INCH-POUND

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SUPERSEDING
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MILITARY SPECIFICATION

ARRESTING HOOK INSTALLATION, RUNWAY ARRESTING SYSTEM, AIRCRAFT, EMERGENCY

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

1. SCOPE

1.1 This specification covers the basic requirements for the design and installation of an aircraft emergency arresting hook intended for use with runway arresting systems. Design requirements for fully operational hooks and installations are contained in specification MIL-D-18717.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

MILITARY

DOD-D-1000 - Drawings, Engineering and Associated Lists

Beneficial comments (recommendations, additional, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Ogden ALC/MMDSA Hill Air Force Base Utah 84056-5609 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 1710

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-A-8860 - Airplane Strength and Rigidity; General Specification for
MIL-D-18717 - Design; Aircraft Arresting Hook Installations
MIL-H-21594 - Hook Point; Aircraft Arresting, Forged Corrosion-Resistant Steel

STANDARDS

MILITARY

DOD-STD-100 - Engineering Drawing Practices
MIL-STD-130 - Identification Marking of U. S. Military Property
MIL-STD-143 - Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-203 - Cockpit Controls, Location and Actuation of, for Fixed Wing Aircraft

PUBLICATIONS

AFSCDH 2-2 - Crew Stations and Passenger Accommodations

(Copies of specifications, standards, publications and drawings required by contractors 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 provision for preproduction testing.

3.2 Materials. Materials shall be as specified herein. When materials are used which are not covered by specifications, they shall be completely defined in detail specifications, or drawings furnished by the contractor.

3.2.1 Protective treatment. When materials are used for components of the installation that are subject to deterioration when exposed to environment conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification.

3.2.2 Selection of specifications and standards. Specifications and standards describing necessary systems, commodities, materials and processes not specified herein, shall be selected in accordance with MIL-STD-143. Parts, materials, or

processes which are not covered by these documents shall be completely described on the manufacturer's drawings or detail specifications.

3.3 Design

3.3.1 Function

a. The arresting hook installation shall be designed and contructed to successfully engage a runway arresting system pendent and decelerate the aircraft to a stop.

b. The particular runway arresting system and its characteristics, for which the aircraft arresting hook installation is to be designed, shall be prescribed by the procuring activity. In the event that such a designation is not made, it shall be assumed that the installation is designed for use with a BAK-13 system.

3.3.2 Retraction

a. There is no requirement for retraction of the hook in flight since the installation is intended for emergency use only.

b. The hook shall be capable of being retracted manually on the ground without the use of special tools.

c. The hook must be capable of being extended either prior to or after landing touchdown, however, the system need not be designed for fly-in engagements.

3.3.3 Loads

a. The arresting hook system shall be designed to withstand the loads resulting from engagement during aborted takeoff and emergency landings. A minimum of Vspa engagement velocities and maximum takeoff aircraft weights shall be as defined in MIL-A-8860 and in the detail aircraft performance specification.

b. It is assumed that the arresting system is engaged after landing impact has been completed and the aircraft has all wheels on the runway. The load on all landing gear wheels may be minimal, with the aircraft weight being supported by wingloading immediately prior to arrestments at higher engagement velocities.

c. Approximate maximum runout loads can be obtained from Fig. 1.

d. Side loads shall equal the maximum load obtained in

Fig. 1, applied at an angle of ± 20° from the aircraft centerline in a horizontal plane.

3.3.4 Geometry (ref. Fig. 2). The arresting hook geometry shall be such that the following parameters are satisfied:

a. The hook attach point shall be located such that aft arresting force does not cause directional instability during the arrestment.

b. The hook shall be located so that aft arresting force causes the minimum amount of increase in nose gear vertical reaction.

c. The aft arresting force shall not cause the nose wheel to be lifted from the runway during any portion of the arrestment.

d. The hook length and down stop shall allow positive contact of the hook point on the runway at a maximum nose down condition (Line N Fig. 2). The "hold-down" force (reference 3.3.5.e) shall be in effect at the above-described position.

e. The hook point shall be so located when up and locked that the point clears the runway by minimum of fourteen (14) inches at the maximum tail down landing attitude with the aft struts and tires compressed to the design sinking speed deflection as shown in Fig. 2, Line (T). If this is incompatible with the aircraft basic design, suitable guards shall be installed which will prevent inadvertent hook-up under these conditions.

f. For other than laterally rigid ("V" type) hooks, the hook shall be free to swing laterally not less than 20 degrees each side of center to allow alignment during an off center or yawed engagement. A spring or other suitable device shall be provided to maintain aft trail prior to cable engagement.

g. The in-flight maximum down angular position of the hook shall be 80° or less when measured relative to the airplane landing approach line A or to the airplane maximum tail down line T (See Fig. 2), whichever is critical.

h. The arresting hook shall be designed to insure engagement after the cable has been displaced by the nose gear and/or main gear and/or tail bumper and/or stores where applicable.

3.3.5 Components. Design of the various components of the installation shall comply with the following requirements:

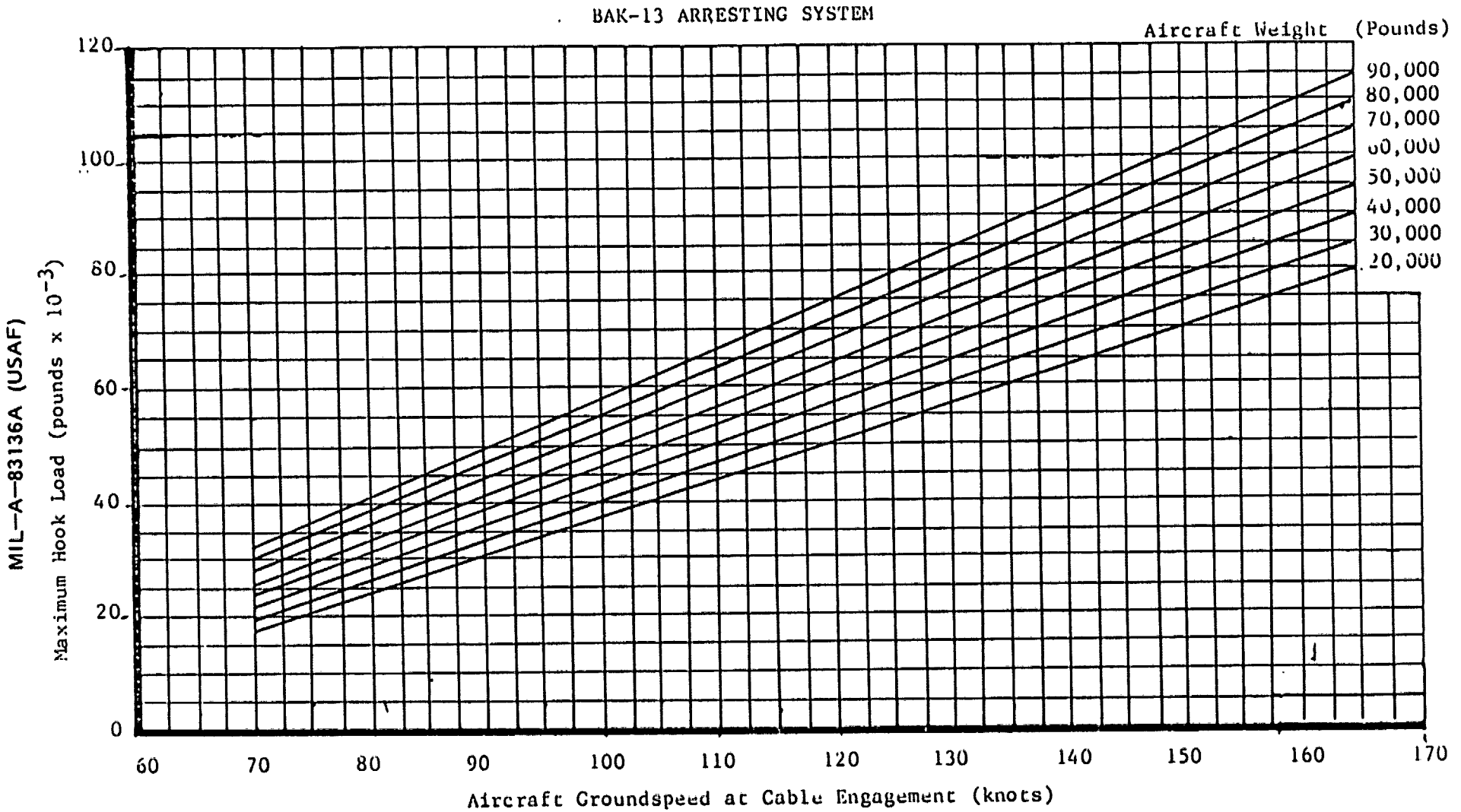

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Figure 1 Ninety-Percent Confidence Curves of Predicted Maximum Aircraft Arresting Hook Loading Versus Aircraft Groundspeed at Cable Engagement for BAK-13 Barriers

Definition of ground lines

Static ground line S	The ground line with the aircraft at rest, in the basic mission take-off configuration
Design landing ground line L	The ground line at the aircraft landing attitude for the design landing configuration (as defined in the detail aircraft specification) with the shock struts & tires deflected to the corresponding landing loads.
Landing approach line A	A theoretical line determined by increasing the angle of line L by vectorially adding the design sinking speed, V_s to the design landing speed, V_f.
Maximum tail down ground line T	The maximum tail down attitude possible, limited by either aircraft structure or the tail bumper (if installed) compressed to maximum working stroke. The shock struts fully compressed and tires deflected corresponding to design landing loads.
Maximum nose down ground line N	The maximum nose down ground line caused by either of the following: 1) Brake drag of .31 times the main gear reaction for the weight and C.G. location causing the most nose down attitude. 2) Nose tire flat, nose strut compressed 1/4 way distance between extended position and maximum static load position; main landing gear tires barely contacting runway.

Aircraft assumed to have zero roll angle

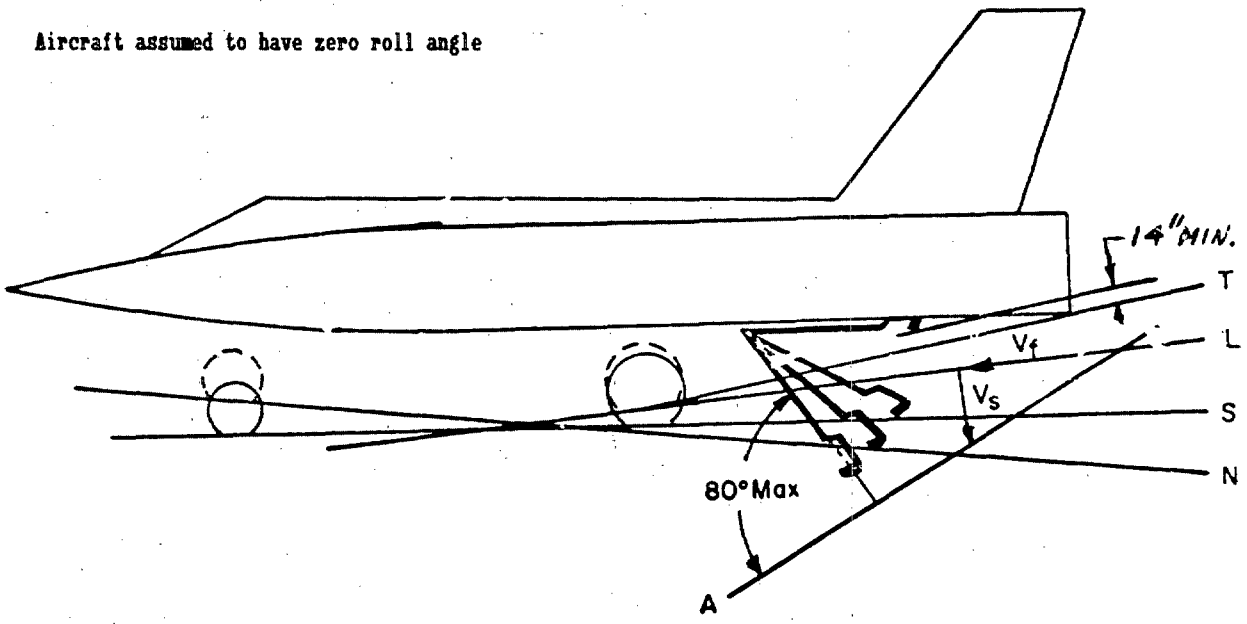

FIGURE 2.

a. The hook point contour shall be designed in accordance with MIL-H-21594 and dimensioned as in Fig. 3 unless otherwise specified by the procuring activity.

b. The hook point shall be easily removable from the shank to allow for replacement in the field.

c. A force shall be provided to lower and maintain the hook extended against air loads equivalent to the gear down placard speed. This force may or may not be from the same source as the "hold down" moment.

d. The hook shall be fully extended and stabilized ready for arrestment within 2 seconds after the cockpit release control has been actuated.

e. A "hold down" moment about the hook attach point shall be provided to load the hook point against the runway. The following minimum values of hold down moment at various hook positions shall be provided:

Hook on runway, A.C in 3 point attitude	M = I/15
Hook full up	M = I/15

Where I = weight moment of inertia of hook about the pivot in pound-inches squared.

The "hold-down" force associated with the "hold-down" moment shall not be less than 100 pounds, measured at the hook point, perpendicular to the hook shank.

If air is used to provide the hold down and extension moment, a pressure gauge which can be readily observed during normal pre-flight shall be incorporated. Any air system shall be designed to provide proper load when subjected to the required extreme changes in temperature between servicing and actual use.

The maximum "hold-down" moment shall be produced in four seconds or less after actuation of hook switch.

f. An energy absorbing device to prevent hook bounce in excess of 2 1/4 inches on a smooth surface shall be provided. The device shall absorb the energy generated by the hook point contacting normal runway discontinuities, such as expansion joints and concrete slab mismatch, so that hook bounce is held to a minimum. The energy absorber shall incorporate a load relief device which will allow the necessary rapid movement of the hook during cable pick-up without overloading the hook assembly or

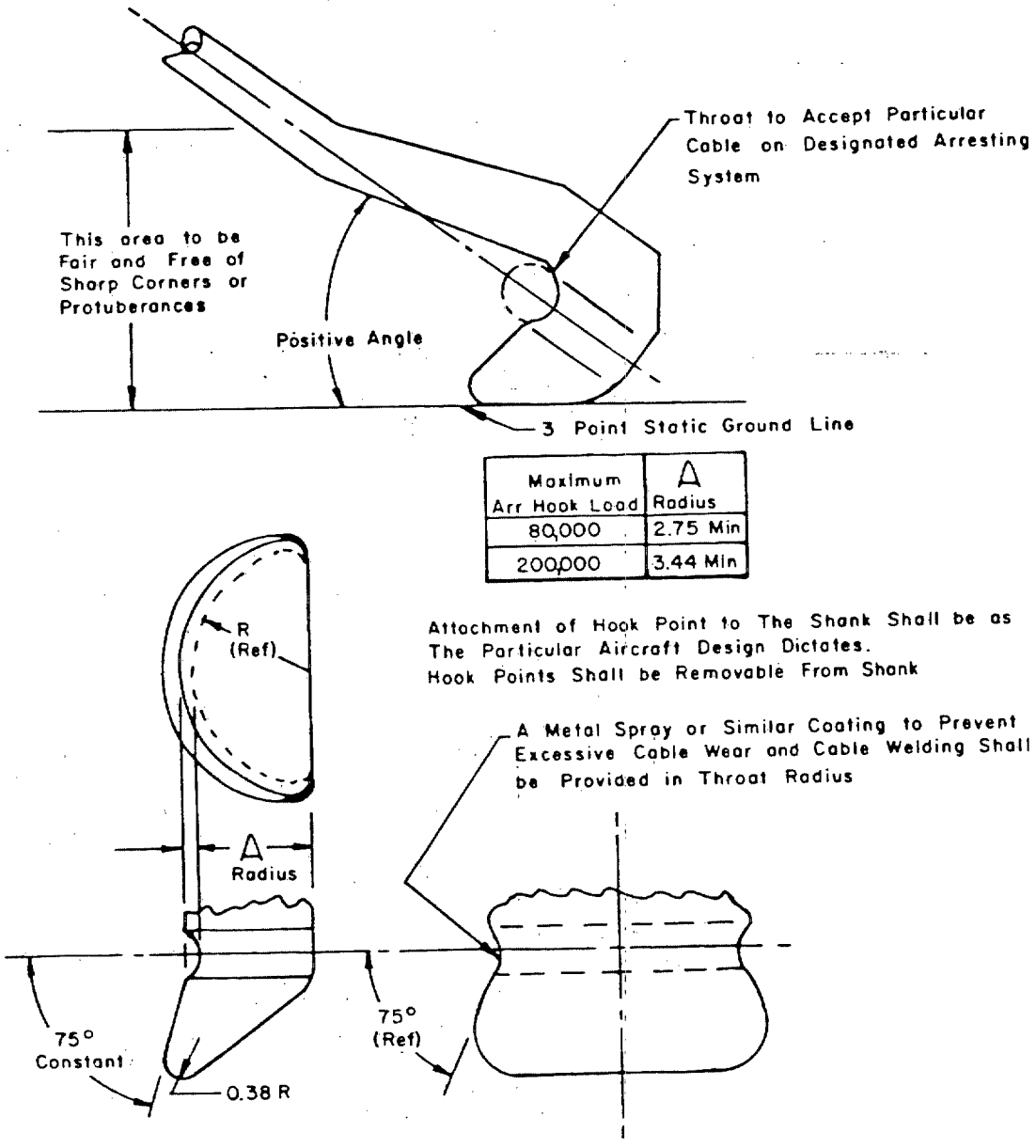

FIGURE 3. Hook Point Dimensions

back-up structure. The energy absorber may be eliminated if analytical and operational test data can be presented indicating that the hook can be made stable by other means. This data must be approved by the procuring activity prior to release for manufacture of the first article.

g. An uplock mechanism shall be provided to retain the arresting hook in the up position during all required aircraft flight and landing conditions and which releases the hook upon command of the pilot. The cockpit controls shall be located in accordance with the requirements of AFSCDH 2-2 and MIL-STD-203. A manually operated mechanical system independent of the proper function of any other aircraft system is desired. A powered system is acceptable provided the source of operating force is not adversely affected by the failure of any single airplane power source. The uplock shall be readily released and re-set from the ground without special tools.

h. A suitable removable ground safety lock with appropriate flag shall be provided to prevent accidental actuation of the uplock.

i. An indicator shall be provided in the cockpit which indicates after release when the arresting hook is in the proper position for barrier engagement.

j. If necessary, an up-stop bumper or energy absorber shall be provided to prevent damage to the aircraft during overshoot of the hook from initial cable pick-up loads or from cable wave loads during runout. The device shall prevent the hook from causing any damage to the aircraft structure or internal equipment under the most adverse required barrier engagement. It is required that, in the location of internal and external aircraft equipment aft of the hook point, the possibility of damage from cable contact be considered.

k. A down-stop which limits the maximum down position of the hook as described in paragraph 3.3.4g is required. The down-stop shall function properly without any system damage after hook release with or without airload present, i.e., aircraft on jacks for system operational check.

3.4 Drawings

3.4.1 Preliminary drawings showing the following shall be submitted to the procuring activity for approval in accordance with the aircraft data submittal requirements document:

a. A profile, plan and front view drawing of the aircraft with an envelope of extreme center of gravity locations

shown. The hook shall be shown at full down, full up, and at pertinent intermediate positions. The various ground lines as required in paragraph 3.3.4 and Fig. 1 shall be shown.

b. A preliminary installation drawing showing the hook point, shank, uplock assembly, snubber, attach fittings and other significant pieces of hardware. Intended materials, heat treatments, and finish processes shall be indicated for major structural components.

c. A schematic of the uplock release and indication system.

3.4.2 Engineering drawings shall be in accordance with DOD-D-1000 and submitted per the requirements of the procurement document.

3.5 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The drawing number requirements of Specification DOD-STD-100 shall govern changes in the manufacturer's part number.

3.6 Performance. The arresting installation shall be capable of satisfactorily completing the ground, flight, and inspection tests specified in Section 4.

3.7 Marking. Assemblies and components shall be identified in accordance with MIL-STD-130.

3.8 Workmanship. The components shall be uniform in quality and free from irregularities or defects which could adversely affect performance, reliability or durability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the 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 tests. Tests shall be classified as:

a. Preproduction - Preproduction tests are those tests required on initial installations to prove and maintain the quality of the installation and its components on a production basis.

b. Quality Assurance - Tests are those tests required on each component or assembly to prove and maintain the quality of the installation and its components on a production basis.

4.3 Preproduction tests

4.3.1 Structural static tests: The contractor shall conduct structural static tests on the arresting hook installation as prescribed in MIL-A-8860, except the repeated load tests. Repeated load test requirements, if any, will be specified by the procuring activity.

4.3.2 Development tests - runway. The contractor shall conduct a series of runway taxi tests to determine the following:

a. The hook system is stable and the hook point will not bounce over the cable during the actual arresting tests.

b. The down-stop functions per paragraph 3.3.5k.

c. The maximum hold-down moment is generated within four seconds, per paragraph 3.3.5e.

These tests may be conducted at Air Force facilities made available upon request. An actual test aircraft may be used or a substitute moving vehicle capable of simulating required runway speeds may be used. Data shall be recorded to determine height of hook bounce and magnitude of bounce loads incurred at various velocities. Also, data shall be recorded to document conformance with paragraphs 3.3.5e and 3.3.5k.

4.3.3 Operational tests. A series of actual barrier engagements shall be conducted to prove the adequacy of the complete design to meet the intended performance requirements. These tests may be conducted by the manufacturer at an Air Force facility or may be conducted by the Air Force with support provided by the manufacturer, whichever type of program is specified in the procurement document. The test program shall determine the following minimum basic parameters:

4.3.3.1 Maximum hook load and barrier load as a function of aircraft weight and contact velocity for on-center engagements and for off-center engagements up to 20 percent of the barrier span.

4.3.3.2 Maximum allowable engagement velocity for on-center and off-center engagements as a function of aircraft weight.

4.3.3.3 Proper function of the complete installation and detail components during above tests.

4.3.3.4 Type of aircraft damage incurred from cable contact and hook overshoot for various types of engagements. Determine the inspection procedures necessary for service aircraft after various types of engagements.

4.4 Quality assurance tests

4.4.1 Examination of product. The arresting hook installation and each component shall be thoroughly examined to determine conformance with this specification and all applicable drawings.

5. PREPARATION FOR DELIVERY

5.1 Not applicable

6. NOTES

6.1 Intended use. The requirements specified herein are intended for use in the design and installation of an aircraft emergency arresting hook for use with runway arresting systems for land based aircraft.

6.2 Subject terms (key word) listing.

a. Arresting hook

b. Hold-down force

c. Hook

d. Landing approach

e. Landing impact

f. Retraction

g. Unlock release

6.3 Changes from previous issue. The margins of this amendment are marked with vertical lines to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment 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 amendment.

Custodian:
Air Force - 99

Review Activities:
Air Force - 82

Preparing Activity:
Air Force - 70

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