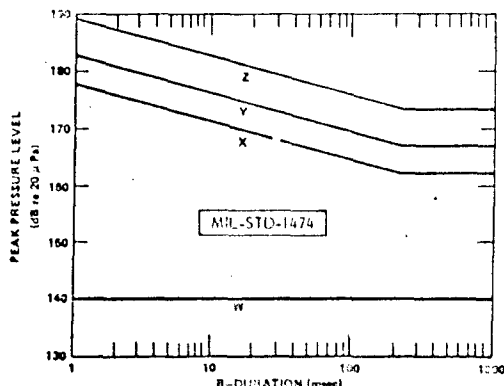


FIGURE 10.G.1 PEAK PRESSURE LEVEL AND B-DURATION LIMITS FOR IMPULSE NOISE

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MEASUREMENT DISTANCE (METERS)	CENTER FREQUENCY (Hz)								NOMINAL HORN-TO-EAR STABILITY (DISTANCE METERS)
	63	125	250	500	1K	2K	4K	8K	
1 1/4	48	34	32	32	32	32	32	32	5
2	50	36	34	34	34	34	34	34	10
3	52	38	36	36	36	36	36	36	15
4	54	40	38	38	38	38	38	38	20
6	58	44	40	40	40	40	40	40	30
10	62	48	44	44	44	44	44	44	50
15	66	52	48	48	48	48	48	48	75
20	68	54	50	50	50	50	50	50	100
25	70	56	52	52	52	52	52	52	125
30	72	58	54	54	54	54	54	54	150
35	74	60	56	56	56	56	56	56	175
40	76	62	58	58	58	58	58	58	200
45	78	64	60	60	60	60	60	60	225
50	80	66	62	62	62	62	62	62	250
55	82	68	64	64	64	64	64	64	275
60	84	70	66	66	66	66	66	66	300
65	86	72	68	68	68	68	68	68	325
70	88	74	70	70	70	70	70	70	350
75	90	76	72	72	72	72	72	72	375
80	92	78	74	74	74	74	74	74	400
85	94	80	76	76	76	76	76	76	425
90	96	82	78	78	78	78	78	78	450
95	98	84	80	80	80	80	80	80	475
100	100	86	82	82	82	82	82	82	500

* SLANT RANGE FROM NOISE SOURCE TO MICROPHONE

FIGURE 10.G.2 AURAL NON-DETECTABILITY LIMITING OCTAVE BAND LEVEL

Duration Per Day in Hours	Sound Level dBA
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4 or less	115

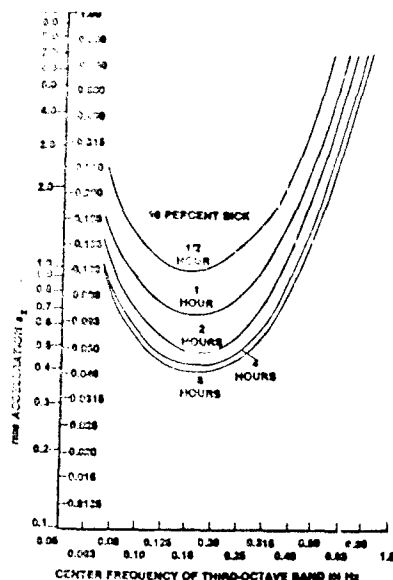
These values apply to total time of exposure per working day regardless of whether this is one continuous exposure or a number of short-term exposure but does not apply to impact or impulsive type of noises.

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_n}{T_n}$$

exceeds unity, then the mixed exposure should be considered to exceed the threshold limit value. C_i indicates the total time of exposure at a specified noise level, and T_i indicates the total time of exposure permitted at that level.

FIGURE 10.G.3 TOTAL NOISE EXPOSURE FOR AN 8-HOUR DAY



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FIGURE 10.G.4 THE 90 PERCENT MOTION SICKNESS

COMMUNICATION REQUIREMENT	SCORE		
	PB	MRT	AI
Exceptionally high intelligibility, separate syllables understood	90%	97%	0.7
Normally acceptable intelligibility, about 1% of sentences correctly heard, single digits understood	75%	91%	0.5
Minimally acceptable intelligibility, limited standard test phrases understood, about 12% sentences correctly heard (in test acceptable for operational equipment)	43%	78%	0.3

NOTE: When information concerning the speech intelligibility of a system is required, three recommended methods are available, with the appropriate selection being dependent upon the requirements of the test:

a. The ANSI standard method of measurement of phonetically balanced (PB) monosyllable word intelligibility, S3.2-1960, should be used when a high degree of sensitivity and accuracy is required.

b. The modified rhyme test (MRT) (see Human Engineering Guide to Equipment Design) should be used if the test requirements are not as stringent or if time and training do not permit the use of the ANSI method.

c. The articulation index (AI) calculations should be used for estimations, comparisons and predictions of system intelligibility based upon ANSI S3.5-1969.

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FIGURE 11.H.1 INTELLIGIBILITY CRITERIA FOR VOICE COMMUNICATIONS SYSTEMS

IMPULSIVE SHOCK CITATION WITH APPROXIMATELY THREE PULSES/DAY

1
1.6
1.4
128
128
128
128

CRITERIA 3) AND 4) ARE SUBJECT TO BLE RESPONSE

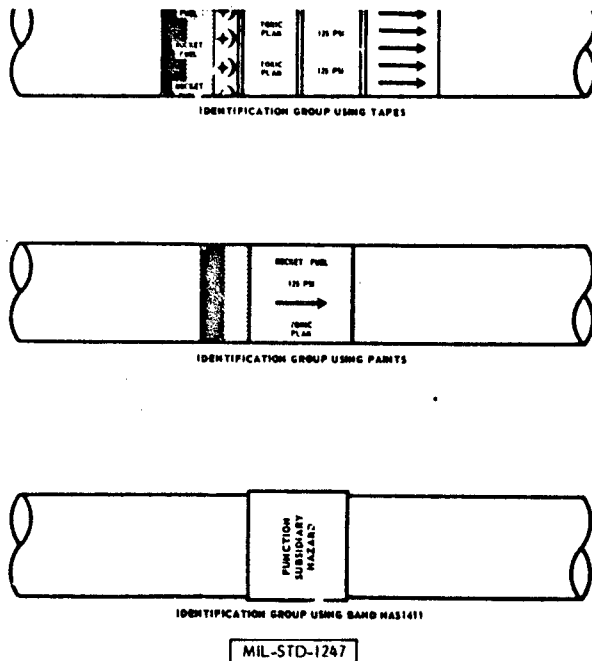


FIGURE 12.H.1 EXAMPLES OF IDENTIFICATION GROUPS

FIGURE 12.H.2 APPLICATION CODE

Pump	Ree
Rocket Outfitter	Gr
Rocket Pump	Re
Water Injection	Re
Lubrication	Yel
Hydraulic	Bl
Solvent	Bl
Pneumatic Air	Or
Instrument Air	Or
Coolant	Gr
Breathing Oxygen	Bl
Air Conditioning	Gr
Nonpropellant	Yel
Battery Activator	Yel
Rain Repellents	Bl
Var. Am.	Gr
Fire Protection	Gr
De-Icing	Gr
Rocket Catalyst	Yel
Compressed Gas	Or
Electrical Conduit	Gr
Inerting Fluid	Or

Color

Blue

Green

Yellow

Orange

Red

Brown

Gray

Black

MIL-STD-1247

FIGURE 12.H.2 APPLICATION CODE

FIGURE 12.H.4 HAZARD IDENTIFICATION MARKING

CLASS OF HAZARD	IDENTIFICATION MARKING	MIL-STD-101 COLOR
Flammable materials. All materials known ordinarily as flammable or combustibles.	FLAM-----	Yellow
Toxic and poisonous materials. All materials extremely hazardous to life or health, under normal conditions, as toxics or poisons.	TOXIC-----	Brown
Anesthetics and harmful materials. All materials productive of anaesthetic vapors and all liquid chemicals and compounds hazardous to life and property but not normally productive of dangerous quantities of fumes or vapors.	ANES-----	Blue
Oxidizing materials. All materials which readily furnish oxygen for combustion and fire producers which react explosively or with evolution of heat in contact with any other materials.	OXYN-----	Green
Physically dangerous materials. All materials, not dangerous in themselves, which are asphyxiating in confined areas or which are generally handled in a dangerous physical state pressure or temperature.	PHDAN-----	Gray
Fire protection materials. All materials provided in piping systems or in compressed gas cylinders exclusively for use in fire protection.	FFH-----	Red

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FIGURE 12.H.5 ELECTRICAL CABLE CODING

Instructions	Number of Conductor	Basic Color	Tracer
1. Find the number of the conductor to be color coded	1	Black	None
	2	White	None
	3	Red	None
	4	Green	None
	5	Orange	None
	6	Blue	None
	7	White	Black
	8	Red	Black
	9	Green	Black
	10	Orange	Black
	11	Blue	Black
	12	Black	White
	13	Red	White
	14	Green	White
	15	Blue	White
	16	Black	Red
	17	White	Red
	18	Orange	Red
	19	Blue	Red
	20	Red	Green
	21	Orange	Green

If a cable has concentrically laid conductors, the first combination of color applies to the center conductor. If a cable contains various sizes of conductors, the first color applies to the largest, continuing in order of conductor size.

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FIGURE 12.H.6 APPLICATION CODE

Function	Color
Intensified pressure	Bl
Supply pressure	Re
Charging pressure	Gr
Reduced pressure	Re
Metered flow	Yel
Exhaust	Bl
Intake	Gr
Drain	Gr
Inactive	Bl

Color	
Red	
Green, Gray	
Red, Gray	
Red, Gray, Red	
Yellow	
Blue, Yellow	
Blue, Brown	
Orange, Blue	
Orange, Gray	
Blue	
Green	
Brown, Gray	
Yellow, Orange	
Yellow, Gray	
Blue, Gray	
Gray, Orange, Gray	
Brown	
Gray	
Yellow, Green	
Orange	
Brown, Orange	
Orange, Green	

FED-STD-595
Code No.

	15102
	14187
	13655
	12197
	11136
	10049
	16473
	17038

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FIGURE 12.H.2 APPLICATION COLORS

ROCKET CATALYST	VERTICAL STRIPES	
ROCKET FUEL	FOUR-POINT STAR INSIDE CRESCENT	
FUEL	FOUR-POINT STAR	
WATER INJECTION	INVERTED CHEVRONS	
LUBRICATION	STAGGERED SQUARES	
HYDRAULIC	CIRCLE	
COMPRESSED GAS	BROAD DIAGONAL STRIPE	
INSTRUMENT AIR	CONTINUOUS ZIG-ZAG LINE	
COOLANT	HORIZONTAL S	
BREATHING OXYGEN	RECTANGLE	
AIR CONDITIONING	GRAVEL PATTERN	
FIRE PROTECTION	HORIZONTAL DIAMOND	
DE-ICING	STAGGERED TRIANGLES	
PNEUMATIC	CONTINUOUS X-FORM LATTICE	
ELECTRICAL CONDUIT	FLASH OF LIGHTNING	
INERTING FLUID	STAGGERED PIPE CROSSES	
SOLVENT	HORIZONTAL STRIPES	
MONOPROPELLANT	BLOCK T	
VACUUM	VERTICAL WAVY LINE	
BATTERY ACTIVATOR	SPARKLING	
RAIN REPELLENT	RAIN DROPS	

FIGURE 12.H.3 FUNCTIONS AND ASSOCIATED SYMBOLS

Tracer	Function	Color	Definition of Function
None	Intensified pressure	Black	Pressure in excess of supply pressure induced by a booster or intensifier.
None	Supply pressure	Red	Pressure of the power-actuating fluid.
None	Charging pressure	Intermittent Red	Pump-inlet pressure, higher than atmospheric pressure.
None	Reduced pressure	Intermittent Red	Auxiliary pressure lower than supply pressure.
Black	Metered flow	Yellow	Fluid at a controlled flow rate (other than pump delivery).
Black	Exhaust	Blue	Return of the power-actuating fluid to reservoir.
Black	Intake	Green	Sub-atmospheric pressure, usually on the intake side of the pump.
Black	Drain	Green	Return of leakage of control-actuating fluid to reservoir.
White	Inactive	Blank	Fluid within the circuit but not serving a functional purpose during the phase being represented.

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FIGURE 12.H.6 HYDRAULIC AND PNEUMATIC CODING

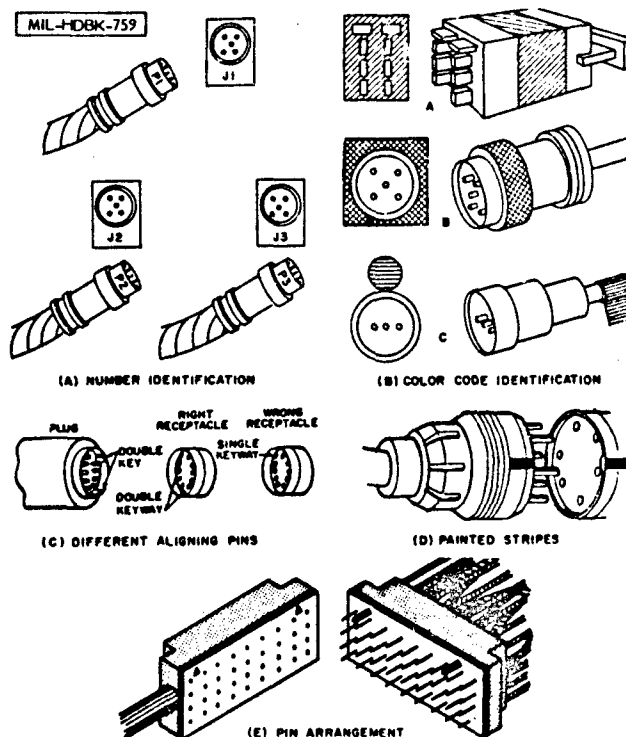


FIGURE 13.H.1 METHODS OF IDENTIFYING PLUGS AND RECEPTACLES

	Two-finger bar	26 4 8 30 (32) (64) (75)	15 30 30 (38) (75) (75)	Not Applicable
	One-hand bar	18 7 4 37 8 30 (41) (111) (75)	20 50 40 (50) (125) (100)	30 5 25 60 (75) (125) (150)
	Two-hand bar	18 7 8 6 40 (41) (215) (75)	20 105 40 (50) (125) (100)	30 110 60 (75) (125) (150)
	T-bar	15 40 30 (38) (100) (75)	20 45 40 (50) (115) (100)	Not Applicable
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	J-bar	20 40 30 (50) (100) (75)	20 45 40 (50) (115) (100)	30 50 60 (75) (125) (150)
	Two-finger recess	12 6 2 8 20 (32) (64) (50)	15 30 20 (38) (75) (50)	Not Applicable
	One-hand recess	20 4 25 35 (50) (110) (90)	35 5 25 40 (90) (135) (100)	35 5 25 60 (90) (135) (125)
	Finger tip recess	0.75 - 0.5 (19) (13)	1.0 - 0.75 (25) (19)	Not Applicable
	One-finger recess	1.25 - 2.0 (32) (50)	1.5 - 2.0 (38) (50)	Not Applicable
Curvature of Handle or Edge ROUNDED NOT PRECLUDED 1ST OF OVAL HANDLES: Four Post				
Weight of Item Up to 15 lbs (up to 6.8 kg) 15 to 20 lbs (6.8 to 9.0 kg) 20 to 40 lbs (9.0 to 18 kg) Over 40 lbs (over 18 kg)				
Minimum Diameter D: 1/4 in. (6 mm) D: 1/2 in. (13 mm) D: 3/4 in. (19 mm) D: 1 in. (25 mm) T: 1/2 in. (13 mm)				
Gripping efficiency is best if finger can rest around handle or edge to any angle of 150 degrees or better.				

FIGURE 14.B.1 MINIMUM HANDLE DIMENSIONS

6 ft. (1.800 m)	29 lb (13 kg)
5 ft. (1.500 m)	35 lb (16 kg)
4 ft. (1.200 m)	50 lb (23 kg)
3 ft. (900 mm)	65 lb (29 kg)
2 ft. (600 mm)	80 lb (36 kg)
1 ft. (300 mm)	85 lb (39 kg)

FIGURE 14.C.1 DESIGN WEIGHT LIMITS

HORIZONTAL FORCE AT LEAST	APPLIED WITH*	CONDITION (μ COEFFICIENT OF FRICTION)
25 lb (108 N) PUSH OR PULL	BOTH HANDS OR ONE SHOULDER OR THE BACK	WITH LOW TRACTION μ = 0.2
45 lb (200 N) PUSH OR PULL	BOTH HANDS OR ONE SHOULDER OR THE BACK	WITH MEDIUM TRACTION μ = 0.3
15 lb (68 N) PUSH	ONE HAND	IF BRACED AGAINST A VERTICAL WALL 20-40 in. (510-1025 mm) FROM AND PARALLEL TO THE PUSH PANEL
70 lb (308 N) PUSH OR PULL	BOTH HANDS OR ONE SHOULDER OR THE BACK	WITH HIGH TRACTION μ > 0.9
110 lb (500 N) PUSH OR PULL	BOTH HANDS OR ONE SHOULDER OR THE BACK	IF BRACED AGAINST A VERTICAL WALL 20-40 in. (510-1025 mm) FROM AND PARALLEL TO THE PANEL OR IF ANCHORING THE FEET ON A PERFECTLY NONSLIP GROUND (LINE A FOOTREST)
186 lb (756 N) THE BACK PUSH		IF BRACED AGAINST A VERTICAL WALL 23-43 in. (585-1095 mm) FROM AND PARALLEL TO THE PUSH PANEL OR IF ANCHORING THE FEET ON A PERFECTLY NONSLIP GROUND (LINE A FOOTREST)

* MAY BE DELETED FOR TWO AND TRIPLED FOR THREE OPERATORS PUSHING SIMULTANEOUSLY FOR THE FOURTH AND EACH ADDITIONAL OPERATOR NOT MORE THAN 75% OF THEIR PUSH CAPABILITY SHOULD BE ADDED

FIGURE 14.C.2 HORIZONTAL PUSH AND PULL FORCES EXERTABLE (INTERMITTENTLY OR FOR SHORT PERIODS OF TIME)

MINIMAL TWO HAND ACCESS OPENINGS WITHOUT VISUAL ACCESS			
Reaching with both hands to depth of 150 to 490mm:		Reaching with both hands to depth of 8 to 18 inches	
Light clothing:	Width 200mm or the depth of reach* Height 125mm	Light clothing:	Width 8" or the depth of reach* Height 5"
Arctic clothing:	Width 150mm plus 3/4 the depth of reach Height 180mm	Arctic clothing:	Width 6" plus 3/4 the depth of reach Height 7"
Reaching full arm's length (to shoulder) with both arms:		Reaching full arm's length (to shoulder) with both arms	
Width	500mm	Width	19 1/2"
Height	125mm	Height	5 1/2"
Inserting bar grasped by handles on the front:		Inserting bar grasped by handles on the front	
15mm clearance around bar, assuming adequate clearance around handles		1 1/2" clearance around bar, assuming adequate clearance around handles	
Inserting bar with hands on the sides:		Inserting bar with hands on the sides	
Light clothing:	Width Box plus 115mm Height 12mm or 15mm around bar*	Light clothing:	Width Box plus 4 1/2" Height 5" or 0.5" around bar*
Arctic clothing:	Width Box plus 180mm Height 18mm or 15mm around bar*	Arctic clothing:	Width Box plus 7" Height 8 1/2" or 0.5" around bar*
*whichever is larger		*whichever is larger	
11 hands full around bottom, allow an extra 20mm for light clothing, 25mm for arctic clothing		11 hands full around bottom, allow an extra 1 1/2" for light clothing, 3" for arctic clothing	
  			
MINIMAL ONE HAND ACCESS OPENINGS WITHOUT VISUAL ACCESS			
Empty hand, to wrist:		Empty hand, to wrist:	
Bare hand, rolled:	85mm sq or dia	Bare hand, rolled:	3 3/8" sq or dia
Bare hand, flat:	55mm x 100mm or 100mm dia	Bare hand, flat:	2 1/8" x 4 1/8" or 4 1/8" dia
Glove or mitten:	100mm x 150mm or 150mm dia	Glove or mitten:	4 1/8" x 6 1/8" or 6 1/8" dia
Arctic mitten:	125mm x 160mm or 160mm dia	Arctic mitten:	5 1/8" x 6 5/8" or 6 5/8" dia
Clenched hand, to wrist:		Clenched hand, to wrist:	
Bare hand:	90mm x 125mm or 125mm dia	Bare hand:	3 5/8" x 5 1/8" or 5 1/8" dia
Glove or mitten:	115mm x 150mm or 150mm dia	Glove or mitten:	4 5/8" x 6 1/8" or 6 1/8" dia
Arctic mitten:	180mm x 215mm or 215mm dia	Arctic mitten:	7 1/8" x 8 5/8" or 8 5/8" dia
Hand plus 1" dia object, to wrist:		Hand plus 1" dia object, to wrist:	
Bare hand:	95mm sq or dia	Bare hand:	3 7/8" sq or dia
Glove or mitten:	150mm sq or dia	Glove or mitten:	6 1/8" sq or dia
Arctic mitten:	180mm sq or dia	Arctic mitten:	7 1/8" sq or dia
Hand plus object over 1" in dia, to wrist:		Hand plus object over 1" in dia, to wrist:	
Bare hand:	15mm clearance around object	Bare hand:	1 7/8" clearance around object
Glove or mitten:	40mm clearance around object	Glove or mitten:	2 5/8" clearance around object
Arctic mitten:	90mm clearance around object	Arctic mitten:	3 5/8" clearance around object
Arm to elbow:		Arm to elbow:	
Light clothing:	100mm x 115mm	Light clothing:	4 1/8" x 4 5/8" or 4 5/8" dia
Arctic clothing:	180mm sq or dia	Arctic clothing:	7 1/8" sq or dia
With object:	Clearances as above	With object:	Clearances as above
Arm to shoulder:		Arm to shoulder:	
Light clothing:	125mm sq or dia	Light clothing:	5 1/8" sq or dia
Arctic clothing:	215mm sq or dia	Arctic clothing:	8 1/8" sq or dia
With object:	Clearances as above	With object:	Clearances as above
  			
MIL-STD-1472			
MINIMAL FINGER ACCESS TO FIRST JOINT			
Push button access:		Push button access:	
Bare hand:	30mm dia	Bare hand:	1 1/8" dia
Gloved hand:	40mm dia	Gloved hand:	1 5/8" dia
Two-finger twist access:		Two-finger twist access:	
Bare hand:	object plus 50mm or act plus 55mm	Bare hand:	object plus 2 1/8" dia
Gloved hand:	object plus 55mm	Gloved hand:	object plus 2 5/8" dia
			

FIGURE 19.B.1 ARM AND HAND ACCESS DIMENSIONS

RECOMMENDED MINIMUM DIMENSIONS FOR HEAD ACCESS, 95TH PERCENTILE	HEAD	SHOULDER	ELBOW
HEAD BAND	6.0	6.0	6.0
SHIRT CLOTHES	6.0	6.0	6.0
HEAD HELMET	17.0	17.0	17.0

RECOMMENDED MINIMUM DIMENSIONS FOR HEAD ACCESS, 95TH PERCENTILE

RECOMMENDED MINIMUM DIMENSIONS FOR HAND ACCESS, 95TH PERCENTILE	W	L	H	RT
EMPTY HAND	4.0	4.0	4.0	2.0
ARCTIC MITTEN	13.0	13.0	13.0	1.0

RECOMMENDED MINIMUM DIMENSIONS FOR HAND ACCESS, 95TH PERCENTILE

FIGURE

MAXIMUM WEIGHT OF ITEM

9 lb (13 kg)
6 lb (16 kg)
0 lb (23 kg)
5 lb (29 kg)
0 lb (36 kg)
5 lb (39 kg)

WEIGHT LIMITS

CONDITION (a. COEFFICIENT OF FRICTION)
WITH LOW TRACTION 0.15
WITH MEDIUM TRACTION 0.35
WITH HIGH TRACTION 0.55
BRACED AGAINST A VERTICAL WALL 300 IN (7620 mm) FROM FLOOR AND PARALLEL TO THE PUSH PANEL
WITH HIGH TRACTION 0.55
BRACED AGAINST A VERTICAL WALL 170 IN (4318 mm) FROM FLOOR AND PARALLEL TO THE PANEL
ANCHORING THE FEET ON A PERFECTLY NONSLIP SURFACE (WHEELS & JOINTS)
BRACED AGAINST A VERTICAL WALL 135 IN (3429 mm) FROM FLOOR AND PARALLEL TO THE PANEL
ANCHORING THE FEET ON A PERFECTLY NONSLIP SURFACE (WHEELS & JOINTS)
AS PUSHER, RESULT: "NEUTRAL" (THAT IS, 75% OF THE)

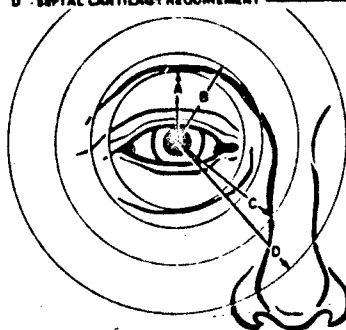
DESIGN WEIGHT LIMITS (MALE PERSONNEL)

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D PULL FORCES EXERTABLE (PERIODS OF TIME)

- A - SUPERCILIARY ARCH REQUIREMENT 11/16" (17 mm)
- B - NASAL BONE REQUIREMENT 7/8" (22 mm)
- C - GREATER ALAR CARTILAGE REQUIREMENT 1-1/4" (32 mm)
- D - ORBITAL CARTILAGE REQUIREMENT 1-3/4" (44 mm)



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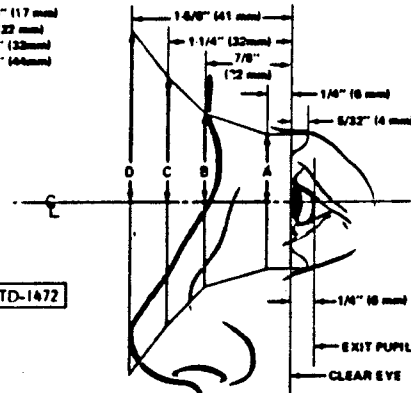
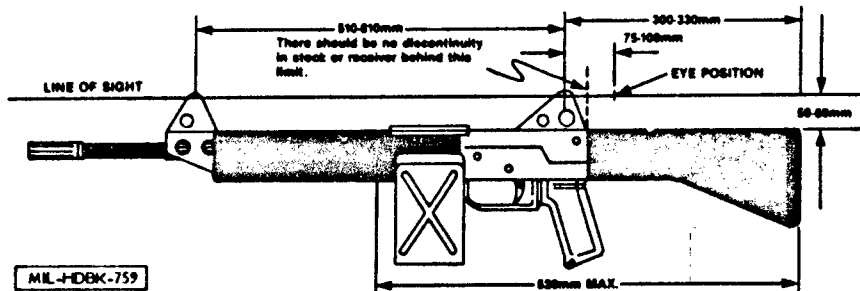


FIGURE 15.B.1 ANATOMICAL LIMITS ON AXIALLY SYMMETRICAL OCULAR METAL PARTS



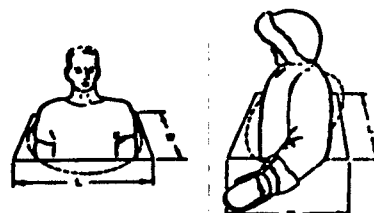
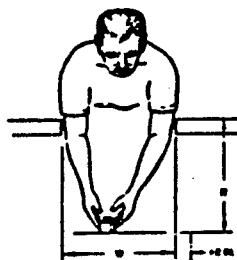
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FIGURE 16.B.1 RIFLES AND MACHINE GUN GUIDANCE DIMENSIONS



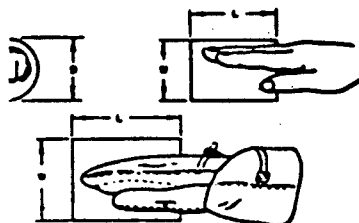
Dimension	Shoulder	Shoulder	Shoulder	Shoulder
Width, in.	W	L	W	L
HEAD SIZE	18.0	18.0	18.0	18.0
HEAD CLOTHES	18.0	18.0	18.0	18.0
HEAD CLOTHES	18.0	18.0	18.0	18.0

**RECOMMENDED MINIMUM DIMENSIONS
FOR HEAD ACCESS, 95TH PERCENTILE**



Dimension	Shoulder	Shoulder	Shoulder	Shoulder
Width, in.	W	L	W	L
TORSO SIZE	18.0	18.0	18.0	18.0
TORSO CLOTHES	18.0	18.0	18.0	18.0
TORSO CLOTHES	18.0	18.0	18.0	18.0

**RECOMMENDED MINIMUM DIMENSIONS
FOR BODY ACCESS, 95TH PERCENTILE**



Dimension	Shoulder	Shoulder	Shoulder	Shoulder
Width, in.	W	L	W	L
HAND SIZE	18.0	18.0	18.0	18.0
HAND CLOTHES	18.0	18.0	18.0	18.0
HAND CLOTHES	18.0	18.0	18.0	18.0

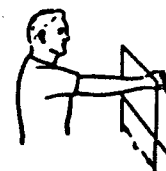
**RECOMMENDED MINIMUM DIMENSIONS
FOR HAND ACCESS, 95TH PERCENTILE**



Dimension	Shoulder	Shoulder	Shoulder	Shoulder
Width, in.	W	L	W	L
TWO HANDS	18.0	18.0	18.0	18.0
ARM REACH	18.0	18.0	18.0	18.0
ARM REACH	18.0	18.0	18.0	18.0

**RECOMMENDED MINIMUM DIMENSIONS
FOR TWO HANDED ACCESS, 95TH PERCENTILE**

SAE J925



Dimension	Shoulder	Shoulder	Shoulder	Shoulder
Width, in.	W	L	W	L
ARM REACH	18.0	18.0	18.0	18.0
ARM REACH	18.0	18.0	18.0	18.0
ARM REACH	18.0	18.0	18.0	18.0

**RECOMMENDED MINIMUM DIMENSIONS
FOR ARM REACH ACCESS, 95TH PERCENTILE**

FIGURE 19.B.2 MINIMUM ACCESS DIMENSIONS FOR CONSTRUCTION AND INDUSTRIAL MACHINERY



FIGURE 23. B. 1 GLOVED-HAND DIMENSIONS FOR 95th PERCENTILE MAN

HAND POSITION	A	B	C	D
EXTENDED FLAT CLOSED AS FIST	26.7 17.8 12.7 11.9 9.4 8.4	27.2 18.5 14.7 14.6 11.4 10.7	28.1 19.2 15.2 14.7 11.8 10.7	28.9 20.3 16.3 15.8 12.7 11.4
QUASIPING HANDLE 2.5 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4
QUASIPING KNOB 0.8 CM DIAMETER	17.8 12.7 11.9 9.4 8.4	18.5 14.7 14.6 11.4 10.7	19.2 15.2 14.7 11.8 10.7	20.3 16.3 15.8 12.7 11.4

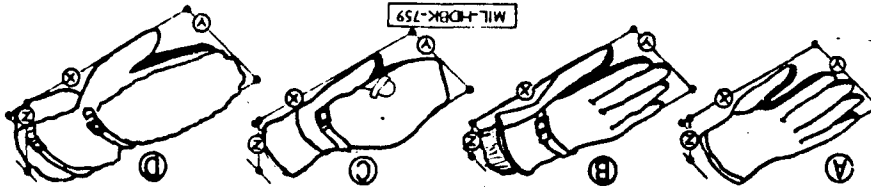


FIGURE 22. B. 3 CVC HELMET-DH-132 DIMENSIONS

DIMENSION	SIZE (mm)
A. LENGTH OF HELMET	200
B. HELMET BREADTH (SHIELD)	210
C. HEIGHT OF SHIELD ABOVE EAR TO TOP	110
D. HEIGHT OF SHIELD TO TOP	200
E. HEIGHT FROM FRONT OF SHIELD TO TOP	80
F. HELMET BREADTH	200
G. HEIGHT FROM BOTTOM OF EAR TO TOP	210 (APPROXIMATE)

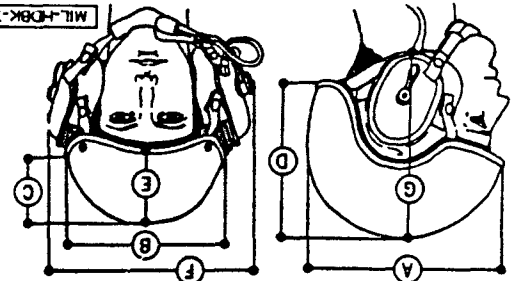


FIGURE 22. B. 4 AIRCREWMAN'S HELMET, SPH4 DIMENSIONS

DIMENSION	SIZE (mm)
A. LENGTH OF HELMET	200
B. HEIGHT OF HELMET SHIELD	240
C. HELMET BREADTH	250
D. HEIGHT FROM FRONT TO TOP	140
E. HEIGHT FROM BACK TO TOP	160
F. SHIELD BREADTH AT NOSE CUTAWAY	65

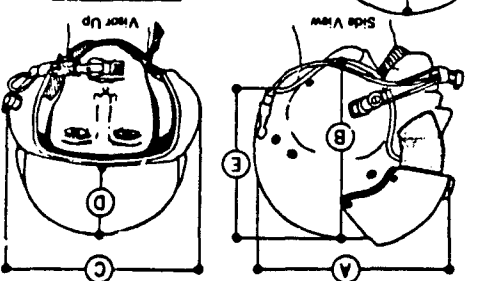


FIGURE 22. B. 1 M-1 HELMET DIMENSIONS

DIMENSION	SIZE (mm)
A. LENGTH FROM EAR TO REAR RIM	200.0
B. HEIGHT	170.0
C. TOP OF HEAD TO TOP OF HELMET	80.0
D. EYEBROW RIDGE TO FRONT RIM	80.0
E. WIDTH, RIM TO RIM	220.0

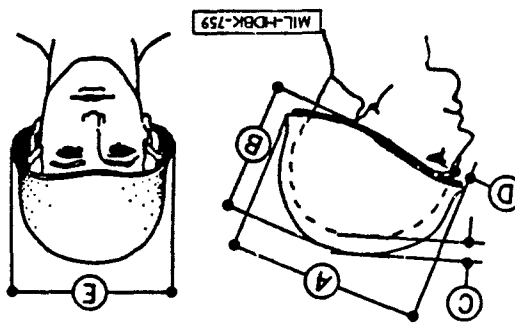
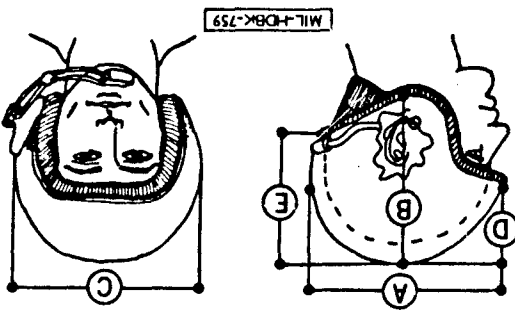


FIGURE 22. B. 2 CVC HELMET T56-6 DIMENSIONS

DIMENSION	SIZE (mm)
A. LENGTH OF HELMET, FRONT RIM TO REAR RIM	200
B. HEIGHT FROM BACK TO TOP	160
C. HEIGHT FROM FRONT TO TOP	160
D. EYEBROW RIDGE TO FRONT RIM	100
E. BREADTH OF HELMET	205



STANDING BODY
DIMENSIONS
1. STANDING
2. EYE HEIGHT
3. SHOULDER AC
4. ELBOW AC
5. ELBOW RADIAL
6. WRIST RADIAL
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95. WRIST RADIAL
96. WRIST RADIAL
97. WRIST RADIAL
98. WRIST RADIAL
99. WRIST RADIAL
100. WRIST RADIAL

FIGURE 25.B.1 STANDING BODY DIMENSIONS

PERCENTILE VALUES IN CENTIMETERS			
50th PERCENTILE		90th PERCENTILE	
GROUND TROOPS	AVIATORS	GROUND TROOPS	AVIATORS
WEIGHT (kg)	66.5	66.4	61.8
STANDING BODY			
1 STATURE			
162.0	151.1	162.4	152.4
3 SHOULDER (ACROSS)			
130.0	123.3	132.0	122.0
4 CHEST (INPIT) HEIGHT			
101.0	100.0	106.0	100.0
8 BUST (INPIT) HEIGHT			
97.0	96.5	101.0	97.0
7 WAIST HEIGHT			
96.0	95.5	101.0	97.0
8 CROUCH HEIGHT			
75.0	74.7	80.0	75.0
9 OLIVEL FURNOW			
73.0	72.6	78.0	73.0
10 ANTERIOR HEIGHT			
67.0	66.8	72.0	67.0
11 CALF HEIGHT			
72.0	71.1	77.0	72.0
12 FUNCTIONAL REACH			
64.2	62.3	73.0	67.0
PERCENTILE VALUES IN INCHES			
WEIGHT (kg)			
122.4	120.1	140.2	111.0
STANDING BODY			
1 STATURE			
64.1	64.0	73.1	72.0
3 ELBOW (ACROSS)			
60.0	60.0	66.2	60.0
4 CHEST (INPIT) HEIGHT			
52.0	52.5	60.0	52.0
8 BUST (INPIT) HEIGHT			
50.0	49.5	57.0	49.0
9 OLIVEL FURNOW			
50.0	49.4	56.0	50.0
10 ANTERIOR HEIGHT			
44.2	44.0	50.0	44.0
11 CALF HEIGHT			
47.0	47.0	52.0	47.0
12 FUNCTIONAL REACH			
38.2	38.0	44.0	38.0
13 FUNCTIONAL REACH			
33.2	32.4	39.0	33.0
2 FUNCTIONAL REACH			
30.0	30.0	35.0	30.0
3 FUNCTIONAL REACH			
28.0	28.0	33.0	28.0
4 FUNCTIONAL REACH			
26.0	26.0	31.0	26.0
5 FUNCTIONAL REACH			
24.0	24.0	29.0	24.0
6 FUNCTIONAL REACH			
22.0	22.0	27.0	22.0
7 FUNCTIONAL REACH			
20.0	20.0	25.0	20.0
8 FUNCTIONAL REACH			
18.0	18.0	23.0	18.0
9 FUNCTIONAL REACH			
16.0	16.0	21.0	16.0
10 FUNCTIONAL REACH			
14.0	14.0	19.0	14.0
11 FUNCTIONAL REACH			
12.0	12.0	17.0	12.0
12 FUNCTIONAL REACH			
10.0	10.0	15.0	10.0
13 FUNCTIONAL REACH			
8.0	8.0	13.0	8.0
14 FUNCTIONAL REACH			
6.0	6.0	11.0	6.0
15 FUNCTIONAL REACH			
4.0	4.0	9.0	4.0
16 FUNCTIONAL REACH			
2.0	2.0	7.0	2.0
17 FUNCTIONAL REACH			
0.0	0.0	5.0	0.0

"SAFE AS 12, HOWEVER,
 MIGHT SHOULDER IS EXTENDED
 AS FAR FORWARD AS POSSIBLE
 WHILE KEEPING THE BACK OF
 THE LEFT SHOULDER FIRMLY
 AGAINST THE BACK WALL.

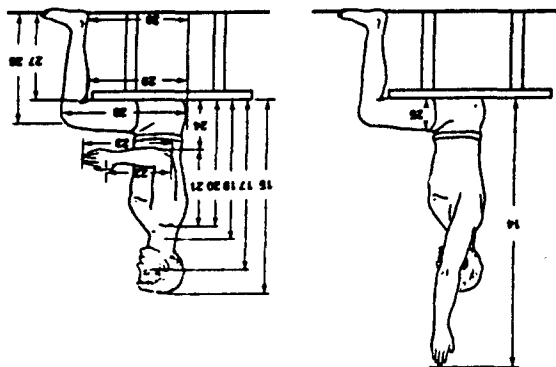
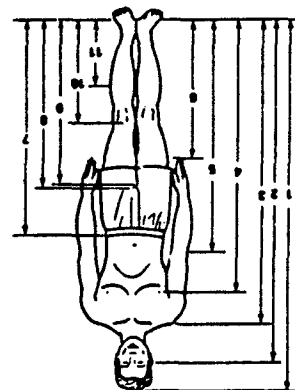
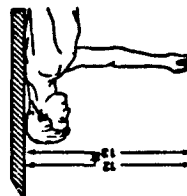


FIGURE 25. B.3 DEPTH AND BREADTH DIMENSIONS

PERCENTILE VALUES IN CENTIMETERS				PERCENTILE VALUES IN INCHES			
50th PERCENTILE		95th PERCENTILE		50th PERCENTILE		95th PERCENTILE	
GROUND	AVIATORS	GROUND	AVIATORS	GROUND	AVIATORS	GROUND	AVIATORS
18.9	20.4	20.7	27.8	7.5	8.0	8.2	11.0
27.3	29.5	29.5	34.4	10.8	11.6	10.8	13.4
32.0	34.4	34.4	37.8	12.6	12.6	12.6	15.1
37.8	39.6	39.6	42.0	14.9	15.1	14.9	16.9
42.0	42.0	42.0	45.2	16.5	16.5	16.5	18.0
45.2	45.2	45.2	48.4	17.8	17.8	17.8	19.3
48.4	48.4	48.4	51.6	19.2	19.2	19.2	20.7
51.6	51.6	51.6	54.8	20.5	20.5	20.5	22.1
54.8	54.8	54.8	58.0	21.6	21.6	21.6	23.6
58.0	58.0	58.0	61.2	22.8	22.8	22.8	25.0
61.2	61.2	61.2	64.4	24.3	24.3	24.3	26.4
64.4	64.4	64.4	67.6	25.3	25.3	25.3	27.2
67.6	67.6	67.6	70.8	26.7	26.7	26.7	28.7
70.8	70.8	70.8	74.0	27.8	27.8	27.8	30.2
74.0	74.0	74.0	77.2	29.1	29.1	29.1	31.7
77.2	77.2	77.2	80.4	30.7	30.7	30.7	33.1
80.4	80.4	80.4	83.6	31.7	31.7	31.7	34.6
83.6	83.6	83.6	86.8	32.2	32.2	32.2	36.1
86.8	86.8	86.8	90.0	33.5	33.5	33.5	37.5
90.0	90.0	90.0	93.2	35.8	35.8	35.8	39.6
93.2	93.2	93.2	96.4	37.3	37.3	37.3	41.9
96.4	96.4	96.4	99.6	38.7	38.7	38.7	44.9
99.6	99.6	99.6	102.8	40.7	40.7	40.7	46.9
102.8	102.8	102.8	106.0	42.0	42.0	42.0	48.4
106.0	106.0	106.0	109.2	43.3	43.3	43.3	50.0
109.2	109.2	109.2	112.4	44.2	44.2	44.2	51.6
112.4	112.4	112.4	115.6	45.2	45.2	45.2	53.1
115.6	115.6	115.6	118.8	46.1	46.1	46.1	54.8
118.8	118.8	118.8	122.0	47.0	47.0	47.0	56.3
122.0	122.0	122.0	125.2	47.6	47.6	47.6	58.0
125.2	125.2	125.2	128.4	48.1	48.1	48.1	59.6
128.4	128.4	128.4	131.6	48.5	48.5	48.5	61.2
131.6	131.6	131.6	134.8	48.9	48.9	48.9	62.8
134.8	134.8	134.8	138.0	49.3	49.3	49.3	64.4
138.0	138.0	138.0	141.2	49.6	49.6	49.6	66.0
141.2	141.2	141.2	144.4	50.0	50.0	50.0	67.6
144.4	144.4	144.4	147.6	50.4	50.4	50.4	69.1
147.6	147.6	147.6	150.8	50.8	50.8	50.8	70.8
150.8	150.8	150.8	154.0	51.2	51.2	51.2	72.3
154.0	154.0	154.0	157.2	51.6	51.6	51.6	74.0
157.2	157.2	157.2	160.4	52.0	52.0	52.0	75.6
160.4	160.4	160.4	163.6	52.4	52.4	52.4	77.2
163.6	163.6	163.6	166.8	52.8	52.8	52.8	78.7
166.8	166.8	166.8	170.0	53.1	53.1	53.1	80.2
170.0	170.0	170.0	173.2	53.5	53.5	53.5	81.7
173.2	173.2	173.2	176.4	53.9	53.9	53.9	83.1
176.4	176.4	176.4	179.6	54.3	54.3	54.3	84.6
179.6	179.6	179.6	182.8	54.7	54.7	54.7	86.1
182.8	182.8	182.8	186.0	55.1	55.1	55.1	87.5
186.0	186.0	186.0	189.2	55.5	55.5	55.5	89.0
189.2	189.2	189.2	192.4	55.9	55.9	55.9	90.6
192.4	192.4	192.4	195.6	56.3	56.3	56.3	92.1
195.6	195.6	195.6	198.8	56.7	56.7	56.7	93.7
198.8	198.8	198.8	202.0	57.1	57.1	57.1	95.2
202.0	202.0	202.0	205.2	57.5	57.5	57.5	96.8
205.2	205.2	205.2	208.4	57.9	57.9	57.9	98.4
208.4	208.4	208.4	211.6	58.3	58.3	58.3	100.0
211.6	211.6	211.6	214.8	58.7	58.7	58.7	
214.8	214.8	214.8	218.0	59.1	59.1	59.1	
218.0	218.0	218.0	221.2	59.5	59.5	59.5	
221.2	221.2	221.2	224.4	59.9	59.9	59.9	
224.4	224.4	224.4	227.6	60.3	60.3	60.3	
227.6	227.6	227.6	230.8	60.7	60.7	60.7	
230.8	230.8	230.8	234.0	61.1	61.1	61.1	
234.0	234.0	234.0	237.2	61.5	61.5	61.5	
237.2	237.2	237.2	240.4	61.9	61.9	61.9	
240.4	240.4	240.4	243.6	62.3	62.3	62.3	
243.6	243.6	243.6	246.8	62.7	62.7	62.7	
246.8	246.8	246.8	250.0	63.1	63.1	63.1	
250.0	250.0	250.0	253.2	63.5	63.5	63.5	
253.2	253.2	253.2	256.4	63.9	63.9	63.9	
256.4	256.4	256.4	259.6	64.3	64.3	64.3	
259.6	259.6	259.6	262.8	64.7	64.7	64.7	
262.8	262.8	262.8	266.0	65.1	65.1	65.1	
266.0	266.0	266.0	269.2	65.5	65.5	65.5	
269.2	269.2	269.2	272.4	65.9	65.9	65.9	
272.4	272.4	272.4	275.6	66.3	66.3	66.3	
275.6	275.6	275.6	278.8	66.7	66.7	66.7	
278.8	278.8	278.8	282.0	67.1	67.1	67.1	
282.0	282.0	282.0	285.2	67.5	67.5	67.5	
285.2	285.2	285.2	288.4	67.9	67.9	67.9	
288.4	288.4	288.4	291.6	68.3	68.3	68.3	
291.6	291.6	291.6	294.8	68.7	68.7	68.7	
294.8	294.8	294.8	298.0	69.1	69.1	69.1	
298.0	298.0	298.0	301.2	69.5	69.5	69.5	
301.2	301.2	301.2	304.4	69.9	69.9	69.9	
304.4	304.4	304.4	307.6	70.3	70.3	70.3	
307.6	307.6	307.6	310.8	70.7	70.7	70.7	
310.8	310.8	310.8	314.0	71.1	71.1	71.1	
314.0	314.0	314.0	317.2	71.5	71.5	71.5	
317.2	317.2	317.2	320.4	71.9	71.9	71.9	
320.4	320.4	320.4	323.6	72.3	72.3	72.3	
323.6	323.6	323.6	326.8	72.7	72.7	72.7	
326.8	326.8	326.8	330.0	73.1	73.1	73.1	
330.0	330.0	330.0	333.2	73.5	73.5	73.5	
333.2	333.2	333.2	336.4	73.9	73.9	73.9	
336.4	336.4	336.4	339.6	74.3	74.3	74.3	
339.6	339.6	339.6	342.8	74.7	74.7	74.7	
342.8	342.8	342.8	346.0	75.1	75.1	75.1	
346.0	346.0	346.0	349.2	75.5	75.5	75.5	
349.2	349.2	349.2	352.4	75.9	75.9	75.9	
352.4	352.4	352.4	355.6	76.3	76.3	76.3	
355.6	355.6	355.6	358.8	76.7	76.7	76.7	
358.8	358.8	358.8	362.0	77.1	77.1	77.1	
362.0	362.0	362.0	365.2	77.5	77.5	77.5	
365.2	365.2	365.2	368.4	77.9	77.9	77.9	
368.4	368.4	368.4	371.6	78.3	78.3	78.3	
371.6	371.6	371.6	374.8	78.7	78.7	78.7	
374.8	374.8	374.8	378.0	79.1	79.1	79.1	
378.0	378.0	378.0	381.2	79.5	79.5	79.5	
381.2	381.2	381.2	384.4	79.9	79.9	79.9	
384.4	384.4	384.4	387.6	80.3	80.3	80.3	
387.6	387.6	387.6	390.8	80.7	80.7	80.7	
390.8	390.8	390.8	394.0	81.1	81.1	81.1	
394.0	394.0	394.0	397.2	81.5	81.5	81.5	
397.2	397.2	397.2	400.4	81.9	81.9	81.9	
400.4	400.4	400.4	403.6	82.3	82.3	82.3	
403.6	403.6	403.6	406.8	82.7	82.7	82.7	
406.8	406.8	406.8	410.0	83.1	83.1	83.1	
410.0	410.0	410.0	413.2	83.5	83.5	83.5	
413.2	413.2	413.2	416.4	83.9	83.9	83.9	
416.4	416.4	416.4	419.6	84.3	84.3	84.3	
419.6	419.6	419.6	422.8	84.7	84.7	84.7	
422.8	422.8	422.8	426.0	85.1	85.1	85.1	
426.0	426.0	426.0	429.2	85.5	85.5	85.5	
429.2	429.2	429.2	432.4	85.9	85.9	85.9	
432.4	432.4	432.4	435.6	86.3	86.3	86.3	
435.6	435.6	435.6	438.8	86.7	86.7	86.7	
438.8	438.8	438.8	442.0	87.1	87.1	87.1	
442.0	442.0	442.0	445.2	87.5	87.5	87.5	
445.2	445.2	445.2	448.4	87.9	87.9	87.9	
448.4	448.4	448.4	451.6	88.3	88.3	88.3	
451.6	451.6	451.6	454.8	88.7	88.7	88.7	
454.8	454.8	454.8	458.0	89.1	89.1	89.1	
458.0	458.0	458.0	461.2	89.5	89.5	89.5	
461.2	461.2	461.2	464.4	89.9	89.9	89.9	
464.4	464.4	464.4	467.6	90.3	90.3	90.3	
467.6	467.6	467.6	470.8	90.7	90.7	90.7	
470.8	470.8	470.8	474.0	91.1	91.1	91.1	
474.0	474.0	474.0	477.2	91.5	91.5	91.5	
477.2	477.2	477.2	480.4	91.9	91.9	91.9	
480.4	480.4	480.4	483.6	92.3	92.3	92.3	
483.6	483.6	483.6	486.8	92.7	92.7	92.7	
486.8	486.8	486.8	490.0	93.1	93.1	93.1	
490.0	490.0	490.0	493.2	93.5	93.5	93.5	
493.2	493.2	493.2	496.4	93.9	93.9	93.9	
496.4	496.4	496.4	499.6	94.3	94.3	94.3	
499.6	499.6	499.6	502.8	94.7	94.7	94.7	
502.8	502.8	502.8	506.0	95.1	95.1	95.1	
506.0	506.0	506.0	509.2	95.5	95.5	95.5	
509.2	509.2	509.2	512.4	95.9	95.9	95.9	
512.4	512.4	512.4	515.6	96.3	96.3	96.3	
515.6	515.6	515.6	518.8	96.7	96.7	96.7	
518.8	518.8	518.8	522.0				

FIGURE 25 B 5 KRAM AND FOOT DIMENSIONS

PERCENTILE VALUES IN CENTIMETERS				PERCENTILE VALUES IN INCHES			
50th PERCENTILE				50th PERCENTILE			
GROUND	AVIATORS	TROOPS	WOMEN	GROUND	AVIATORS	TROOPS	WOMEN
57 HAND LENGTH	17.4	17.7	18.1	20.7	19.1	20.7	20.0
58 PALM LENGTH	9.6	10.0	9.8	9.7	10.0	9.7	9.5
59 HAND BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
60 HAND CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
61 HAND THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
62 FOOT LENGTH	24.5	24.6	24.6	22.2	21.6	22.2	21.8
63 INSTEP LENGTH	17.7	17.5	18.3	21.7	19.8	21.7	19.8
64 FOOT BREADTH	9.0	9.0	9.0	9.0	9.0	9.0	9.0
65 FOOT CIRCUMFERENCE	22.5	22.6	22.6	27.0	26.3	27.0	26.5
66 HEEL ANGLE	31.3	30.7	30.5	37.0	36.3	37.0	36.5
CIRCUMFERENCE				CIRCUMFERENCE			
67 FOOT CIRCUMFERENCE	22.5	22.6	22.6	27.0	26.3	27.0	26.5
68 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
69 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
70 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
71 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
72 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
73 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
74 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
75 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
76 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
77 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
78 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
79 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
80 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
81 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
82 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
83 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
84 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
85 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
86 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
87 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
88 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
89 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
90 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
91 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
92 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
93 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
94 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
95 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
96 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
97 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
98 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
99 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
100 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4

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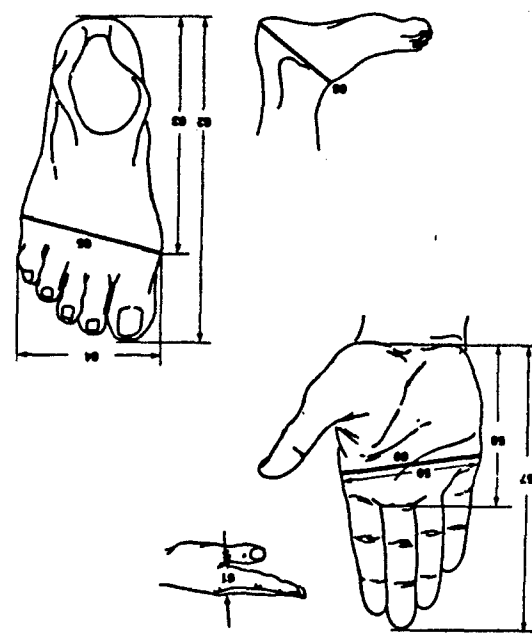
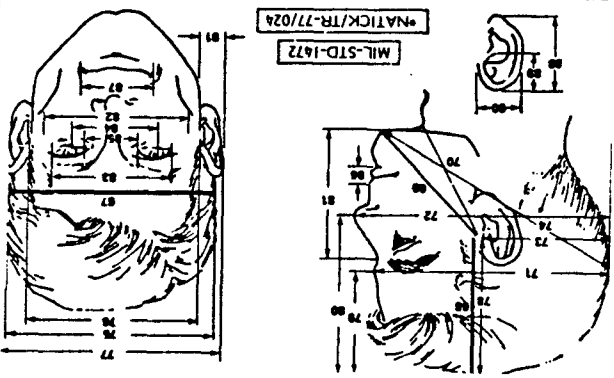


FIGURE 25 B 6 HEAD AND FACE DIMENSIONS

PERCENTILE VALUES IN CENTIMETERS				PERCENTILE VALUES IN INCHES			
50th PERCENTILE				50th PERCENTILE			
GROUND	AVIATORS	TROOPS	WOMEN	GROUND	AVIATORS	TROOPS	WOMEN
57 HEAD LENGTH	17.4	17.7	18.1	20.7	19.1	20.7	20.0
58 PALM LENGTH	9.6	10.0	9.8	9.7	10.0	9.7	9.5
59 HAND BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
60 HAND CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
61 HAND THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
62 FOOT LENGTH	24.5	24.6	24.6	22.2	21.6	22.2	21.8
63 INSTEP LENGTH	17.7	17.5	18.3	21.7	19.8	21.7	19.8
64 FOOT BREADTH	9.0	9.0	9.0	9.0	9.0	9.0	9.0
65 FOOT CIRCUMFERENCE	22.5	22.6	22.6	27.0	26.3	27.0	26.5
66 HEEL ANGLE	31.3	30.7	30.5	37.0	36.3	37.0	36.5
CIRCUMFERENCE				CIRCUMFERENCE			
67 FOOT CIRCUMFERENCE	22.5	22.6	22.6	27.0	26.3	27.0	26.5
68 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
69 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
70 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
71 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
72 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
73 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
74 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
75 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
76 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
77 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
78 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
79 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
80 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
81 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
82 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
83 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
84 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
85 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
86 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
87 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
88 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
89 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
90 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
91 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
92 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
93 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
94 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
95 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
96 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
97 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4
98 ANKLE CIRCUMFERENCE	19.5	19.6	19.6	22.1	20.8	22.1	20.5
99 ANKLE BREADTH	8.1	8.2	8.0	8.0	8.1	8.0	7.9
100 ANKLE THICKNESS	2.4	2.4	2.4	2.4	2.4	2.4	2.4

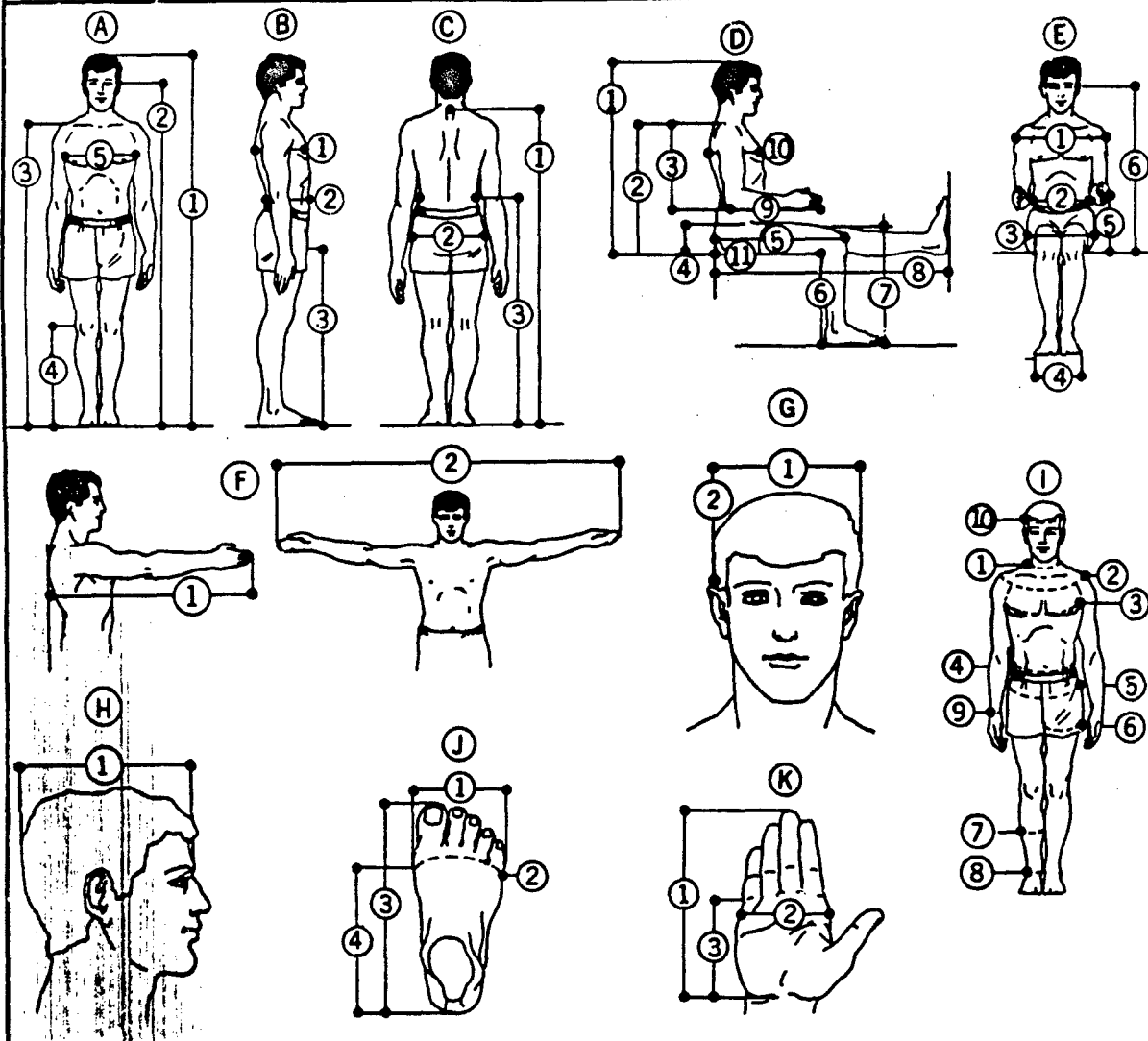
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	BASIC UNIFORM		ADDITIONS TO THE BASIC UNIFORM					
	UNDERWEAR KHAKIS, OR O.D.'S OR FATIGUES, SOCKS, SHOES, HELMET & LINER		BLOUSE OR FIELD JACKET		BLOUSE OR FIELD JACKET OVERCOAT		COMBAT SUIT OVERCOAT, GLOVES, WOOL CAP & COMBAT BOOTS	
WEIGHT (kg)	5th	95th	5th	95th	5th	95th	5th	95th
100.0	62.3	101.6	63.4	102.9	65.5	105.0	66.9	106.4
BODY DIMENSIONS (mm)								
A-1 STATURE	176.9	182.3	180.9	182.3	180.9	182.3	187.9	192.5
D-1 SITTING HEIGHT	87.1	100.3	87.4	100.5	87.9	100.6	88.1	101.1
E-1 EYE HEIGHT, SITTING	71.9	84.3	72.1	84.6	72.4	84.8	72.8	86.1
D-2 MID-SHOULDER HEIGHT, SITTING	66.9	83.5	67.8	85.0	68.9	86.0	70.4	83.9
D-7 KNEE HEIGHT, SITTING	52.9	62.2	52.9	62.2	53.1	62.2	53.1	62.2
D-5 BUTTOCK-KNEE LENGTH	56.1	63.6	56.4	63.9	56.5	63.9	56.1	63.6
D-3 SHOULDER-ELBOW LENGTH	34.3	40.6	36.3	41.7	36.3	42.7	36.3	42.7
E-1 SHOULDER BREADTH	42.7	51.4	44.5	53.3	46.0	54.9	46.8	54.9
A-5 CHEST BREADTH	29.5	35.6	29.7	35.8	29.2	35.3	29.7	35.8
E-2 FOREARM-FOREARM BREADTH	41.4	52.2	42.7	53.2	44.7	55.2	45.5	51.0
C-2 HIP BREADTH	31.8	38.9	37.3	46.4	38.2	46.1	34.0	40.9
E-3 HIP BREADTH, SITTING	32.3	40.9	32.8	41.6	33.8	42.2	34.5	42.9
B-1 CHEST DEPTH	21.8	22.9	22.1	23.0	25.4	26.5	26.4	32.5
J-3 FOOT LENGTH	27.7	32.6	27.7	32.6	27.7	32.6	27.7	32.6
J-1 FOOT BREADTH	10.7	11.9	10.3	11.9	10.2	11.9	12.2	13.7
HAND LENGTH (See Figure 25 B.5 for 95th percentile)								
HAND BREADTH (See Figure 25 B.5 for 95th percentile)								

MIL-HDBK-759

FIGURE 25. B.7 CLOTHED BODY DIMENSIONS OF THE 5th AND 95th PERCENTILE SOLDIER



A. 1.
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B. 1.
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C. 1.
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D. 1.
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E. 1.
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F. 1.
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G. 1.
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H. 1.
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I. 1.
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J. 1.
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K. 1.
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1. BASE

