

MIL-I-18373A(AS)**28 September 1967****SUPERSEDING****MIL-I-18373(Aer)****31 December 1954****MILITARY SPECIFICATION****INSTRUMENTS AND NAVIGATION EQUIPMENT,
AIRCRAFT: INSTALLATION OF**

This specification has been approved by the Naval
Air Systems Command, Department of the Navy.

1. SCOPE

1.1 Scope - This specification presents general and detail requirements for the installation of instruments and navigation equipment, both government-furnished and contractor-furnished, for Navy aircraft.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONSMilitary

MIL-C-5015	Connectors; Electric, "AN" Type
MIL-W-5086	Wire, Electrical 600-Volt, Copper, Aircraft
MIL-B-5087	Bonding; Electrical, and Lighting Protection, for Aerospace Systems
MIL-W-5088	Wiring, Aircraft, Installation of
MIL-H-5440	Hydraulic Systems; Aircraft Types I and II, Design, Installation and Data Requirements for
MIL-T-5679	Thermocouple Leads, Iron and Constantan, Chromel and Alumel, and Copper and Constantan, Installation of

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Military (Continued)

MIL-C-6136	Conduit; Flexible, Shielded, Aluminum Alloy
MIL-C-6390	Clamps and Instruments, Aircraft, Installation of
MIL-C-6818	Clamps, Instrument Mounting, Aircraft
MIL-E-7080	Electric Equipment; Aircraft, Selection and Installation of
MIL-C-7188	Compasses, Pilot's Standby, Installation of
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification for
MIL-C-7762	Compasses, Installation of
MIL-G-7940	Gages, Fuel Quantity, Capacitor Type, Installation and Calibration of
MIL-H-8891	Hydraulic Systems, Manned Flight Vehicles, Type III, Design, Installation, and Data Requirements for
MIL-F-17874	Fuel Systems; Aircraft, Installation and Test of
MIL-I-18079	Installation of Angle of Attack and Sideslip Systems
MIL-C-18244	Control and Stabilization Systems; Automatic, Piloted Aircraft, General Specification for
MIL-O-19838	Oil Systems, Aircraft, Installation and Test of
MIL-N-25027	Nut, Self-Locking, 250 Deg. F, 450 Deg. F, and 800 Deg. F, 125 KSI FTU, 60 KSI FTU, and 30 KSI FTU
MIL-P-26292	Pitot and Static Pressure Systems, Installation and Inspection of
MIL-C-26482	Connectors, Electric, Circular, Miniature, Quick Disconnect

Special Aeronautical Requirements

SD-24 General Specification for Design and Construction
of Aircraft Weapons Systems

STANDARDS

Federal

FED-STD-595 Colors

Military

MIL-STD-765 Compass Swinging, Aircraft, General Require-
ments for

MIL-STD-1247 Identification of Pipe, Hose, and Tube Lines
for Aircraft, Missile and Space Systems

MS25497 Instrument, Pilot, Flight, Basic Standard
Arrangement for Helicopters

MS26556 Case, Flight Report Holder and Map

MS28028 Thermometer - Self Indicating, Bimetallic

MS28042 Clamp, Mounting, Aircraft Instruments

MS28112 Instrument, Basic Standard Arrangement for
Fixed Wing Aircraft

MS33549 Case, Instrument, 2-3/4 Dial, with Sump,
Standard Dimensions for

MS33558 Numerals and Letters, Aircraft Instrument Dial,
Standard Form of

MS33620 Chart, Hose Selection

MS33632 Wiring Diagram, Two-Pole Tachometer
Generator and Percent RPM Tachometer Indicator

MS33638 Cases, Instrument, Flange-Mounted, Aircraft

MS33639 Cases, Instrument, Clamp-Mounted, Aircraft

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DRAWINGS

Air Force - Navy Aeronautical

AND10405	Instrument Board-Installation of Vibration Insulated
AND20005	Drive - Type XV Engine Accessory

2.2 Availability of Documents - When requesting any of the applicable documents, refer to both title and number. Copies of this specification and applicable documents may be obtained upon application to the Commanding Officer, Naval Supply Depot, Code 1051, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

3. REQUIREMENTS

3.1 Modifications, Deviations and Revisions - Modifications to, or deviations from, the requirements of this specification will be permitted only when specifically included in the detail specification for the aircraft involved, or when specifically approved by the procuring activity in writing. In case of conflict with the current issue of SD-24 (General Specification for Design and Construction of Aircraft Weapon Systems), this specification shall govern; in case of conflict with the aircraft detail specification, the aircraft detail specification shall govern.

3.2 Instruments to be Installed - The instruments to be installed in a given model aircraft, including instruments to be furnished for test purposes, shall be specified in the aircraft detail specification.

3.3 Instrument Arrangement - The basic flight instruments shall be arranged in accordance with MS28112 or MS25497, as applicable. The directional indicator shall be installed as near as practicable to the centerline of the pilot's and/or the co-pilot's panels. Functionally related instruments shall be grouped together as panel space permits. The instrument arrangement shall be subject to the approval of the procuring activity.

3.4 Government Furnished Equipment - Specified equipment for new construction Naval aircraft shall be Government selected and furnished in accordance with the aircraft detail specification.

3.4.1 Outline Dimensions - The outline dimensions for Government furnished equipment shall be in accordance with the aircraft detail specification.

3.4.2 Equipment Weights - The weight of each item of Government furnished equipment shall be as specified in the aircraft detail specification.

3.4.3 Equipment Modification or Reworking - Government furnished equipment shall not be modified or reworked in any manner without the specific approval of the procuring activity.

3.5 Contractor Furnished Equipment - Unless otherwise specified, all mounting hardware, supports, panels or mounts, all electrical connector plugs and fluid connection fittings for instruments and all hose, tubing, wiring, or conduit connected to, or necessary for, proper installation of equipment shall be furnished by the contractor and shall be in accordance with applicable specifications as stated herein. Thus, in the event that it is necessary for the contractor to select equipment which is peculiar to a given model aircraft, the equipment shall conform, where practicable, with procuring activity design specifications and the contractor shall submit to the procuring activity at least six months in advance of the required delivery of the first equipment a proposed installation of the equipment. The proposal shall include installation drawings of the equipment, the instrument manufacturer's name and part number of each item of equipment required, the location and quantity per aircraft of each item of equipment, and the required delivery schedule for the equipment. If approved, the contractor will procure and furnish the equipment so selected.

* 3.5.1 Pointer and Dial Markings - The pointer and dial markings of instruments furnished by the contractor shall be durable lusterless white Color No. 37875 of FED-STD 595 with a background of durable lusterless black Color No. 37038 of FED-STD-595. A sketch of the proposed dial design, including details of marking, shall be submitted to the procuring activity for approval whenever instruments are furnished by the contractor. The form of the numerals and letters shall be in accordance with MS33558. Instrument cases shall be in accordance with MS33549, MS33638 or MS33639. The clamps for clamp-mounted instruments shall be in accordance with MS28042.

3.6 Handling of Instruments - Due attention shall be given to the delicate nature of aircraft instruments in the storage, handling and use thereof.

* 3.7 Instruments and Instrument Boards - Instruments and instrument boards shall be installed in accordance with the requirements of AND10405 and in accordance with the requirements of this specification. Vibration isolators shall be provided by the contractor where necessary.

3.7.1 Instrument boards shall be of nonmagnetic electrically conducting material and shall be bonded in accordance with MIL-B-5087.

3.8 Instrument Mounting in Panel or Board - All panel mounted instruments shall be mounted with the case lugs or mounting ring against the front of the panel so that the instrument may be installed and removed from the front of the panel.

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- * 3.8.1 For flange-mounted instruments, #6-32 UNC self locking plate nuts conforming to MIL-N-25027 shall be installed on the rear of the panel for each instrument. The plate nuts shall be installed by welding or by the use of flush type rivets to leave the front of the panel smooth and free of surface obstructions. For clamp-mounted instruments, the clamps shall be in accordance with MIL-C-6818 and shall be installed in accordance with MIL-C-6390. Round-head brass mounting screws having a durable, lusterless black, oxidized nickel finish shall be provided for each instrument.
- 3.8.2 Each instrument shall be installed and supplied with sufficiently long electric wiring or conducting tubing to permit the instrument to be pulled out of the panel to expose the connection for assembly or disassembly purposes at the front of the panel. Where necessary, suitable means shall be provided to prevent fouling or objectionable interference of slack wiring or tubing when the instrument is installed in the panel.
- * 3.9 Instrument Range Markers - Instrument range markers shall consist of white arcs to indicate normal operating ranges and red strips to indicate minimum and maximum limits.
- 3.10 Instrument Lighting - Instrument lighting shall be as specified in the aircraft detail specification.
- 3.11 Instrument Power Requirements - Electrical power requirements for instruments are subject to the approval of the procuring activity. Unless otherwise specified, inverters and/or alternators of sufficient capacity and of the proper type are Government-furnished to supply all alternating-current-operated instruments.
- * 3.11.1 Circuit Protective Devices - Circuit protective devices shall be installed as specified in MIL-E-7080.
- 3.12 Electric and Fluid Connections -
- 3.12.1 General - Hose, tubing, wiring or conduit connected to shock-mounted or vibration-insulated instrument indicators, transmitters or components shall be of an approved flexible type.
- 3.12.2 Electrical Wiring - Electrical equipment shall be wired in accordance with MIL-W-5088 and MIL-E-7080.
- 3.12.2.1 Electrical wiring used in the installation of equipment shall be in accordance with MIL-W-5086.
- * 3.12.2.2 Electrical Connector Plugs - Unless otherwise specified, all mating electrical connector plugs for equipment shall conform to MIL-C-5015 or MIL-C-26482.

3.12.2.3 Flexible Conduit - Flexible conduit used in the installation of equipment shall be in accordance with MIL-C-6136.

* 3.12.3 Instrument Fluid Line Tubing - Unless otherwise required, instrument fluid line tubing shall be 1/4-inch O. D. and shall be selected and installed in accordance with MIL-H-5440 or MIL-H-8891, as applicable.

* 3.12.3.1 Instrument Fluid Line Identification - Instrument fluid lines shall be identified in accordance with MIL-STD-1247.

* 3.12.3.2 Threads - All instrument connections shall have straight threads conforming to MIL-S-7742 unless otherwise specified by the procuring activity.

* 3.13 Pitot-Static Systems - Pitot-static tubes, pitot tubes, and flush static ports shall be installed in accordance with MIL-P-26292.

3.14 Correction Cards and Card Holders - Correction cards with card holders shall be provided for recording altimeter and airspeed indicator corrections and compass residual deviations. Correction cards shall be mounted as close as practicable to the instruments they serve. However, the instrument arrangement shall not be compromised by complying with this requirement

* 3.15 Automatic Flight Control (AFC) and Stabilization Systems - These systems serve to stabilize and control aircraft throughout various maneuvers as selected or directed by the human pilot or other control means. The variety of maneuvers which can be performed depends on the type of equipment installed.

3.15.1 Automatic pilot equipment as specified in the aircraft detail specification shall be installed in accordance with MIL-C-18244 and the applicable manufacturer's operation and maintenance instructions handbook.

3.15.2 Adequate guarding and protection of cockpit controlling means such as switches, knobs, engagers, etc., shall be installed to minimize the possibility of inadvertent hard-over maneuvers.

3.16 Attitude and Directional Gyro Reference Indicators - These are defined as remote indicating or direct reading gyroscopic instruments,

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functioning to indicate the attitude, direction, and rate of turn of the aircraft in space.

* 3.16.1 The attitude and directional gyro reference instruments shall be installed in accordance with the applicable manufacturer's operation maintenance instructions handbook and approved installation instructions (EI).

3.16.2 Compass and Directional Gyro Reference Systems - Compasses are classified as either (1) direct or remote reading magnetic or (2) compass-controlled directional-gyro stabilized systems. Direct reading magnetic compasses are self-contained magnetic instruments affected by the earth's magnetic field. Compass controlled directional-gyro stabilized systems are utilized either by synchronizing gyro information to the earth's magnetic meridian or as low-drift free gyro systems. Directional-gyro stabilized compass systems include directional controlled gyro magnetic transmitter, amplifier, and remote indicator suitably linked electrically so that accurate and stabilized indications of aircraft heading are obtained from movement of the transmitter in the earth's magnetic field or action of the free gyro. Systems incorporate electrical output utilized for (1) heading or directional intelligence for electronic, navigational, bombing, and armament systems or (2) directional control of the aircraft through control and stabilization systems.

3.16.2.1 Installation and Compensation -

3.16.2.1.1 General - Compasses shall be installed in accordance with MIL-C-7188 for direct reading compasses and MIL-C-7762 for remote indicating compasses and gyro reference systems shall be swung and compensated in accordance with MIL-STD-765.

* 3.16.2.1.2 The transmitter detects the direction of the lines of force of the earth's magnetic field and transmits this information electrically to the directional gyro unit. The transmitter consists of a pendulous sensing element sealed in a case and adjustable compensating magnets. The magnets may be positioned to oppose the local deflecting forces causing disturbance to the earth's magnetic field. The transmitter shall be located as far as possible from all sources of local magnetic deviation such as electrical cables, engines, and indicating transmitters. Magnetic materials shall not be used in the installation of the transmitter.

3.16.2.1.3 The transmitter shall be shock-mounted or vibration insulated only if the amplitude of vibration (as measured from the mean or average position) exceeds 0.010 inch in the range of normal operating engine rpm. The transmitter shall be installed at a location where aircraft acceleration loadings will not exceed the design limitations of the transmitter.

3.16.2.1.4 The contractor shall compensate each compass and compass indicator and insert properly filled out deviation cards in each compass card holder.

3.16.2.1.5 In order that the angular displacement of the transmitter with respect to the longitudinal axis of the aircraft may be more readily estimated, mounting brackets shall be provided with suitable one-degree markings or graduations extending five degrees on each side of a zero mark. The brackets shall be marked and installed so that the graduations are adjacent to the lubber line of the transmitter with the zero mark aligned with the longitudinal axis of the aircraft.

* 3.16.2.2 Pilot's Standby Compass - The pilot's standby compass shall be installed and tested in accordance with MIL-C-7188.

3.17 Position Indicating Systems - Wheels, flaps (wing, cowl, inter-cool, oil cooler), controls, trim tabs, and other position indicating equipment shall be installed when specified in the aircraft detail specification. The indicators shall be readily visible to the proper member of the flight crew.

* 3.17.1 Position indicating equipment shall be installed so that on calibrated indicator dials, the indications shall be within ± 2 degrees of the actual angular position of the part at any point in the travel of the part.

3.17.2 All wheel position indicating equipment shall clearly indicate the unlocked, locked-down and locked-up positions of each wheel unit.

3.17.3 Unless otherwise specified, the lock switches for wheels or for other parts, when required in connection with position indicating equipment, shall be furnished and installed by the contractor and shall be of an approved type.

• 3.17.4 The electrical installation of position indicating equipment shall be subject to approval by the procuring activity.

3.17.5 Contractor-furnished position indicating instruments shall be in accordance with the applicable military specifications. Where a military specification is not applicable, procuring activity approval is required.

3.18 Quantity Gage Systems -

* 3.18.1 Fuel Quantity Gage System - Unless otherwise specified, the contractor shall furnish and install for the fuel system a null-balancing electronic capacitor-type quantity gage system with linear indicator scales in accordance with MIL-F-17874 and the specifications incorporated in the aircraft detail specification.

3.18.1.1 The installation and calibration of the fuel quantity gage system shall be in accordance with MIL-G-7940.

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- * 3.18.2 Oil Quantity Gage System - The installation and calibration of the oil quantity gage system shall be in accordance with MIL-O-19838.
- * 3.18.3 Other Fluids Quantity Gage Systems - Quantity gage systems for fluids other than fuel and oil shall be as specified in the aircraft detail specification and shall be installed in accordance with the applicable manufacturer's *operation and maintenance instructions handbook*.

3.19 Pressure Indicating Equipment - Pressure gages shall be installed for applications specified in the aircraft detail specification.

3.19.1 Pressure gage equipment includes the following:

- Manifold pressure gages
- Torque and Brake Mean Effective Pressure (BMEP) gages
- Fuel pressure gages
- Oil, hydraulic fluid, and pneumatic pressure gages

3.19.2 Pressure gage equipment is classified as (1) direct reading or (2) remote indicating. Remote indicating pressure gage equipments include a transmitter and indicator suitably linked together electrically so that the indicator follows the movement of the transmitter.

3.19.3 The dials of some pressure gages do not indicate by name the specific pressures which are to be measured, e.g., engine oil, brake system, emergency system. This information shall be provided by the contractor by means of a suitable nameplate or marking on the panel below the pressure gage.

3.19.4 Manifold Pressure Gages - The gage shall be connected to a low point in the intake manifold and, insofar as practicable, the tubing connected to the transmitter or to the gage shall be arranged so as to slope continuously from the gage or transmitter down to the manifold connection so that any moisture condensing in the tubing will drain to the manifold. In aircraft where the length or unavoidable dips in the line may be conducive to collection of condensate, the contractor shall install drainage sumps or a purging system subject to approval by the procuring activity.

3.19.4.1 No equipment other than additional supplementary manifold pressure gages shall be connected to the manifold pressure gage line.

3.19.5 Torque and Brake Mean Effective Pressure (BMEP) Gages - The torque pressure gage is an oil pressure gage which indicates a pressure created by torque reaction in the torque nose of the engine. This oil pressure is proportional to the propeller shaft torque.

3.19.5.1 The BMEP gage is a variation of the torque pressure gage. It senses the same oil pressure but is calibrated according to a specified engine constant and indicates the theoretical mean pressure existing in the engine cylinders.

* 3.19.5.2 Torque pressure gages are furnished with a vent connection in anticipation of installations where the pressure on the opposite side of the oil pressure piston will not be atmospheric. When the vent inlet of the gage is not connected to the engine, a threaded plug having a 1/16 inch diameter hole drilled through it shall be installed in the vent inlet of the gage.

3.19.5.3 In some cases the torque nose delivers an oscillating pressure. In such cases it may be found necessary to install a restrictor in the gage line to prevent excessive oscillation of the pointer. Installation of a surge chamber is sometimes necessary in order to reduce pointer vibration adequately.

3.19.6 Fuel Pressure Gages - Reciprocating engine fuel pressure gages indicate the differential between the pressure of the fuel entering the carburetor and the pressure at the carburetor deck. The port marked "P" of the fuel pressure gage or transmitter shall be connected to the fuel pressure port of the carburetor. The port marked "V" of the fuel pressure gage or transmitter shall be connected to the carburetor deck.

3.19.6.1 Some engines have a carburetor deck pressure which does not deviate appreciably from atmospheric pressure. In such installations, a vent tube shall be connected to the vent inlet of the gage or transmitter, the opposite end of the tube being located so as to provide satisfactory drainage of fuel in the event of internal failure of the instrument.

3.19.6.2 A restriction snubber or orifice shall be provided in the fuel pressure gage line at the carburetor to prevent fluctuation of the pointer and to prevent the rapid loss of fuel in case of a break in the line.

3.19.6.3 No other equipment shall be connected to the fuel pressure gage line.

3.19.7 Oil, Hydraulic and Pneumatic Pressure Gages - Hydraulic pressure gages shall be installed in accordance with MIL-H-5440 or MIL-H-8891.

3.19.7.1 A restriction snubber or orifice shall be provided in the gage line located as far as practicable from the gage or transmitter to prevent the rapid loss of oil in case of a break in the gage line and to prevent fluctuation of the pointer.

3.19.7.2 No other equipment other than supplementary pressure gages, pressure switches or restrictions shall be connected to oil pressure gage lines.

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3.20 Temperature Indicating Systems - Three types of temperature indicating systems are used in Naval aircraft:

Electrical Resistance Type

Thermocouple Type

Bi-metal Type

3.20.1 Electrical Resistance Type - The electrical resistance type temperature indicating system consists of a bulb and an indicator. This system is used to indicate the temperature of lubricating oil, coolant, carburetor air, free air, cylinder heads, etc. Thermometer bulbs provided with holes for safety wiring shall be safety wired.

3.20.1.1 When the thermometer bulb is installed in a fluid line, the "well" shall be so designed that the sensitive part of the bulb is completely immersed in the direct flow of the medium.

3.20.1.2 The bulb, when used for measurement of free air temperature, shall be installed so that it will not be subjected to the direct rays of the sun, slipstream of the propeller, or the exhaust gases. When the bulb is installed so that its projection becomes a hazard to personnel or is likely to be broken or damaged during normal handling of the aircraft, it shall be protected by a suitable guard.

3.20.2 Thermocouple Type - Thermocouple type systems installed in accordance with MIL-T-5679 are used to indicate turbine engine tail pipe or inlet temperatures, and cylinder head temperatures on engines which do not have provisions for installation of a resistance bulb. Chromelalumel thermocouples are used for turbine engines and iron-constantan for reciprocating engines. Both thermocouple systems incorporate the cold junction compensation in the indicator and require an external circuit of applicable thermocouple lead wire. Lead wire is cut to desired length from various standard sizes (resistance per foot) and a resistor is included in the circuit to obtain the required external resistance.

3.20.2.1 All leads, wiring and components shall be adequately supported to prevent vibration failures.

3.20.2.2 The firewall connectors shall be either the straight or angle type as required.

3.20.2.3 Terminals for the firewall connector are furnished with the connectors. Other terminals as required may be furnished by the contractor but shall be subject to specific approval by the procuring activity.

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3.20.3 Bi-metal Type - The requirements of 3.20.1.2 are applicable also to the installation of free air thermometers of the bi-metal type conforming to MS28028. MIL thermometer bulbs provided with holes for safety wiring shall be safety wired.

3.21 Tachometer Systems - All tachometers are of the remote indicating type consisting of a synchronous indicator and a generator designed for mounting on standard accessory drive AND20005. Indicators and generators for turbine engines are not interchangeable with reciprocating engine indicators and generators.

3.21.1 Reciprocating engine tachometers indicate crankshaft rpm. The generator is a four pole generator and is driven at one-half crankshaft speed. Indicators are either single or dual, non-sensitive or single sensitive. The dual non-sensitive indicator is available with a built in synchroscope. Separate synchroscope indicators are available for two and four engine aircraft.

3.21.2 Turbine engine tachometers indicate percent of rated turbine rpm. The generator is a two pole generator and is driven at 4200 rpm when the turbine is at rated speed; at rated speed the indicator is at "100 percent".

3.21.3 The installation of tachometers shall be in accordance with MS33632.

3.21.4 Electrical connector plugs and all nuts or bolts used in mounting tachometer generators shall be safety wired.

3.22 Fuel Flowmeter Systems - When listed in the aircraft detail specification the Fuel flowmeter systems shall provide the rate of fuel flow in Pounds per Hour (PPH) for each engine. The installation shall be in accordance with the requirements incorporated in the aircraft detail specification and the applicable manufacturer's installation, operation and maintenance instructions.

3.23 Navigation Equipment - For the purpose of this specification the following equipment is included in the term "Navigation Equipment":

- Compass Reference
- Binoculars
- Chart Boards
- Computers
- Data Boards
- Drift Meters
- Dead Reckoning Tracers
- Attitude and Directional Gyros

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Ground Position Plotters
 Navigation Computer Sets
 Navigation Computer Groups
 Navigator's Cases
 Periscopic Sextant Mounts
 Plotting Boards
 Plotting Boards Bases
 Sextants
 Watches
 Watch Cases

3. 23. 1 Navigation equipment shall be installed in accordance with this specification and with the applicable manufacturer's operation and maintenance instructions handbook. Installation of the drift meter, astrocompass or sextant shall be made in such a manner that normal aircraft vibration shall not impair the taking of sights.

3. 23. 1. 1 Ground Position Indicators - When listed in the aircraft detail specification, Ground Position Indicators shall be installed by the contractor. The installation shall be in accordance with the requirements incorporated in the aircraft detail specification and the applicable manufacturer's operation and maintenance instructions handbook.

3. 23. 1. 2 Dead Reckoning Tracers - When listed in the aircraft detail specification, Dead Reckoning Tracers shall be installed by the contractor. The installation of the Dead Reckoning Tracer shall be governed by its application in the aircraft and by the requirements set forth in the aircraft detail specification and the applicable manufacturer's operation and maintenance instructions handbook.

3. 23. 2 Stowage Provisions - Light, secure, compact and safe stowage provisions convenient and readily accessible to the navigator are required for the following equipment when listed in the aircraft detail specification.

- Binoculars (with case)
- Computers
- Drift Meters
- Navigator's Cases (Compass and Dividers)
- Parallel Rulers
- Plotting Boards
- Plotting Board Bases
- Sextants (with case)
- Aircraft Navigational Watch Case
- Watches

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3. 23. 2. 1 Binocular and Sextant Case Stowage - Binocular and sextant cases shall be stowed in an upright position, so that the binoculars or sextant may be removed from the case without the case being unsecured or removed from its stowage.

3. 23. 2. 2 Navigator's Drawer - A three-compartment drawer, or equivalent, shall be provided for the stowage of (1) maps and charts; (2) computers, plotters, dividers and compasses; and (3) stop watches and the aircraft navigational watch case if stowage provisions for the watch case are not made in the navigator's table. The chart-containing portion of the drawer shall have minimum dimensions of 20 by 30 inches.

3. 23. 2. 3 Aircraft Navigational Watch Case Stowage - The aircraft navigational watch case shall be mounted in a level position either in the navigator's table or in the front portion of the navigator's drawer. When mounted in the table the viewing glass of the case shall be beneath a flush transparent portion of the table's surface, and the case and watch shall be readily visible to the navigator. Sufficient clearance shall be provided for the protective metal cover plate on the case to uncover the viewing glass. When mounted in the drawer, the case and watch shall be readily visible to the navigator from his seated position when the drawer is partially opened. The case shall be capable of being easily removed from its stowed position without the use of tools. The navigation watch shall be installed in the watch case.

3. 23. 3 Chart Boards, Plotting Boards and Plotting Board Bases -

3. 23. 3. 1 General - The chart board serves as a base and holder for the navigational plotting board, and also provides a compartment for stowage of certain charts, photographs, papers, pencils and erasers. The chart board and plotting board are used as a unit in aircraft which do not carry a navigator.

3. 23. 3. 1. 1 A chart board tray shall be furnished by the contractor to serve as a holder for the chart board in both the stowed and "Out" position. The tray installation shall conform to all applicable specifications as described herein for chart board installations with the exception that it need not necessarily be readily removable from the guides or rail supports.

3. 23. 3. 1. 2 When no chart board is specified for fighter, attack or trainer type aircraft, a knee-pad chart plotting board or data board may be issued as squadron equipment or pilot's personal gear. A safe, convenient stowage space shall be provided for the leg-mounted boards in the above types of aircraft.

3. 23. 3. 1. 3 In aircraft which carry a navigator, no chart board is used, other means of stowage being provided for navigational data and equipment, but the plotting board is used in connection with the plotting board base when so specified in the aircraft detail specification.

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3. 23. 3. 1. 4 Chartboards which are made of magnetic materials shall not be installed in Naval aircraft.

3. 23. 3. 2 Chart Board Installation - When specified in aircraft for use at a station not supplied with a desk or table the chart board shall be installed so that when it is in the "Out" or "ready-for-use" position it shall be mechanically held at a height and position convenient to the user when the aircraft is in normal flight attitude. In the pilot's cockpit, chart boards shall be installed as high above the stick as practicable, and the minimum clearance between the chart board in the "Out" position and the stick in any position shall be one inch.

3. 23. 3. 2. 1 Chart boards shall be installed in rigid supports or guides which do not project beyond the surface of the instrument panel. If practicable, the chart board shall slide fore and aft in guides so that in the stowed position the edge of the chart board is approximately flush with the instrument panel. The chart board in any position shall not interfere with the shock mounting of the instrument panel.

3. 23. 3. 2. 2 Where a chart board tray is supplied by the contractor, it shall be designed to allow the pilot or responsible aircrew member to quickly and easily remove and insert the chart board using one hand and it shall contain the chart board in such a manner as to hold it in place in any flying attitude of the aircraft. The contractor shall supply permanently installed springs, clips, fasteners, or mating receptacle to secure the chart board in place without requiring alteration of the chart board.

3. 23. 3. 2. 3 If practicable, all the basic flight instruments, but at least the airspeed indicator, the gyro horizon and directional gyro or primary compass shall be visible with the chart board in the "Out" position.

3. 23. 3. 2. 4 A ball-end spring latch shall be provided in the chart board guide or support on each side. The spring stiffness shall be sufficient to hold the chart board and/or the chart board tray securely in place. The design of the latches shall permit the chart board and/or tray to be readily changed from the "Out" position to the stowed position and vice versa using one hand when stowage is provided behind the panel and to be removed entirely from the guides or supports using one hand. Other suitable means to secure the chart board and/or tray in the "Out" position and the stowed position may be provided, subject to specific approval by the procuring activity.

3. 23. 3. 2. 5 The contractor shall provide a locking device which will retain the chart board and/or tray in the stowed position against forward accelerations of the aircraft of approximately 5 g. For the type of chart boards having drawers, both the chart board and the drawer shall automatically

lock when pushed into the stowed position in installations which provide stowage of the chart board behind the instrument panel.

3.23.3.2.6 The chart board installation shall be so designed that at least three and one-fourth inches of each chart board leg or chart board tray leg is supported when the chart board is in the "Out" position. The chart board in any position shall be contained in such manner as to be structurally supported in place in any flying attitude of the aircraft. The design shall be such that the entire chart board surface extends clear of the instrument panel in the "Out" position and that the top of the chart board is free to open not less than 80 degrees.

3.23.3.2.7 If space or aircraft configuration does not permit stowage of the chart board behind the plane of the instrument panel, stowage shall be provided in any position in the cockpit which permits the pilot conveniently and by means of one hand to move the chart board from the stowed to the "Out" position and vice versa. The "Out" position installation shall be that as described above. Deviations from this installation shall be made only upon specific approval of the procuring activity.

3.23.3.2.8 Where a lighted chart board which requires an external power supply is specified, the aircraft contractor shall provide suitable power and the plugs or receptacles to mate with the connector supplied as a part of the chart board.

3.23.3.3 Plotting Board Base Installation - Sufficient space shall be provided on the navigator's table to hold this base, and storage provisions convenient to the navigator shall be provided for the base and plotting board assembly when the navigator's table must be cleared.

3.23.4 Drift Meters - Two types of drift meters may be employed in Naval aircraft:

- Vertical Type
- Horizontal Type

Drift meters shall be installed in the navigator's work area in a location which will provide maximum convenience in use, taking into consideration such factors as accessibility, body position of the navigator, and head room. Drift meters shall be retractable if subject to damage from water spray or other external causes of damage or mis-use when not being operated. Drift meters shall be installed so as not to be subject to stresses or strains which could cause bending of the tube and resulting mis-alignment of the optical system.

3.23.4.1 The vertical type drift meter shall be installed perpendicular to the horizontal plane of the aircraft in normal flight attitude. A line through

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the 0 and 180 degrees marks of the azimuth scale shall be parallel to the fore and aft axis of the aircraft within 0.5 degree. The 0 degree mark shall be forward.

3.23.4.1.1 Rotation of the vertical drift meter through 360 degrees in azimuth shall be possible without mechanical interference. The objective end of the drift meter shall project through the bottom of the fuselage a minimum distance required to obtain an angular visibility of 35 degrees on each side of the longitudinal axis from the vertical to 85 degrees aft of the vertical. The procurement activity shall be advised of the required length of drift meter to meet these requirements.

3.23.4.1.2 The drift meter tube shall be suitably protected at the point of passage through the fuselage.

3.23.4.2 The horizontal type drift meter shall be installed with the objective tube projecting horizontally through the fuselage of the aircraft. The tube should protrude a sufficient distance so that the fuselage will not be in the field of view of the sight.

3.23.4.2.1 When the grid lines are parallel within 0.5 degree to the fore and aft axis of the aircraft, the drift reading shall be zero.

* 3.23.4.3 The installation of the drift meter shall be in accordance with the applicable manufacturer's operation and maintenance instructions handbook.

3.23.5 Periscopic Sextants - When the periscopic sextant is specified, the navigation dome and astrocompass are not required.

3.23.5.1 The periscopic sextant mount is designed to hold the periscopic sextant in such a manner as to provide the navigator complete and unobstructed visibility of the celestial hemisphere from -10 degrees to +92 degrees in elevation in any direction.

3.23.5.2 The sextant mount shall be installed on the fuselage overhead at a position convenient to the navigator and at such a location that will permit him to utilize to the maximum extent practicable the full capabilities of the sextant. An unobstructed view throughout 360 degrees in azimuth at all altitudes of 15 degrees and above is required when the aircraft is in normal horizontal flying attitude. The mount shall be installed so that it is within 3 degrees of horizontal when the aircraft is in normal horizontal flying attitude. The mount shall be installed so that the lubber line is aligned within 0.25 degree of the longitudinal axis of the aircraft. Means shall be provided to enable the navigator to adjust his height to an optimum eye level for operation of the periscopic sextant. The mount shall be so located that doors, hatches, or other structure will neither interfere with the taking of sights nor strike the mount or the sextant in its operating ("UP" or "DOWN") position. Sufficient hand room shall be provided to permit operating the crank of the azimuth counter. The mount

shall be installed using a suitable gasket or spacer which will not cause strain or distortion of the mounting plate of the mount when it is fastened to the aircraft. A seal or sealing compound shall be used to prevent water leakage. The mount installation shall be designed so that no well or depression will exist which would retain water over the mount opening.

* 3.23.5.3 The installation of the periscopic sextant shall be in accordance with the applicable manufacturer's operation and maintenance instructions handbook.

3.23.6 Periscopic Sextant Astro-Windows - Astro-windows or observation domes shall be placed in the immediate vicinity of the periscopic sextant mount in accordance with the provisions of SD-24.

3.23.7 Map or Data Cases - A map or data case conforming to MS26556 shall be provided for the pilot in accordance with the provisions of SD-24. The case shall be readily accessible to the pilot.

3.24 Accelerometers - The accelerometer is a self-contained, direct-reading instrument which indicates acceleration of the aircraft along its vertical axis. The accelerometer shall be rigidly mounted so that the plane of the dial is vertical when the aircraft is in normal flight attitude. It shall be mounted in a position which will permit it to be easily read and reset by the pilot in flight. Installations in shock mounted panels are not desired because they give erroneous indications caused by resonance during taxiing over rough terrain and in certain flight conditions where buffeting is encountered.

3.25 Inclinometers - Inclinometers are provided to indicate, in degrees of arc, the attitude of the aircraft in relation to a fixed datum reference, usually the lateral or the longitudinal leveling datum references.

3.25.1 When mounted laterally, the inclinometer shall read zero when the aircraft is level as indicated by a level placed on the lateral leveling datum reference.

3.25.2 When mounted longitudinally, the inclinometer shall read zero when the aircraft is level as indicated by a level placed on the longitudinal leveling datum references.

3.26 Angle of Attack and Sideslip Systems - Angle of attack and sideslip systems provide pilots indication, approach light operation, artificial stall warning and signals for armament computers. Angle of attack and sideslip systems shall be installed in accordance with MIL-I-18079.

* 3.27 Head Up Display System (HUD) - The installation of the HUD shall be subject to the approval of the procuring activity.

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- * 3.28 Vertical Display System (VED) - The installation of the VED shall be subject to the approval of the procuring activity.
- * 3.29 Horizontal Tactical Display System (HTD) - The installation of the HTD shall be subject to the approval of the procuring activity.

4. QUALITY ASSURANCE PROVISIONS

4.1 General - The installation of each instrument and instrument component in each aircraft shall be inspected at the contractor's plant by the contractor under supervision of the Government Inspector to determine compliance with the requirements of this specification.

4.2 Tests - Tests shall be conducted by the contractor to determine that all instruments function properly after installation, that all instrument electrical circuits are operative, and that there are no leaks in instrument suction, pressure, or other lines. Any defects which may be found shall be corrected prior to delivery of the aircraft.

4.3 Inspection Reports - The contractor shall furnish the Inspector with a report in duplicate stating that the aircraft instrument installation has been subjected to the required inspection and tests and found to comply with the requirements of this specification.

4.4 Previous acceptance or approval of material, or release of any design by the Government, shall in no case be construed as a guaranty of final acceptance.

5. PREPARATION FOR DELIVERY - This section is not applicable to this specification.

6. NOTES -

6.1 Revisions - In specification revisions and superseding amendments an asterisk "" preceding a paragraph number denotes paragraphs in which changes have been made from the previous issue. This has been 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 as written, irrespective of the asterisk notations and relationship to the last previous issue.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
INSTRUCTIONS		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).		
SPECIFICATION MIL-I-18373A (AS)		INSTRUMENTS AND NAVIGATION EQUIPMENT, AIRCRAFT: INSTALLATION OF
ORGANIZATION (Of submitter)	CITY AND STATE	
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED (Printed or typed name and activity)		DATE

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