

MIL-I-7028  
11 OCTOBER 1950

Superseding  
AN-I-2a  
18 November 1944

MILITARY SPECIFICATION  
INSTRUMENTS AND INSTRUMENT BOARDS;  
AIRCRAFT, INSTALLATION OF

This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments.

1. SCOPE

1.1 This specification covers the general requirements for the installation of aircraft instrument boards and instruments.

2. APPLICABLE DRAWINGS

2.1 Drawings.- The following drawings of the issue in effect on date of invitation for bids, shall form a part of this specification to the extent specified herein:

Air Force-Navy Aeronautical Standard Drawings

AN8008	Insulator - Vibration
AND10405	Instrument Board - Installation of Vibration Insulated
AND10407	Insulators - Installation of Vibration
AND10415	Instruments - Flight, Basic, Standard Arrangement of

(Copies of this specification and copies of other publications referenced herein or required for Government procurement, and the Index of Military Aeronautical (AN or MIL) Standards, may be obtained upon application to the Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; or the Commanding Officer, U. S. Naval Air Station, Johnsville, Pennsylvania.)

3. REQUIREMENTS

3.1 Instrument Board.-

3.1.1 Mounting.- The main instrument board shall be mounted normal to the longitudinal axis of the airplane. Auxiliary boards shall be mounted convenient to the proper member of the crew under normal operating conditions. The main instrument board may be tilted when required to obtain satisfactory visibility, subject to the approval of the Procuring Service.

3.1.1.1 All instrument boards shall be mounted on vibration insulating units as shown on Drawing AND10407, utilizing vibration insulators in accordance with Drawing AN8008.

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3.1.1.2 The vibration insulators shall be mounted in pairs with their mounting surfaces horizontal when the airplane is in flight. They shall be so located that the vertical axes of all insulators are in a single vertical plane. This plane shall pass through the center of gravity of the instrument board complete with the instruments as shown on Drawing AND10405.

3.1.1.3 The number, size, rating, and location of vibration insulating units shall be such that a total deflection of  $1/8 \pm 1/64$  inch will be produced on each pair of units. The rating of each single unit is the load required to deflect it  $1/16$  inch.

3.1.1.4 The amplitude of vibration of the instrument board shall be between the limits of 0.003 and 0.005 inch in at least one direction, and shall not exceed 0.005 inch in any direction with the airplane in normal flight. NOTE: AN AUXILIARY PANEL VIBRATOR OR TAPPER SHALL BE PROVIDED IF NECESSARY TO INCREASE THE VIBRATION TO A MINIMUM OF 0.004 INCH IN AT LEAST ONE DIRECTION.

3.1.1.5 All vibration insulating units shall be readily accessible in order that they may be replaced conveniently when necessary.

3.1.1.6 Vibration insulators made of aluminum alloy shall be used in all locations.

3.1.2 Insulating Unit Size.- For instrument boards complete with instruments, weighing less than 16 pounds, size 1 units (1-inch diameter) shall be used. For boards weighing between 16 and 40 pounds, size 2 units (1-1/2 inch diameter) shall be used. For boards weighing more than 40 pounds, size 3 units (2-inch diameter) shall be used. This is necessary in order that equal flexibility in all directions may be provided. Example: If an instrument board weighs 16 pounds, four pairs of 4-pound units will produce a static deflection of  $1/8$  inch. This same deflection ( $\pm 1/64$ ) may be obtained with five pairs of 3-pound units.

3.1.3 Instrument Board Design.- Instrument boards shall be of nonmagnetic metal of the lightest practicable weight and entirely satisfactory for the purpose intended. They shall be so designed that maximum stiffness is obtained. Instrument boards of weak construction due to large cutout areas shall be suitably reinforced by the formation of a flange around the edges or by the addition of stiffeners.

3.1.4 Mounting Brackets.- All members or brackets to which the vibration insulating units are attached shall be designed with sufficient rigidity to prevent any appreciable flexing in themselves or in their attachment to adjacent members. Supporting brackets shall not be mounted on the cowling or any other member which may be subjected to vibration from the flow of air, unless adequate provisions for rigid support are made.

3.1.5 Smubbing.- Suitable smubbing means shall be provided to prevent excessive deflection of the insulating units, and to absorb shocks due to catapulting, arrested landing, or rough field landing.

3.1.6 Clearance.- Adequate clearance shall be provided in all directions to prevent the instrument board and the instruments from coming in contact with any other part of the airplane.

3.1.7 Finish.- The finish of the instrument board shall be durable dull black.

3.1.8 Projections.- Every precaution consistent with engineering practice shall be taken to mitigate the possibility of head and face injuries to the pilot in case he is thrown against the instrument board in a crash.

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3.2 Instrument Arrangement.- The instrument arrangement shall be subject to the approval of the Procuring Service.

3.2.1 Flight Instruments.- Flight instruments shall be arranged in accordance with Drawing AND10413, as close to the center line of the pilot's vision as possible, preferably with the center line within the circumference of the middle group of instruments shown on Drawing AND10413.

3.2.2 Navigation Instruments.- On single-pilot aircraft the navigation instruments shall be adjacent to, and to the right of, the flight instruments. For two-pilot, two-panel aircraft, navigation instruments shall be located between the two flight instrument panels. For two-pilot, single-panel aircraft the navigation instruments shall be adjacent to, and to the left of, the flight instrument panel.

3.2.3 Engine Instruments.- On single-pilot aircraft the engine instruments shall be adjacent to, and to the left of, the flight instruments. For two-pilot, two-panel aircraft, engine instruments shall be located between the two flight instrument panels. For two-pilot, single-panel aircraft the engine instruments shall be adjacent to, and to the right of, the flight instrument panel.

3.2.4 Miscellaneous Instruments.- Miscellaneous instruments shall be located in the most convenient place to suit the particular design of each type of airplane and shall be acceptable to the Procuring Service.

3.2.5 Correction Cards.- Correction cards shall be located as close as practicable to the instruments to which they apply.

3.2.6 Instrument Grouping.- The grouping of the instruments shall be as follows:

Flight Instruments

Accelerometer  
Airspeed Indicator  
Altimeter  
Turn and Bank Indicator  
Gyro Horizon Indicator or Attitude Indicator  
Directional Gyro Indicator  
Rate-of-Climb Indicator

Navigation Instruments

Compass  
Clock

Engine Instruments

Tachometer  
Thermometers  
Pressure Gages  
Engine Gage Unit  
Synchroscope Indicator  
Fuel Flow Meter

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Miscellaneous Instruments

Suction Gage  
Fuel Level Gage  
Oil Level Gage  
Free-Air Thermometer  
Pressure Gages - Hydraulic  
Position Indicator (wheels and flaps)  
Inclinometer  
Pressure Gage - De-Icing

3.2.7 Instruments.— When instruments are furnished by the Procuring Service, they will be in condition for installation in the airplane and shall not be changed without the specific authorization of the Procuring Service.

3.2.8 Accessibility.— Instruments requiring manipulation or adjustment shall be convenient to the operator's reach without interfering with the control of the airplane.

3.2.9 Visibility.— Instruments shall be so arranged that graduations are not hidden from the operator's view when he is in normal position.

3.2.10 Protection.— The instruments shall be protected from moisture and weather. Particular attention shall be given to the protection of instrument transmitters mounted in engine nacelles. The transmitters shall be mounted in a location where the temperature never exceeds 70°C (158°F).

3.2.11 Markings.— If the markings on the dials of instruments do not plainly indicate their purpose, suitable legends shall be provided on the instrument board. These shall be kept to a minimum.

3.2.12 Maintenance.— All instruments and connections thereto shall be accessible for replacement without removing other instruments or equipment.

3.2.13 Remote Indicating Instrument Transmitters.— Remote indicating instrument transmitters which require protection from vibration shall be mounted in groups, if practicable, on brackets which are supported on vibration insulating units in accordance with Drawing ANDI0407.

3.2.14 Supercharged Cabin Airplanes.— In supercharged cabin airplanes where a pressure differential is maintained between the cabin and the outside air, specially designed instruments may be required. Installation of any such special instruments shall be subject to the approval of the Procuring Service.

3.3 Prior to the Mock-up and/or Engineering Acceptance Inspection, the airplane contractor shall submit drawings containing the following information to the Procuring Service for study and evaluation:

- (a) Instrument board dimensions
- (b) Location of obstructions and other equipment near instrument board
- (c) Position of operator with relation to instrument board
- (d) Instrument arrangement
- (e) Types of instruments

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4. INSPECTION

4.1 Each instrument board shall be carefully examined to determine conformance to all the requirements of this specification.

NOTICE: When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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## 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

ORGANIZATION (of submitter)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

 DIRECT GOVERNMENT CONTRACT 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?

 YES 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 BY (Printed or typed name and activity)

DATE

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