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MILITARY SPECIFICATION

SEAT SYSTEM, UPWARD EJECTION, AIRCRAFT, GENERAL SPECIFICATION FOR

1. SCOPE

1.1 This specification covers the general requirements for adjustable, upward, aircraft ejection seat systems.

2. APPLICABLE DOCUMENTS

* 2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

QQ-P-416	Plating, Cadmium (Electrodeposited)
QQ-Z-325	Zinc Coating, Electrodeposited, Requirements for
TT-E-489	Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces)
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner

Military

MIL-P-116	Preservation, Methods of
MIL-M-3171	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
MIL-C-6021	Castings, Classification and Inspection of
MIL-H-6088	Heat Treatment of Aluminum Alloys
MIL-H-6875	Heat Treatment of Steels (Aircraft Practice, Process for)
MIL-R-8236	Reel, Shoulder Harness, Inertia Lock
MIL-P-8585	Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity

FSC 1680

MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-P-15280	Plastic Material, Unicellular (Sheets and Tubes)
MIL-P-19644	Plastic Foam, Molded Polystyrene, (Expanded Bead Type)
MIL-A-25165	Aircraft Emergency Escape System, Identification of
MIL-C-25570	Container, Survival and Oxygen Equipment, Cushion, Seat: General Specification for
MIL-H-25579	Hose Assembly, Tetrafluoroethylene, High Temperature, Medium Pressure
MIL-C-25918	Cartridge Actuated Devices, Aircraft Crew Emergency Escape, General Specification for

STANDARDS

Federal

FED-STD-191	Textile Test Methods
FED-STD-595	Colors

Military

MIL-STD-100	Engineering Drawing Practices
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-721	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety
MIL-STD-785	Reliability Program for Systems and Equipment Development and Production
MIL-STD-810	Environmental Test Methods
MIL-STD-838	Lubrication of Military Equipment
MIL-STD-846	Escape System Testing: Ground, Track, and Flight Test
MIL-STD-882	System Safety Program for Systems and Associated Subsystems and Equipment: Requirements for
MIL-STD-889	Dissimilar Metals
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking, and Waterproofing; with Appropriate Test Methods
MIL-STD-1247	Markings, Functions and Hazard Designations of Hose, Pipe, and Tube Lines for Aircraft, Missile, and Space Systems

DRAWINGS

Air Force

52C1543	Streamer Assembly - Warning, Flight Status

PUBLICATIONS

Air Force Systems Command Design Handbook

DH2-2	Crew Stations and Passenger Accommodations

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Preproduction. This specification makes provisions for preproduction testing.

3.2 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

* 3.3 Materials. Materials which are not specifically covered by requirements herein shall be of the highest quality, of the lightest practicable weight, and suitable for the purpose intended.

3.3.1 Metals. Metals shall be of the corrosion-resistant type or treated to resist corrosion due to fuels, salt spray, or atmospheric conditions which may be encountered during normal service.

* 3.3.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.3.1.2 Heat treatment. Heat treatment of aluminum and steel parts shall be in accordance with MIL-H-6088 and MIL-H-6875, respectively.

3.3.1.3 Castings. Castings shall conform to MIL-C-6021.

3.3.2 Lubrication. Lubrication shall conform to MIL-STD-838. Lubrication shall function satisfactorily within the temperature range of -65° to +200°F.

* 3.3.3 Nonmetallic materials. Materials that are nutrients for fungi shall not be used in the construction of the seat system. All upholstery or cover materials shall be flame resistant. The upholstery and cover materials shall be capable of withstanding the wear and handling incident to normal service usage.

* 3.4 Design. The ejection seat system shall be designed to provide a maximum degree of operational reliability, a minimum amount of maintenance, maximum comfort, ease of adjustment, simplicity, durability, and minimum weight. It shall be designed to provide safe escape throughout the escape performance envelope specified herein and shall include completely automatic functioning of all components and subsystems after actuation of the ejection control. The seat system shall be compatible and integrate with the aircraft for which it is intended in accordance with Handbook DH2-2, Design Note 2A1, Sub-notes 1(1) and 1(3) entitled "Cockpit-Basic Dimensions, Fixed Wing" and "Cockpit-Clearance Dimensions, Ejection Seat," respectively. The seat system shall include the following:

a. Seat assembly

b. Personnel restraint subsystem

c. Initiation subsystem

d. Ejection sequencing subsystem (when applicable)

e. Ballistic subsystem

f. Propulsion subsystem

g. Stabilization subsystem

h. Parachute recovery subsystem

i. Survival subsystem.

* 3.4.1 Seat assembly. The seat assembly shall consist of the seat bucket and back structure with a headrest. The seat assembly shall provide adequate support and retention of the occupant's body, arms, and legs during emergency operation; shall be fully suited to normal operational use; and shall comfortably accommodate variations in anthropometric dimensions of crewmembers between the 5th and 95th percentile sizes (see 6.6).

* 3.4.1.1 Seat adjustment. The seat assembly shall be provided with a 5-inch vertical adjustment. The seat adjustment shall be accomplished by movement of the entire ejectable portion of the seat system, including the rocket catapult, as a single unit. The adjustment shall be accomplished by a positive-action, electrically powered screwjack.

* 3.4.1.1.1 Adjustment control. The vertical adjustment control shall be located on the right-hand side of the seat bucket and shall be easily accessible to the seat occupant. A momentary-ON, three-position, center-OFF type switch shall be used. The switch shall be positioned so that the direction of switch actuation corresponds with the direction of seat movement.

* 3.4.1.2 Ejection position. The ejection seat system shall be designed to permit ejection from any position within the range of vertical seat adjustment.

* 3.4.1.3 Seat bucket sides. In order to provide lateral leg retention, the seat bucket sides shall extend forward of the front edge of the seat bottom. The seat side extensions shall be designed to laterally brace the seat occupant's legs against airloads encountered subsequent to ejection.

* 3.4.1.4 Headrest. A headrest shall be provided in the upper portion of the seat back and located to provide head support for 5th through 95th percentile crewmembers. The headrest design shall include a fixed dimensional relationship with the seat bottom for all conditions of seat adjustment and shall incorporate provisions to diminish lateral head motion under ejection conditions. The entire upper portion of the seat back shall be designed to permit maximum rearward vision, consistent with structural requirements for head support and operational requirements when installed in the aircraft. The headrest shall not cause any interference with seat/man separation.

* 3.4.1.4.1 Headrest upholstery. The contact surface of the headrest shall be padded with a high-energy-absorbing foam material conforming to MIL-P-19644 with a thickness of 1.75 inches and a density of 2 pounds per cubic foot. This polystyrene foam shall be covered with a padding of 2 pounds per cubic foot flexible foam, 0.19 inch thick, conforming to MIL-P-15280. The headrest shall be covered with upholstery (see 3.10).

* 3.4.1.5 Canopy piercers. Canopy piercers shall be incorporated in the seat assembly, except where ejection through the canopy is not permitted because of hatch or canopy construction. The design and installation of the canopy piercers shall assure positive canopy penetration before contact can occur between the canopy and seat occupant and shall also assure a clear opening through the canopy sufficient for safe passage of the seat and seat occupant.

* 3.4.1.6 Armrests. Armrests shall be mounted on the seat bucket sides. The armrests shall be designed to provide lateral arm restraint during emergency operation, shall comfortably accommodate all crewmembers from the 5th to the 95th percentile with their flight clothing, and shall not interfere with crewmember access to the aircraft flight controls. The contact surfaces of the armrests shall be padded with a high-energy-absorbing material of at least 1/2-inch thickness. The padded armrests shall be covered with upholstery (see 3.10).

* 3.4.1.7 Environmental flight clothing. The seat assembly shall be designed to provide space for and be compatible with 5th through 95th percentile crewmembers wearing any of the environmental flight clothing and personal equipment required by the aircraft flight operational capabilities.

* 3.4.1.8 Emergency oxygen. An emergency source of oxygen shall be mounted on the seat assembly to provide emergency breathing oxygen, and, if required, pressure suit pressurization. The source shall contain sufficient oxygen for an aircraft emergency descent from maximum altitude, or for free fall following ejection from maximum altitude to the aneroid altitude setting of the recovery parachute. Provisions shall be incorporated for actuation of the oxygen supply automatically upon ejection and for actuation manually in the aircraft. The emergency oxygen supply shall be replaceable without removing the seat from the crew station and shall include a readily visible status indicator to reflect full capacity of the required oxygen.

* 3.4.1.9 Personal lead services. Personal leads shall be provided for the following services, as required: aircraft oxygen, emergency oxygen, communications, anti-g, and ventilation. Personal leads shall be standard according to the service provided. All connections shall be positive so that proper attachment is assured to provide the required services. All disconnections shall be accomplished automatically during the ejection/recovery sequence, as required for the individual services. Provisions shall be incorporated for disconnection of personal leads in conjunction with the release modes of the personnel restraint subsystem.

* 3.4.1.10 Ejection rails. A set of ejection rails and rollers (or slide blocks) shall be furnished with the seat assembly. The rails shall be designed to be installed parallel to the seat back and shall be sufficiently rigid to prevent deflection which would cause binding of the rollers (or slide blocks) or allow the rollers to jump the rails. The rails and rollers (or slide blocks) shall be designed to provide maximum guided catapult stroke in the aircraft during ejection. The ejection rails and rollers (or slide blocks) shall be such that the friction produced between the rails and rollers (or slide blocks), as a result of the airload on the seat during ejection, will be held to a minimum. Provisions shall be made to prevent foreign objects from becoming lodged between the rollers (or slide blocks) and the rails, consistent with ease of seat installation.

* 3.4.2 Personnel restraint subsystem. The seat system shall incorporate a personnel restraint subsystem that will provide full torso restraint and control, allowing maximum crewmember proficiency during all conditions of flight. The restraint attachments shall be designed to provide sufficient structural integrity for positive crewmember retention without injury under all conditions of emergency ejection and ditching/crash impact. Torso restraint shall be provided through use of an integrated torso harness. The torso harness shall include provisions for attaching personnel parachute risers and the survival kit. Depending upon system design, it may also contain provisions for attaching lap straps from the seat in lieu of using a separate lap belt assembly. In cases where lap straps are used, the attachment to the torso harness shall be designed to prevent any movement or submarining of the seat occupant because of ejection or crash accelerations.

3.4.2.1 Crewmember efficiency. The personnel restraint subsystem shall not decrease crewmember efficiency nor cause more than a minimum of restriction to his movement during normal flight.

* 3.4.2.2 Upper torso restraint. The seat system shall incorporate an inertia lock reel mechanism conforming to MIL-R-8236, with additional requirements for powered retraction. The manual inertia lock reel control shall be located on the left side of the seat assembly within easy access of the seat occupant. The inertia lock reel mechanism shall include powered retraction provisions to automatically position and restrain the seat occupant against the backrest of the seat as a pre-ejection function. The powered retraction provisions shall be capable of positioning the seat occupant through 0 to 18 inches of travel and taking up a load up to 300 pounds within 0.3 second maximum at 70°F (0.4 second maximum at -65°F). The reel-in velocity shall be limited to a mean of 9 feet per second with a standard deviation of 1 foot per second. The maximum total load applied to the seat occupant after the reel has positioned the occupant shall not exceed 100 pounds.

3.4.2.3 Inertia reel strap bearing point. The inertia reel strap bearing point (or reel location in systems where the strap reels directly into the mechanism without first passing over a bearing surface) shall be located so that, when in the fully restrained position, no compression loads will be transferred to the seat occupant's spinal column. This location (bearing point) shall be based upon a 95th-percentile sitting shoulder height.

* 3.4.2.4 Lower torso restraint. The seat system shall incorporate provisions for lower torso restraint through the use of either a lap belt assembly or lap straps that attach from the seat assembly to the torso harness. In either case, the seat attachment points shall be located on a line in the side view which is 45° to the seat bucket bottom and through the seat reference point (see figure 1). In systems designed to incorporate lap straps, the survival kit retention straps shall be permanently attached to the lap straps so that the survival kit actuator handle is clear for easy access of the crewmember at all times during parachute descent prior to kit actuation.

* 3.4.2.5 Restraint subsystem automatic release. Provisions shall be incorporated to automatically release the crewmember from the seat system after ejection. Sequencing of the automatic release shall be compatible with the recovery parachute operation.

* 3.4.2.6 Ingress and egress devices. Any fastening devices provided on the restraint subsystem for normal ingress to, or egress from the seat system shall be easy to operate. The number of such devices shall be kept to a minimum and shall be designed so that they can be attached and detached by the crewmember without assistance.

3.4.2.7 Emergency restraint subsystem release. A restraint subsystem manual release shall be provided which shall incorporate the following features:

a. Actuation to release the crewmember from the seat system (including parachute and survival equipment) when the seat system is in the aircraft cockpit

b. Actuation to release the crewmember, recovery parachute, and survival equipment from the seat assembly after ejection from the aircraft

c. Actuation by a single motion, with a squeeze to release the safety latch, permitting actuation of the control

d. Release control designed and located so that it can be easily reached and actuated by a crewmember in the fully retracted position, including actuation by a pressurized pressure suit gloved hand, if applicable.

e. The release control shall include a lock mechanism which requires a separate reset function after the control has been actuated. The reset function shall not require the use of tools.

* 3.4.3 Initiation subsystem. All pre-ejection functions and firing of the seat system rocket catapult shall be accomplished by one complete extension of the ejection controls. The controls shall be integrated into loop-type handgrips on the forward portions of both sides of the seat bucket. The complete ejection sequence shall be initiated by a single, upward-and-aft movement of the handgrips. The motion of the ejection controls shall be irreversible, and the controls shall be interconnected to provide initiation of ejection when either or both of the controls are actuated. This subsystem shall be equipped with a safety lock, integrated into the controls, which must be released before actuation can be accomplished. The safety lock shall be designed to permit release during extension of the controls by a seated crewmember.

* 3.4.3.1 Pre-ejection functions. The following are required pre-ejection functions:

a. Initiation of crewmember positioning and restraint

b. Initiation of canopy and hatch removal

c. Initiation of ejection sequencing subsystem (where applicable).

* 3.4.3.2 Control forces. The force required to actuate each ejection control handgrip shall be 20 ±3 pounds.

* 3.4.3.3 Ground safety device. The seat system shall be protected against inadvertent actuation on the ground by a single safety device. The safety device shall positively lock the ejection controls in the stowed position. The linkage between ejection controls and system initiators shall be designed so that, when the controls are safetied, application of force to the linkage will not actuate the system. Additional ground safety devices shall be provided for protection during maintenance activities, but they shall be interconnected and located so they cannot remain installed when the aircraft is ready for flight. Streamers on the safety devices shall be provided in accordance with Drawing 52C1543.

* 3.4.3.4 Canopy and hatch removal. The seat system shall include provisions for positive, immediate removal of the aircraft canopy and hatch.

* 3.4.3.5 Ejection through the canopy. The ejection controls and initiation subsystem shall be designed to permit automatic ejection of the seat assembly through the canopy in the event the canopy jettison mechanism malfunctions. On those aircraft where ejection through the canopy is not permitted because of hatch or canopy construction, means shall be provided to prevent firing of the rocket catapult until the hatch or canopy has been jettisoned.

* 3.4.4 Ejection sequencing subsystem. For a multicrew aircraft requiring an ejection seat system, an ejection sequencing subsystem shall be provided. Sequencing shall be initiated by the command pilot as a pre-ejection function and shall not preclude the other crewmember(s) from initiating his own ejection.

The sequencing subsystem shall be designed to jettison canopies and eject the seat/man combinations in a manner to:

a. Provide protection of personnel from the rocket-catapult heat and blast effects

b. Ensure the escape of all crewmembers in minimum time

c. Preclude collisions between jettisoned canopies and ejected seat/man combinations

d. Preclude collisions between ejected seat/man combinations.

In training aircraft, the sequencing subsystem shall provide means for the instructor pilot to initiate the ejection from either ejection seat system position. Particular attention shall be directed toward assurance of minimum time between ejection initiation and separation of the last crewmember from the aircraft.

* 3.4.5 Ballistic subsystem. All propellant-actuated devices and cartridge-actuated devices shall conform to MIL-C-25918 and shall be approved by the procuring activity prior to installation. The energy required for actuation of mechanical or propulsion links may be transmitted either by transmission hose or by detonating transmission lines. Ballistic gas transmission hose shall conform to the -4 configuration of MIL-H-25579.

* 3.4.6 Propulsion subsystem. The seat system shall be provided with a rocket-catapult propulsion subsystem with sufficient impulse to assure aircraft tail clearance throughout the aircraft performance envelope, and, in conjunction with the parachute recovery system, provide recovery from high sink-rate conditions. The rocket catapult shall conform to MIL-C-25918 and shall be approved by the procuring activity prior to installation. The catapult action shall be aligned within 5° of the seat assembly back angle. The rocket thrust shall be as defined by the center-of-gravity (cg) envelope.

* 3.4.7 Stabilization subsystem. Provisions shall be incorporated for seat/man stability during free flight, including the period from rocket ignition through recovery parachute deployment. The stabilization subsystem shall become effective at the time of seat/aircraft separation and shall include the following characteristics:

a. Counteract rotations caused by: (1) the eccentricity between the dynamic cg and the rocket thrust line, and (2) aerodynamic forces

b. Control the application of deceleration forces. The ejection seat shall be stabilized in such a manner that the neutral direction of aerodynamic deceleration is eyeballs out or eyeballs in. Damped oscillations about the neutral direction of aerodynamic deceleration shall not exceed 20° in the pitch or yaw plane.

c. Maintain optimum attitude for recovery parachute deployment

d. Stabilize the seat/man combination in the spinal direction during free fall to the altitude aneroid setting for recovery parachute opening, following a high altitude ejection.

* 3.4.7.1 CG envelope. The cg envelope applicable to the stabilization subsystem for the seat system shall be the broadest envelope determined by surveying crewmember body sizes and authorized equipment combinations. Based upon the static cg locations for 5th and 95th percentile crewmembers, the cg envelope shall include a ±2.0-inch tolerance about each individual cg with respect to the rocket thrust line. The relationship of rocket thrust line to cg envelope shall be in accordance with the principle shown on figure 2; however, the cg envelope may not necessarily be totally above the thrust line.

* 3.4.8 Parachute recovery subsystem. The parachute recovery subsystem shall incorporate an Air Force approved and qualified canopy and shall be fully automatic upon ejection. The initiation of the recovery parachute shall be controlled by a multimode velocity, acceleration, or force-sensing device and an aneroid. The aneroid-actuating altitude of the recovery subsystem shall be 15,000 ±1,000 feet. At altitudes below the aneroid setting, the recovery parachute shall be deployed in the minimum time after ejection, consistent with human tolerances. The parachute shall be released from the crewmember by the actuation of not more than two releases.

3.4.8.1 Manual parachute deployment. Provision shall be incorporated for manual parachute deployment following ejection. An actuation handle for manual deployment shall be provided which can be easily reached and actuated by the crewmember either while still in the seat or while separated from the seat. The control shall be actuated by a force not greater than 27 pounds, using only one hand.

3.4.8.2 Seat/man separation. Seat/man separation shall be accomplished by the deployment and inflation of the recovery parachute. This separation shall be positive and shall prevent seat/man/parachute interference.

* 3.4.9 Survival subsystem. A survival kit in accordance with MIL-C-25570 shall be provided in the seat bucket, except that oxygen equipment and provisions shall not be included within the kit. The kit shall be restrained from lateral movement and from jumping over the seat lip during negative g maneuvers. The kit shall be attached to the personnel restraint subsystem and shall be automatically deployed in conjunction with the parachute recovery subsystem operation.

* 3.4.9.1 Personnel locator devices. A method shall be incorporated for automatically actuating personnel locator devices upon seat ejection. Any radio locator device antenna shall be routed to afford maximum signal capability. The automatic actuation feature shall include a rapid dearming capability which will permit dearming by the crewmember while he is in the seat.

3.4.10 System operation time. The total time from emergency escape initiation to full inflation of the recovery parachute shall not exceed 3 seconds at any altitude below the aneroid altitude setting of the recovery parachute.

* 3.4.11 Acceleration limitations. The acceleration limitations specified herein are given for acceleration measured or, during initial design verification, computed as acting at the seat bucket. The limitations pertain to the condition where the acceleration environment will not be amplified by the restraint system or seat cushion materials. The $+G_z$ limits are defined for a probability of spinal injury of 5 percent. The limits specified for other acceleration directions are not nominal limits for "no injury" but are maximum limits beyond which disabling injury can be expected.

* 3.4.11.1 Ejection acceleration. The acceleration imposed on the seat occupant in the $+G_z$ direction (parallel to the spinal column) by the ejection catapult shall be limited in terms of dynamic response index (DRI) values calculated according to the method described in 6.5.1. If the acceleration vector is not parallel (within 5°) to the z axis, the acceleration limitations specified in 3.4.11.2 shall be used. The limits for specific catapult pre-ignition temperature and ejected weight representing the ejection seat, personal equipment, and 50th percentile human body weight are as follows:

a. The mean acceleration time history generated at a pre-ignition temperature of $70^{\circ}F$ shall not yield a DRI value in excess of 18.0 with an allowable standard deviation of 1.0.

b. The mean acceleration time history generated at a pre-ignition temperature of 165°F shall not yield a DRI value in excess of 22.0 with an allowable standard deviation of 1.0.

* 3.4.11.2 Acceleration after aircraft separation. The seat acceleration due to catapult thrust and aerodynamic deceleration shall be limited to satisfy the following equation:

$$\sqrt{\left(\frac{DRI}{DRI_L}\right)^2 + \left(\frac{G_x}{G_{xL}}\right)^2 + \left(\frac{G_y}{G_{yL}}\right)^2} \leq 1.0$$

where:

DRI is the dynamic response index value computed for the z axis component of the acceleration time history using the method specified in 6.5.1.

DRI_L is the limit value of the DRI. The value of DRI_L shall be 18 unless the resultant acceleration vector is more than 5 conical degrees off the z axis and aft of the plane of the seat back, in which case the value of DRI_L shall be 16.

G_x, G_y are the acceleration magnitudes of the x and y axis components of the acceleration time history that are determined using the technique described in 6.5.2.

G_{xL} is the limit value for the x axis (fore and aft) of figures 3, 4, and 5.

G_{yL} is the limit value for the y axis (sideways) of figure 6.

Note: In cases where there are acceleration components acting in the $-G_z$ direction, the equation shall be solved using:

$\frac{-G_z}{-G_{z_L}}$ in place of $\frac{DRI}{DRI_L}$ where $-G_z$ is the -z direction and

$-G_{z_L}$ is the limit value for the -z direction of figures 7 and 8.

* 3.4.12 Design escape capability. The seat system shall be designed to provide the following safe escape capabilities which shall be verified by analysis:

a. Aircraft performance envelope - All flight attitudes and load factors within the design limit structural strength of the aircraft and within the velocity-altitude envelope of the aircraft, except that the maximum velocity shall be 600 knots equivalent airspeed (KEAS)

b. Zero altitude (level) - From zero airspeed up to maximum velocity of the aircraft, except that the maximum velocity shall be 600 KEAS

c. Low level - Under low altitude, adverse attitude conditions including, but not limited to those specified in table I.

TABLE I. Low Level Escape Performance 1/

Attitude		Velocity (knots)	Altitude (feet)
Fore and aft	Roll angle		
Level	60°	120	0 2/
Level	180°	150	200
Level	0°	150	300 3/
60° down	0°	200	500
30° down	0°	450	500
60° down	60°	200	550
45° down	180°	250	600

1/ Unless otherwise specified, the cited conditions are at the initiation of the escape sequence.

2/ Impact occurs at instant of seat/aircraft separation.

3/ 10,000 feet per minute sink rate.

d. CG locations - Under the preceding conditions with the cg location for any crewmember from the 5th to 95th percentile, with flight clothing and survival/personal equipment as shown on figure 2.

3.4.12.1 Design verification. Initial verification of the seat system escape design shall be accomplished through use of a 6 degree of freedom computer program. A maximum amount of actual test data available from system tests shall be used to refine the computer program.

3.4.13 Precautions against component misinstallation. Cartridge-actuated devices, propellant-actuated devices, and other replaceable components shall be designed to preclude improper installation which could adversely affect the proper functioning of the seat system or its subsystems.

* 3.4.14 Reliability. The minimum acceptable probability of success is 0.98 at the 90-percent lower confidence limit. A reliability analysis shall be conducted as required by MIL-STD-785 and shall include the following:

a. Full description of the component parts to be used in the seat system, with logic diagrams and functional block diagrams to show the relationships of the components to the reliability of the seat system

b. Specific techniques used for allocating quantitative requirements to the components, and the allocated values

c. Analysis of potential modes of failure, their probable cause and effects on performance and reliability, the severity of these effects, the probability of occurrence, and the degree of protection afforded by the design against failure occurrence or their adverse results.

* 3.4.15 Maintainability. The seat system shall require not more than 1 manhour of maintenance downtime, as defined in MIL-STD-721, per flight hour of the aircraft.

* 3.4.16 System safety program. The system safety program shall comply with the applicable requirements of MIL-STD-882.

3.5 Construction

* 3.5.1 Methods. Riveting or welding may be used in the construction of the seat system where permanent attachments are made. Fittings and joints requiring disassembly for maintenance shall be attached by bolting or other suitable removable attachment.

* 3.5.2 Projections. The seat system shall be free of any projections or sharp edges which could snag, jam, or damage clothing and equipment, injure the seat occupant or maintenance personnel, foul personal equipment, jeopardize operation of seat components, or interfere with recovery parachute operation.

* 3.5.3 Drain holes. Drain holes shall be provided in the bottom of the seat bucket and in any enclosures where water could accumulate.

3.6 Performance

3.6.1 Ballistic transmission flow. The ballistic gas transmission hose and fittings shall provide free flow in accordance with the design schematic of the ballistic subsystem.

3.6.2 Structural strength

* 3.6.2.1 Proof loads. The seat system shall withstand the following proof loads without permanent deformation:

a. Front edge of seat bucket - 270 pounds downward, distributed 1-1/2 inches each side of centerline

b. Armrest - 135 pounds downward, 4 inches aft of forward edge

c. Ejection controls - 200 pounds tension, center of gripping surface

d. Headrest - 330 pounds aftward, distributed over 2-inch-square area at center of headrest

e. Seat back - 1,000 pounds aftward, perpendicular to surface, uniformly distributed (below the headrest).

* 3.6.2.2 Ultimate loads. The seat system shall withstand the following ultimate loads without fracture of materials or failure of attachments:

a. Front edge of seat bucket - 400 pounds downward, distributed 1-1/2 inches each side of centerline

b. Armrest - 200 pounds downward, 4 inches aft of forward edge

c. Ejection controls - 300 pounds tension, center of gripping surface

d. Headrest - 500 pounds aftward, distributed over 2 inch-square area at center of headrest; 40 times the weight of the headrest assembly forward, through the cg of the headrest assembly

e. Seat back - 1,500 pounds aftward, perpendicular to surface, uniformly distributed (below the headrest)

f. Restraint subsystem - 8,600 pounds forward, through the occupant cg; 20° to each side of forward; and 1,750 pounds downward, through the occupant cg

g. Seat system - 8,600 pounds plus 40 times the seat system weight forward and 20° to each side of forward, respectively, through the occupant and seat system combination cg; and 4,300 pounds plus 25 times the seat system weight downward, through the occupant and seat system combination cg.

h. Ejection airload - The ejection airload (simulating the dynamic pressure loads imposed upon the seat and its occupant by windblast during ejection from the aircraft) as applied normal to the centerline of the rollers (or slide blocks) and through the combined center of pressure of the exposed portion of the seat and its occupant, distributed over that portion of the seat back exposed to the airstream. For the application of this load, the seat shall be positioned on the rails (or slide blocks) in the most structurally critical position. The ejection airload shall be applied simultaneously with the applicable rocket-catapult load. The ejection airload shall be computed in accordance with conventional methods of aerodynamic computation and shall be subject to approval by the procuring activity. The critical condition for computation of the ejection airload shall be assumed to be the maximum free-stream dynamic pressure associated with the ejection seat system performance. The computed load shall be considered an ultimate load at maximum aircraft speed or 600 KEAS, whichever is less.

* 3.6.3 Environmental conditions. The seat system shall be capable of satisfactory operation under the following conditions and shall withstand the applicable tests specified in section 4 without degradation in performance:

a. Operation at temperatures from -65° to +160°F

b. Vibration which may be experienced within the aircraft structural limits

c. Exposure to salt-laden atmosphere

d. Exposure to a warm, highly humid atmosphere as encountered in tropical climates

e. Exposure to rainfall as encountered in any locale

f. Shock which may be experienced within the mechanical shock environment expected in service use. The seat shall not become detached from the attachment points during crash safety shock conditions as specified in 4.6.6.9.

g. Exposure to dust

h. Explosive decompression conditions which may be encountered in service use.

3.6.3.1 Windblast. The capability for successful seat ejection shall not be adversely affected by windblast conditions at maximum aircraft airspeed or 600 KEAS, whichever is less. Some examples of unacceptable conditions resulting from windblast are as follows:

a. Disconnected personal leads

b. Adversely distorted personal leads

c. Flailing of personal leads or equipment

d. Restraint subsystem failure

e. Inadequate restraint for arms, legs, or body

f. Inadequate installation of seat components.

3.6.3.2 Fungus. All nonmetallic materials used in the construction of the seat system shall withstand exposure to fungi without deterioration when tested as specified in 4.6.6.12.

3.6.4 Flame resistance. All upholstery and cover materials shall meet the flame-resistance test specified in 4.6.7.

* 3.6.5 Ejection. The seat system shall recover the dummies utilized in all ejection tests conducted in accordance with 4.6.8 without exceeding the acceleration limitations specified in 3.4.11.

3.7 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in manufacturer's part numbers shall be governed by the requirements of MIL-STD-100.

* 3.8 Dimensions. The critical dimensions of the seat system shall be as specified on figures 1 and 9.

* 3.9 Weight. The weight of the seat system shall be kept to a minimum consistent with the escape requirements and the performance of the aircraft.

* 3.10 Colors. The color of the basic ejection seat shall be medium gray, color 36231 of FED-STD-595. The headrest and armrest upholstery shall be red maroon, color 21136. The ejection controls shall have alternate stripes of 3/4-inch-wide orange-yellow, color 13538, and 1/4-inch-wide black, color 37038.

3.11 Finishes and protective treatments

3.11.1 Protective chemical treatment of metals. Aluminum alloy parts shall be anodically treated in accordance with MIL-A-8625. Noncorrosion-resistant steel parts shall be cadmium plated in accordance with QQ-P-416 or zinc plated in accordance with QQ-Z-325. Magnesium alloy parts shall be protected from corrosion in accordance with MIL-M-3171.

3.11.2 Protective organic treatment of metals. Subsequent to the application of approved chemical treatment, all exposed metal surfaces shall be given at least one coat of zinc-chromate primer in accordance with MIL-P-8585.

3.11.3 Finish. Two coats of aircraft enamel in accordance with TT-E-489 shall be applied over all zinc-chromate-treated surfaces of the basic ejection seat.

3.12 Markings

* 3.12.1 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. A nameplate, permanently and legibly marked in accordance with MIL-STD-130, shall be securely attached to the ejection seat in a location where it can be read without removal of the seat from the aircraft.

* 3.12.2 Transmission hose and fluid lines. All ballistic transmission hose or detonating transmission lines shall be marked for identification in accordance with MIL-A-25165. All fluid lines shall be marked in accordance with MIL-STD-1247.

3.13 Workmanship. The seat system, including all parts and accessories, shall be fabricated and finished with workmanship acceptable to Government requirements. Particular attention shall be given to freedom from defects, burrs, and sharp edges; accuracy of dimensions, radii, fillets, and marking of parts and assemblies; thoroughness of welding, brazing, painting, and riveting; alignment of parts and tightness of assembly screws and bolts; etc.

4. QUALITY ASSURANCE PROVISIONS

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

* 4.2 Classification of inspections. The examination and testing of the ejection seat system shall be classified as follows:

a. Preproduction inspection

b. Quality conformance inspection.

* 4.3 Test conditions. Unless otherwise specified, all tests required by this specification shall be made at an ambient pressure of 28 to 32 inches of mercury, a temperature of $75^{\circ} \pm 20^{\circ}$F, and a relative humidity of 80 percent or less. Where tests are made with atmospheric pressure or temperature substantially different from the above values, proper allowance shall be made for the change in instrument reading.

* 4.4 Preproduction inspection. Preproduction inspection shall consist of all the examinations and tests described under 4.6.

* 4.4.1 Preproduction samples. The preproduction samples shall consist of:

a. One complete ejection seat system unless otherwise indicated in the approved preproduction test plan

b. Material samples as required to conduct the material tests specified herein.

* 4.4.2 Test plan. A test plan shall be prepared to describe the test objectives, quantities to be tested, test schedule, testing facility and location, instrumentation types and accuracy, test parameters to be recorded, and data reduction and analysis techniques.

* 4.4.3 Order of testing. Unless otherwise specified, tests shall be conducted in the following order:

a. Any required component tests

b. Structural and environmental tests

c. Ground, track, and flight escape tests.

* 4.5 Quality conformance inspection. Quality conformance inspection shall consist of:

a. Individual inspection

b. Sampling inspection.

* 4.5.1 Individual inspection. Each seat system shall be subjected to the following examination and test as described under 4.6:

a. Examination of product

b. Ballistic transmission flow.

* 4.5.2 Sampling inspection. The sampling inspection shall consist of the following examination and tests as described under 4.6:

a. Examination of preparation for delivery

b. Structural strength

c. Ejection control forces.

* 4.5.2.1 Inspection lot. An inspection lot shall be expressed in units of complete ejection seat systems manufactured under essentially the same conditions and submitted for acceptance at substantially the same time.

* 4.5.2.2 Sampling plan. Sampling shall be in accordance with MIL-STD-105, acceptable quality level (AQL) of 1.5 and special inspection level S-4. Failure of the structural strength or the ejection control forces test by any unit shall be classified as a critical defect and the provisions of the acceptance and rejection paragraph entitled "Special Reservation for Critical Defects" of MIL-STD-105 shall apply.

4.6 Inspection methods

* 4.6.1 Examination of product. Each seat system shall be carefully examined to determine conformance to this specification and applicable drawings with respect to materials, workmanship, standard parts, weight, finish, adjustments, dimensions, amd markings. Special attention shall be given to the ejection control mechanism.

* 4.6.2 Examination of preparation for delivery. Inspection of the preservation, packaging, packing, and marking shall be in accordance with section 5.

* 4.6.3 Ballistic transmission flow. The ballistic gas transmission hose and fittings shall be subjected to a flow test, based upon the design schematic of the ballistic subsystem. The plumbing connections to the propellant-actuated devices shall be disconnected for the performance of this test. The fluid used shall be dry air or dry nitrogen at a pressure not greater than 450 psig. Any flow condition or restriction of flow which is not in accordance with the design schematic shall be cause for rejection.

* 4.6.4 Structural strength. The ejection seat shall be mounted on the ejection rails and retained in a test jig which simulates the attachments and interfaces of the ejection seat and rails within the aircraft structure. Under these conditions, the seat systems shall be subjected to and shall withstand the required ultimate loads for preproduction inspection and the required proof loads for sampling inspection as specified under 3.6.2. These loads shall be applied to the seat without cushions. The loads may be applied by means of hydraulic or pneumatic press, jacks, shot bags, or other suitable method. The restraint subsystem shall be tested by applying the loads to a block or frame fitted within the seat and held in place by the restraint subsystem. The block or frame shall be formed to simulate operational use of the restraint subsystem.

* 4.6.5 Ejection control forces. Each ejection control handgrip shall be actuated. The force required for actuation shall be measured and shall meet the requirement specified in 3.4.3.2.

* 4.6.6 Environmental tests

* 4.6.6.1 High temperature. The seat system shall be subjected to a high temperature test in accordance with method 501, procedure I of MIL-STD-810, except that step 4 shall be omitted. Steps 5 and 7 shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.2 Low temperature. The seat system shall be subjected to a low temperature test in accordance with method 502, procedure I of MIL-STD-810. The temperature for step 4 shall be -65°F. Steps 5 and 7 shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.3 Vibration. The seat system shall be subjected to a vibration test in accordance with method 514, procedure I, curve D of MIL-STD-810. Equipment operation shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.4 Salt fog. The seat system shall be subjected to a salt fog test in accordance with method 509, procedure I of MIL-STD-810. Equipment operation shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.5 Humidity. The seat system shall be subjected to a humidity test in accordance with method 507, procedure I of MIL-STD-810. Step 7 shall include operation of the ejection controls, seat adjustment, and inertia reel control. In addition, these operations shall be performed at the end of five cycles (120 hours), with the condensation remaining on the seat system.

* 4.6.6.6 Rain. The seat system shall be subjected to a rain test in accordance with method 506, procedure I of MIL-STD-810. Equipment operation shall include operation of the ejection controls, seat adjustment, and inertia reel control. Operation during the rain is not required.

* 4.6.6.7 Temperature shock. The seat system shall be subjected to a temperature shock test in accordance with method 503, procedure I of MIL-STD-810. Step 9 shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.8 Dust. The seat system shall be subjected to a dust test in accordance with method 510, procedure I of MIL-STD-810. Step 5 shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.9 Shock. The seat system shall be subjected to a shock test in accordance with method 516, procedures I and III of MIL-STD-810. The shock pulse shape shall be in accordance with figure 516-1, amplitude a and time duration c. Equipment operation shall include operation of the ejection controls, seat adjustment, and inertia reel control.

* 4.6.6.10 Explosive decompression. The seat system shall be subjected to an explosive decompression from 8,000 feet equivalent altitude to the maximum cruise altitude of the aircraft within 100 milliseconds. After this exposure, operation of the ejection controls, seat adjustment, and inertia reel control shall be tested.

* 4.6.6.11 Windblast. The seat system, with a dummy properly restrained for ejection, shall be exposed to windblast of 600 ±20 KEAS (or maximum aircraft airspeed ±3 percent, if less than 600 KEAS) for a minimum of 0.3 second in each of the following attitudes, emerging into the airstream during ejection:

a. Fully exposed, in line with guide rails

b. 45° rotation to right

c. 90° rotation to right

d. 45° rotation to left

e. 90° rotation to left

f. 30° pitch forward

g. 30° pitch aft.

Photographic coverage of each windblast exposure test shall include a minimum of two high-speed motion picture cameras (2,000 frames per second, or greater), located to provide maximum coverage of exposed portions of the seat system. No conditions which would adversely affect the capability for successful seat ejection shall occur during the windblast exposures (see 3.6.3.1 for examples of unacceptable conditions).

* 4.6.6.12 Fungus. Samples of all nonmetallic materials used in the construction of the seat system shall be subjected to a fungus test in accordance with method 508, procedure I of MIL-STD-810.

* 4.6.7 Flame resistance. Samples of all upholstery and cover material shall be tested in accordance with method 5906 of FED-STD-191. The burning rate shall not exceed 4 inches per minute. In addition, if the specimens do not support combustion after the ignition flame is applied for 15 seconds, or if the flame extinguishes itself and subsequent burning without a flame does not extend into the undamaged areas, the material shall also be acceptable.

* 4.6.8 Ejection. Ejection tests of the seat system shall be conducted in accordance with MIL-STD-846.

* 4.6.9 Reliability. A reliability of 0.90 with a 0.90 confidence level shall be demonstrated by satisfactory completion of 22 consecutively successful system tests as required by MIL-STD-846.

* 4.6.10 Maintainability verification. Time studies of all corrective maintenance tasks shall be conducted by simulating failures. Timing of each maintenance task shall be performed at least three times to determine average values. The maintenance tasks considered shall be only those related to field level maintenance. The time to accomplish each maintenance task shall include time for preparation, recognition, fault location, removal (based only on the installation provisions of the item), fault correction, adjustment and realignment, final test, and replacement, but shall exclude supply time and administrative time. In the case of repetitive subtasks which occur by the

nature of the sequence of maintenance actions (e.g., removal), it shall not be necessary to redetermine the average time required. Recommended preventive maintenance tasks shall be identified, with associated required task times, based either upon time studies performed or upon experience data already available.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A. Each seat system shall be preserved and packaged in accordance with MIL-P-116, method IIA.

5.1.2 Level C. Seat systems shall be preserved and packaged in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from the supply source to the first receiving activity for immediate use. This level may conform to the supplier's commercial practice provided the latter meets the requirements of this level.

5.1 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A. Seat systems preserved and packaged as specified in 5.1.1 shall be packed in overseas-type shipping containers conforming to PPP-B-601 or PPP-B-621. Insofar as practical, shipping containers shall be of uniform shape and size, of minimum cube and tare consistent with the protection required, and shall contain identical quantities. The gross weight of each shipping container shall not exceed the weight limitation of the specification. Containers shall be closed and strapped in accordance with the specification and appendix thereto.

5.2.2 Level B. Seat systems preserved and packaged as specified in 5.1.1 shall be packed in a domestic-type shipping container conforming to PPP-B-601 or PPP-B-621. The unit container, closed and strapped in accordance with the applicable appendix of the container specification, shall be the shipping container.

5.2.3 Level C. Seat systems shall be packed in a manner that will afford adequate protection at the lowest rate against damage during direct domestic shipment from the supply source to the first receiving activity for immediate use. This level shall conform to applicable carrier rules and regulations and may be the supplier's commercial practice provided the latter meets the requirements of this level.

5.3 Physical protection. Cushioning, blocking, and bracing shall be in accordance with MIL-STD-1186, except that for domestic shipments, waterproofing requirements for cushioning materials and containers shall be waived. Drop tests of MIL-STD-1186 shall be waived when the item is preserved, packaged, and packed for immediate use or when the drop tests of MIL-P-116 are applicable.

5.4 Inspection window. An inspection window shall be provided on method IIA packages in accordance with MIL-P-116 and shall be so located that the humidity indicator can be readily viewed.

5.5 Marking. Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The upward ejection seat system covered by this specification is intended for use by all crewmembers in aircraft requiring upward emergency escape.

* 6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification

b. Whether canopy piercers are required (see 3.4.1.5)

c. Flight clothing and personal equipment to be considered (see 3.4.1.7)

d. Applicable levels of preservation, packing, and packaging (see 5.1 and 5.2).

* 6.3 Data. For the information of contractors and contracting officers, any of the data referenced in this specification or specified in applicable documents listed in section 2 or in referenced lower-tier documents need not be prepared for the Government and should not be furnished to the Government unless specified in the contract or order. The data to be furnished should be listed on DD Form 1423 (Contractor Data Requirements List), which should be attached to and made a part of the contract or order.

* 6.4 Definitions. For the purpose of this specification, the following definition will apply:

* 6.4.1 Seat reference point. The seat reference point is the point at which the centerline of the seat back surface (depressed) and seat bottom surface (depressed) intersect. When the seat is positioned at the midpoint of the adjustment range, this intersection is called the neutral seat reference point.

6.5 Techniques

* 6.5.1 Determination of dynamic response index (DRI). The DRI is representative of the maximum dynamic compression of the vertebral column of the human body. In physical terms, the DRI is calculated by mathematically describing the human body in terms of an analogous, lumped parameter, mechanical model consisting of a mass, spring, and damper. The DRI is determined from the following equations:

$$\frac{d^2\delta}{dt^2} + 2\zeta\omega_n \frac{d\delta}{dt} + \omega_n^2 \delta = \frac{d^2 Z}{dt^2}$$

$$DRI = \frac{\omega_n^2 \delta_{max}}{g}$$

Where:

δ - compression of the spring in feet

ζ - 0.224 (damping ratio of the model)

ω_n - 52.9 radians/sec (undamped natural frequency of the model)

$\frac{d^2 Z}{dt^2}$ - Z axis output acceleration from the seat bucket in ft/sec^2

t - time in seconds

g - 32.2 ft/sec^2 (acceleration due to gravity)

Substituting given numerical values, these equations become:

$$\frac{d^2\delta}{dt^2} + 23.7 \frac{d\delta}{dt} + 2798\,\delta = \frac{d^2 Z}{dt^2}$$

$$DRI = 86.9\ \delta_{max}$$

* 6.5.2 Graphic approximation technique. Based upon acceleration time plots from measurements or computations, rise time, plateau duration, and g values in the x and y axes at a specific time may be obtained using the following graphic approximation technique, as shown on figure 10.

a. Establish the calibration baseline, correcting for any gravity bias acceleration.

b. Establish the maximum (peak) acceleration magnitude.

c. Construct a reference line parallel to the calibration baseline at a magnitude equal to 10 percent of the peak acceleration. The intersection of this line with the acceleration time plot defines points 1 and 2.

d. Construct a second reference line parallel to the calibration baseline at a magnitude equal to 90 percent of the peak acceleration. The intersection of this line with the acceleration time plot defines points 3 and 4.

e. Construct the onset line defined by the straight line through points 1 and 3.

f. Construct the offset line defined by the straight line through points 2 and 4.

g. Construct a line parallel to the calibration baseline, through the peak acceleration. The time interval defined by the intersections of this line with the constructed onset and offset lines (points 5 and 6) is the plateau duration (Δt).

h. Locate the intersection of the constructed onset line with the calibration baseline (point 7). The time interval defined by points 7 and 5 is the rise time (T_R).

i. For a given plot of accelerations in the x and y axes, the specific g values are graphically obtained from the constructed onset and offset lines for the specific time at which the summation vector of acceleration is the greatest. An example is shown on figure 11.

* 6.6 AFSC Design Handbook 1-3 is the reference document for anthropometric data on Air Force personnel.

6.7 The margins of this specification are marked with an asterisk to indicate where changes from the previous issue were made. This was done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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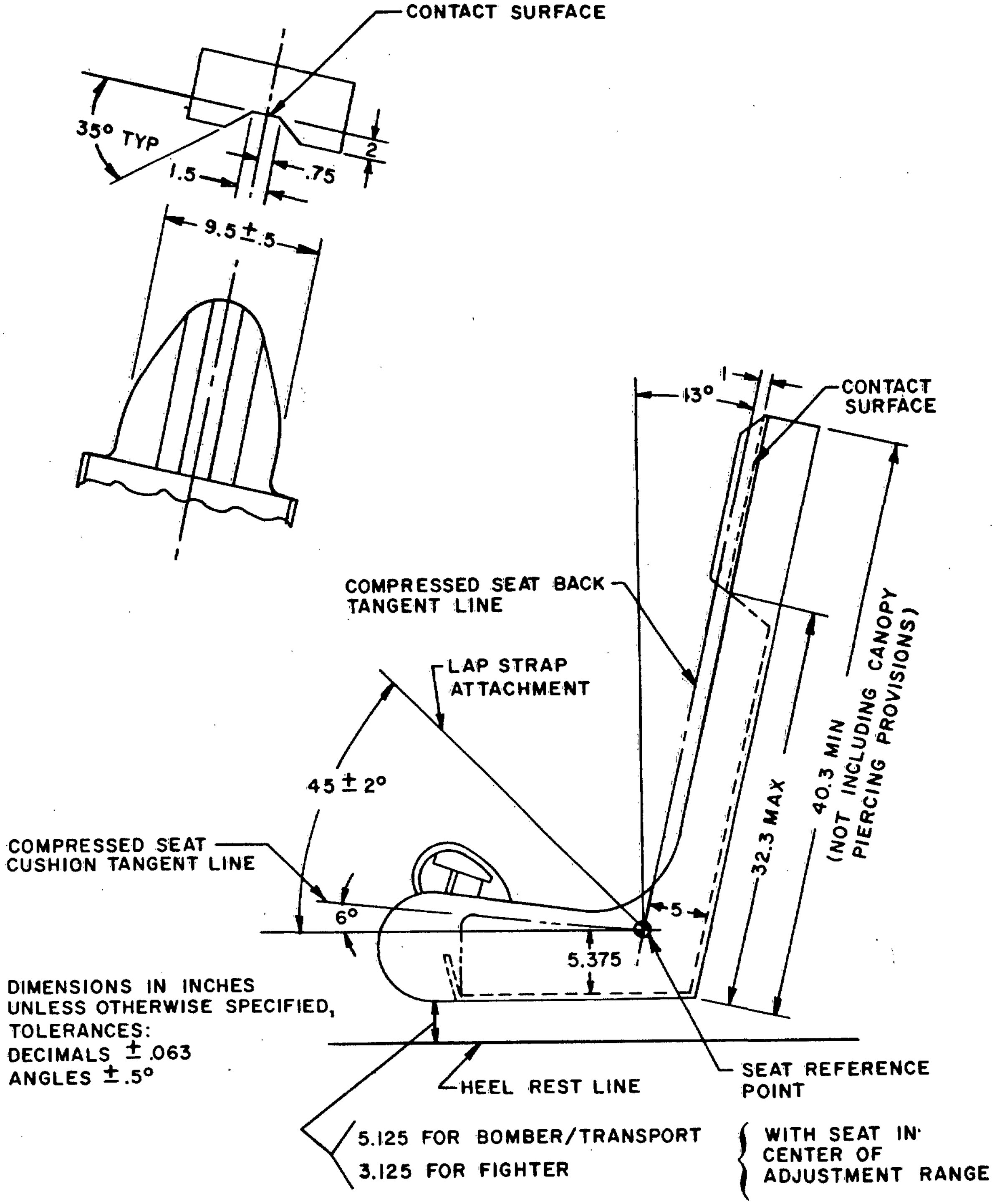
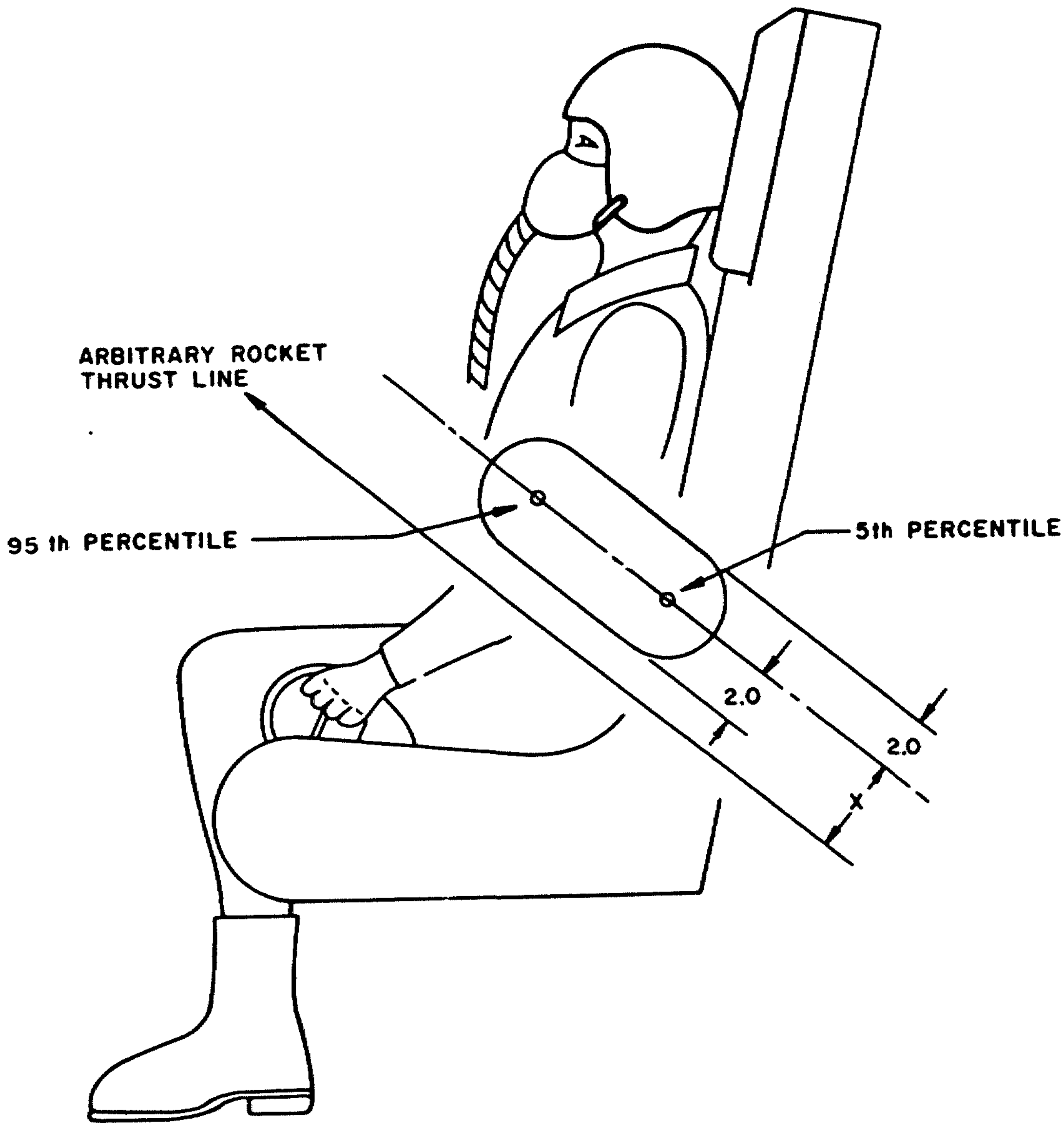
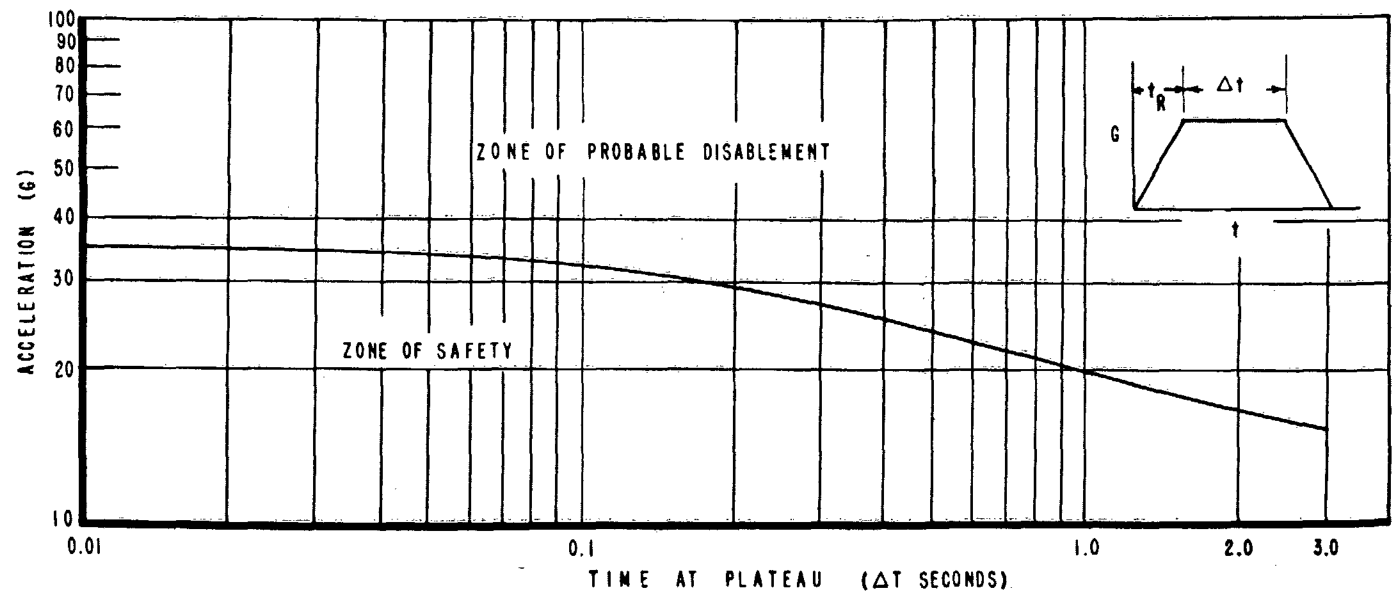


FIGURE 1. Side View of Seat with Example of Headrest Details



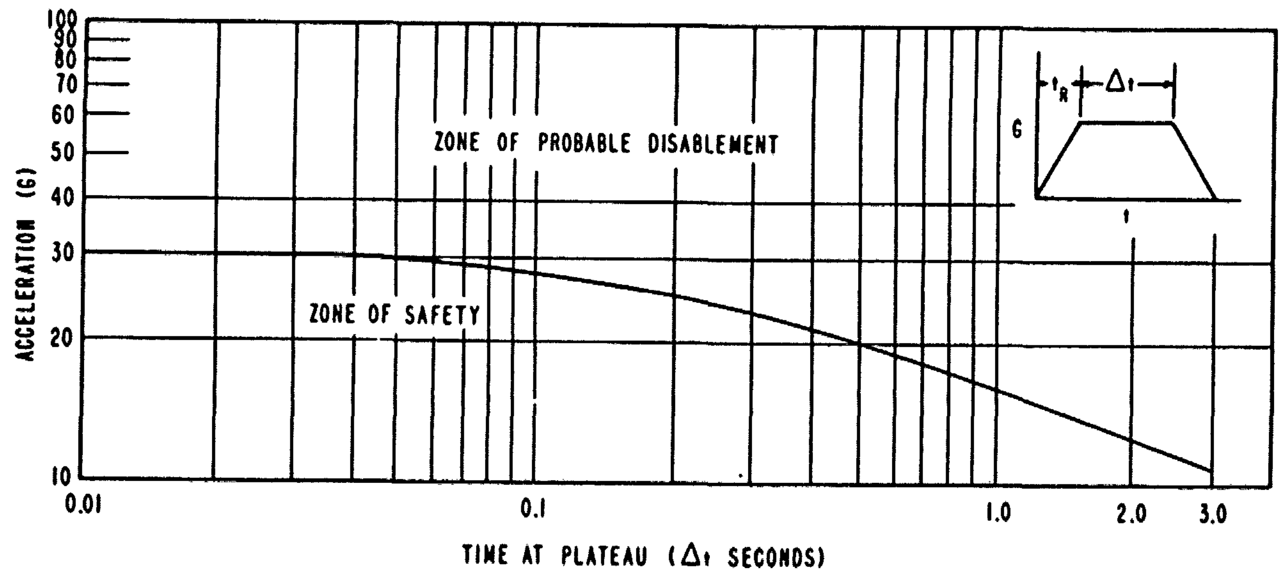
DIMENSIONS IN INCHES.

FIGURE 2. Center-of-Gravity Envelope Example



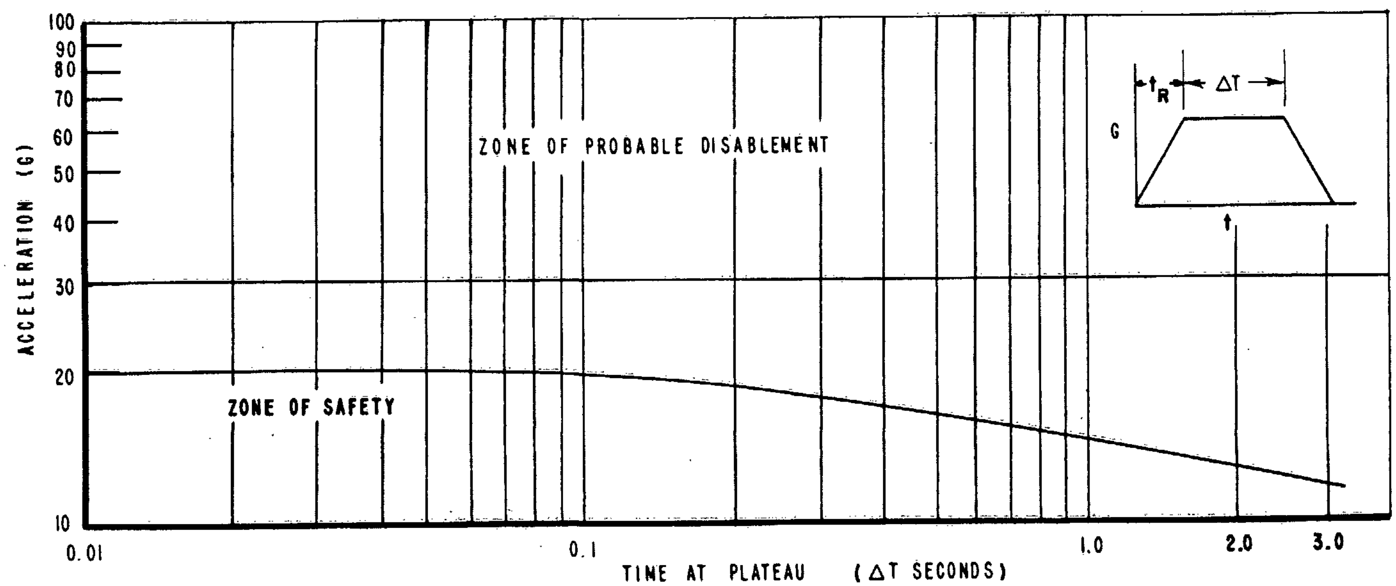
Δt (SEC)	0-.03	.06	.084	.13	.15	.19	.22	.27	.32	.38	.45	.52	.61	.73	.87	1.0	1.22	1.5	1.92	2.45	3.0
G	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15

FIGURE 3. Acceleration Limit ($+G_{xL}$) (Rise Time ≥ .03 Sec)



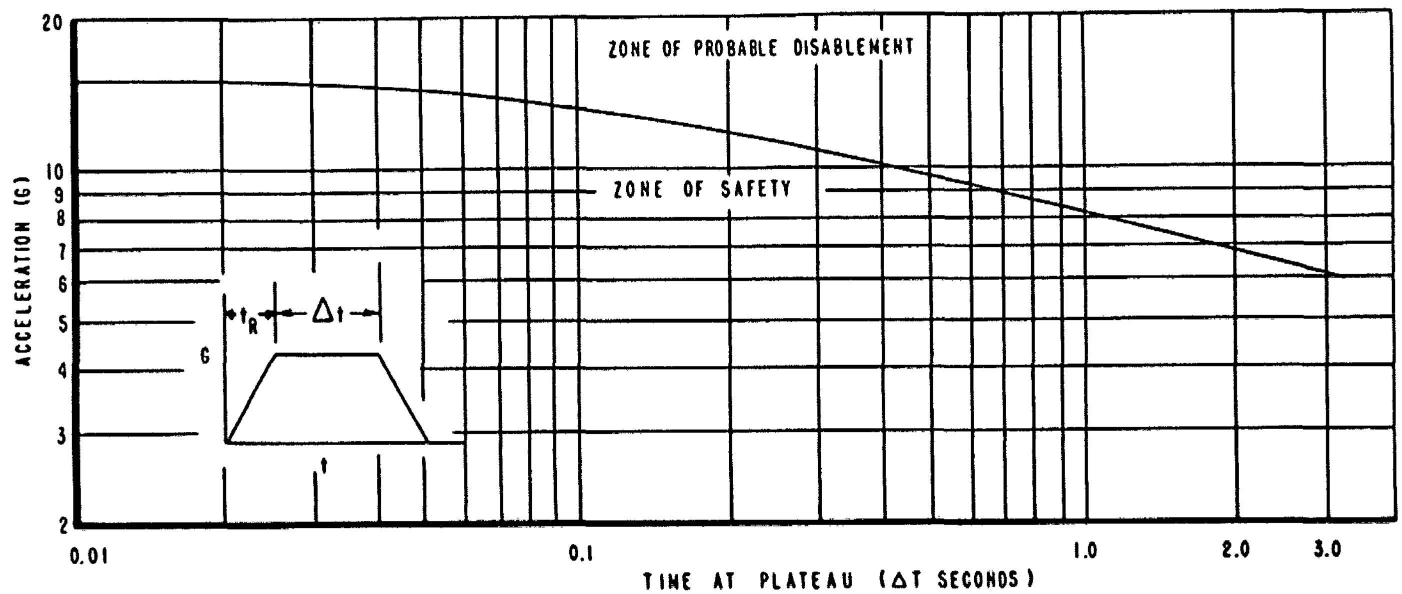
Δt (SEC)	0-.03	.05	.08	.11	.15	.2	.23	.30	.33	.38	.45	.6	.75	.9	1.0	1.2	1.5	1.9	2.5	3.0
G	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11

FIGURE 4. Acceleration Limit ($-G_{xL}$) (Rise Time ≥ .03 Sec)



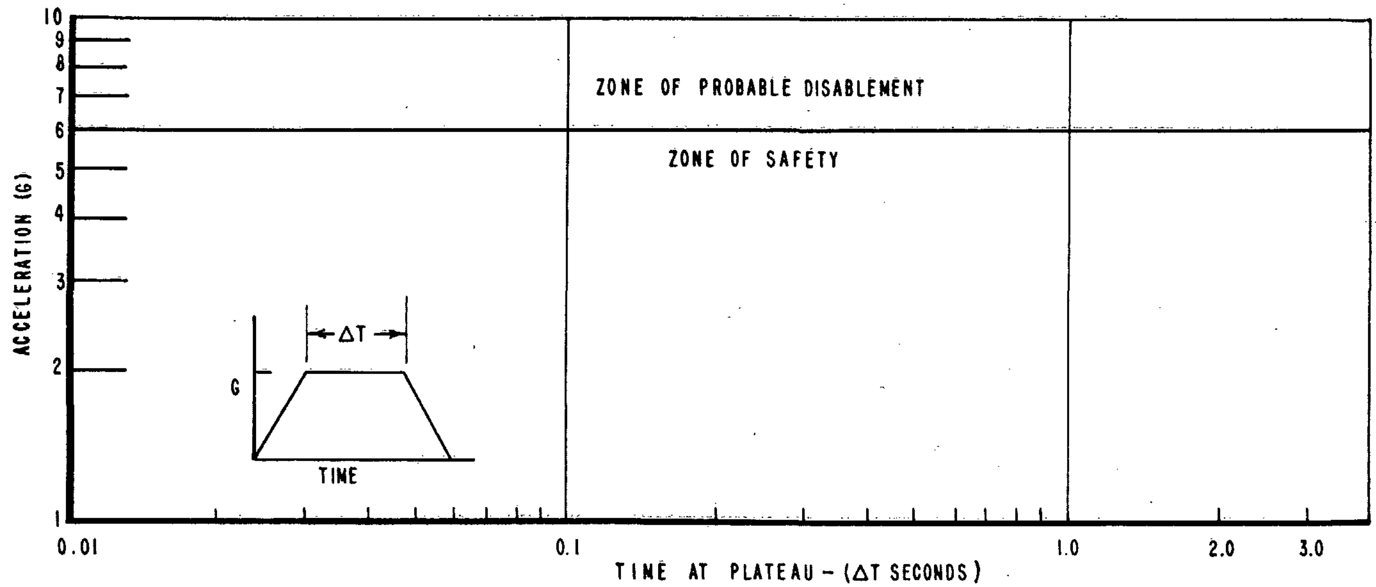
Δt (SEC)	0-.03	.085	.15	.25	.36	.52	.75	1.1	1.6	3.0
G	20	19.5	19	18	17	16	15	14	13	11.5

FIGURE 5. Acceleration Limit ($\pm G_{x_L}$) (Rise Time < .03 Sec)



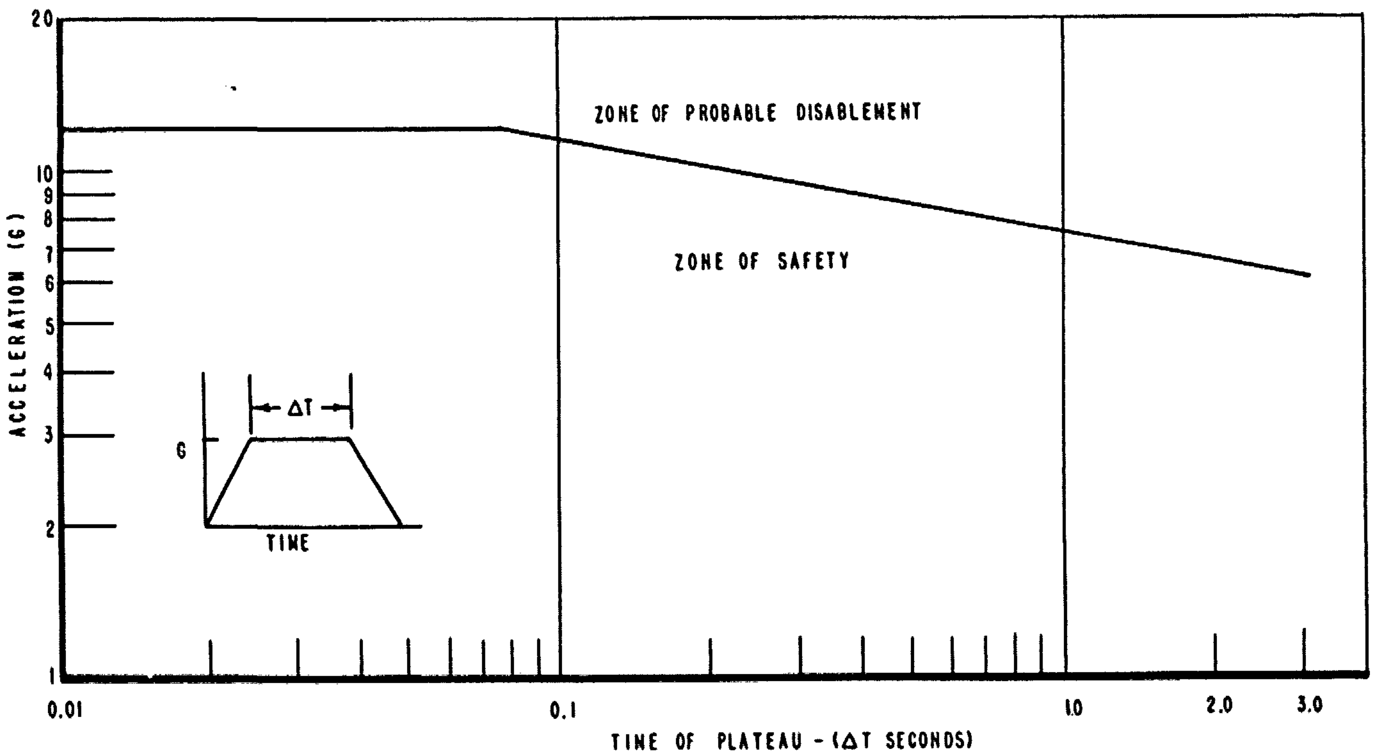
Δt (SEC)	0-.03	.06	.11	.18	.28	.41	.62	.96	1.6	3.0
G	15	14	13	12	11	10	9	8	7	6

FIGURE 6. Acceleration Limit ($\pm G_{y_L}$) (Any Rise Time)



PLATEAU	DURATION M SEC	0-3000
	MAGNITUDE G	6

FIGURE 7. Acceleration Limit for $-G_z$ (Rise Time < .04 Sec)



PLATEAU	DURATION MSEC	80	126	208	360	666	1340	3000
	MAGNITUDE G	12	11	10	9	8	7	6

FIGURE 8. Acceleration Limit for $-G_z$ (Rise Time $\geq$ .04 Sec)

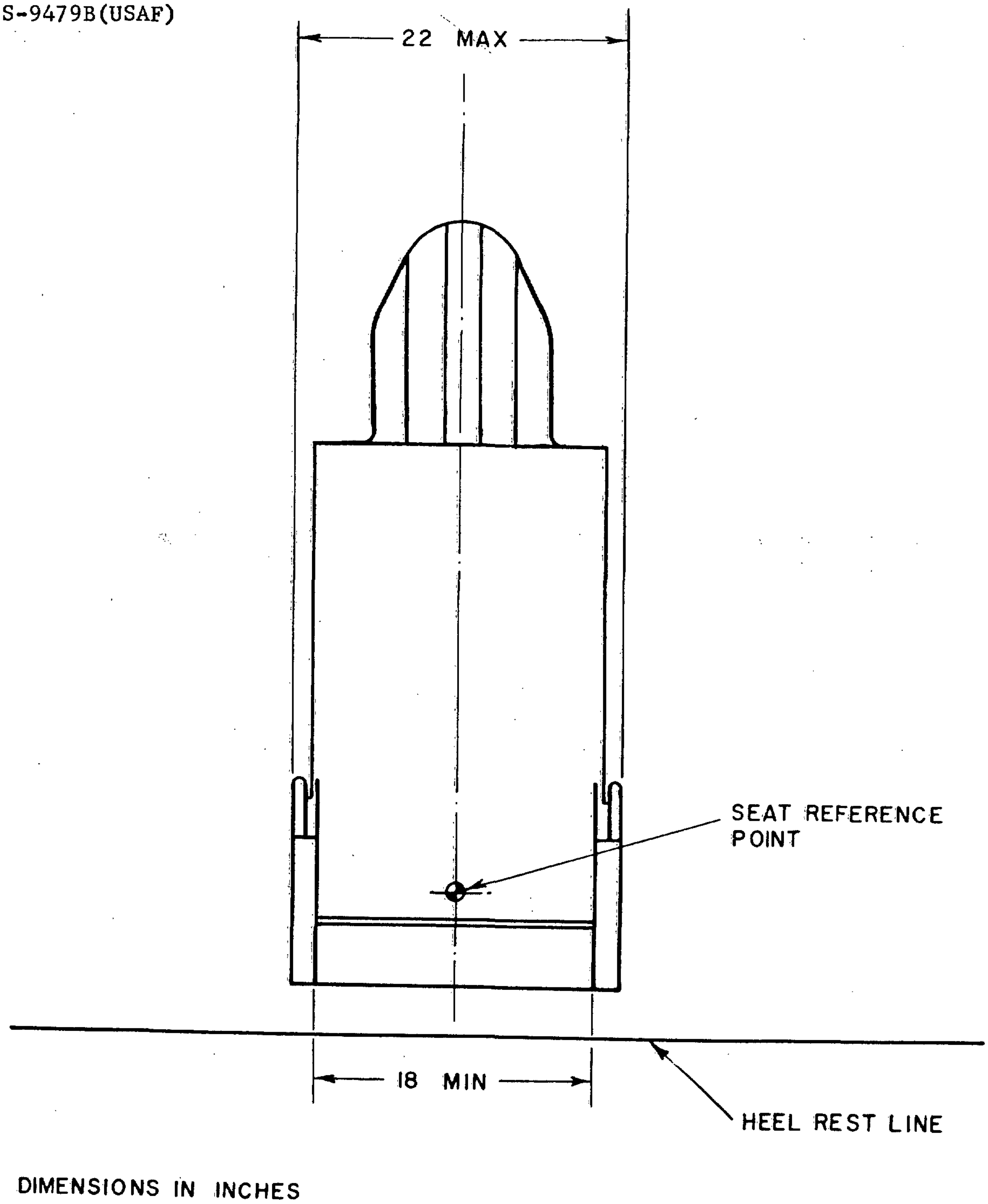


FIGURE 9. Front View of Seat

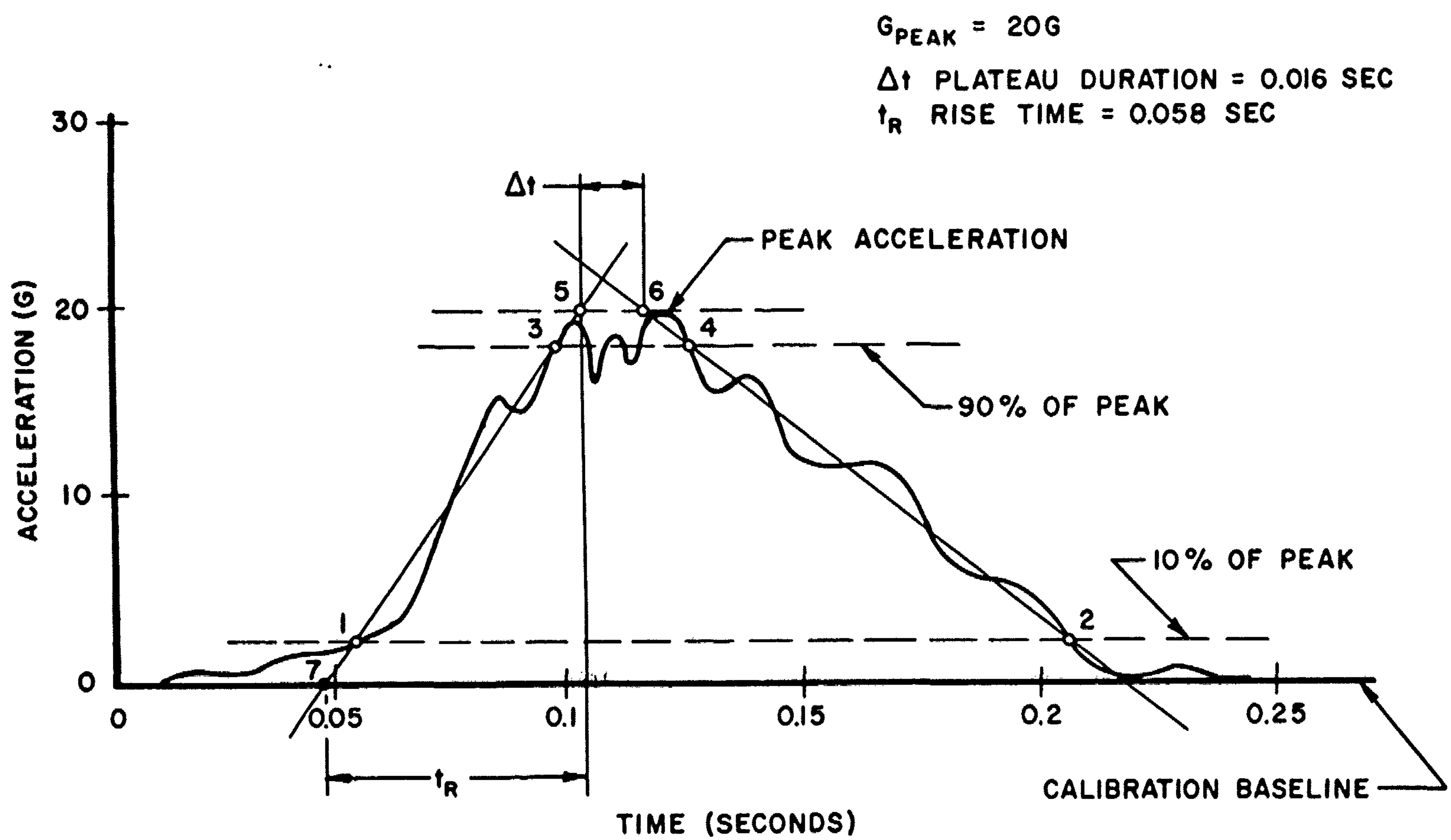


FIGURE 10. Graphic Approximation Example

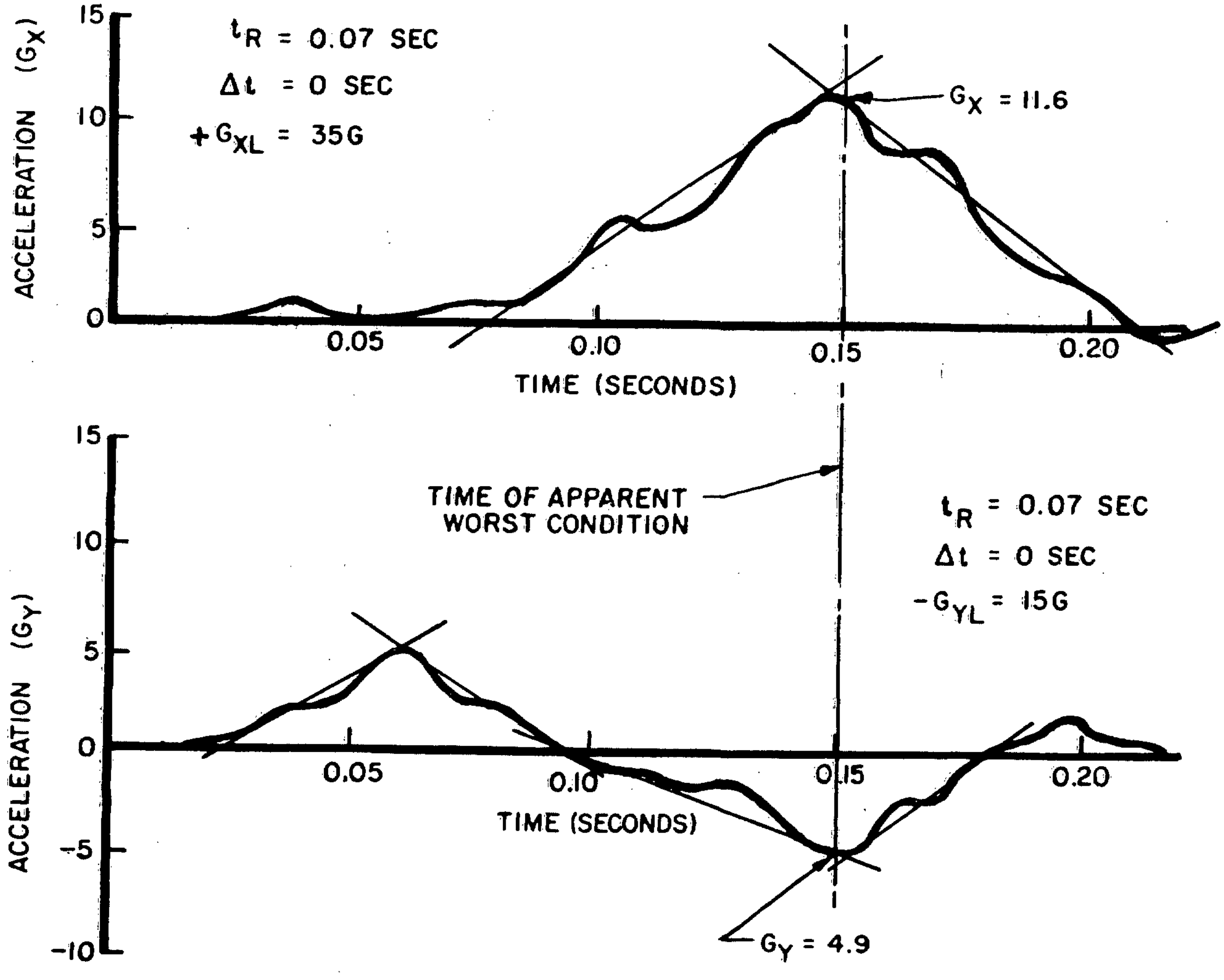


FIGURE 11. Multiaxial Acceleration Environment Example

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