

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

AIRCRAFT ALIGNMENT SYMMETRY CHECKS

(This EO replaces EO 05-1-2AN dated 8 Oct 54)

GENERAL

1 This instruction details the general procedure to be followed and the equipment required when performing aircraft alignment and symmetry checks. In addition, an alternative symmetry check method is detailed using a water-level method.

2 This order is to be read in conjunction with, but is not to supersede, the applicable -2 or -3 EOs. Aircraft diagrams, required dimensions, special instructions and special equipment required will be detailed in the applicable aircraft EO.

DEFINITIONS

3 An alignment check involves the measurement of distances between reference points on the aircraft and distances between reference points projected from the level aircraft to the floor plane.

4 A symmetry check involves the measurement of elevations to reference points on a level aircraft relative to a horizontal reference plane.

5 These measurements are then checked against the established dimensions as laid down for the applicable aircraft.

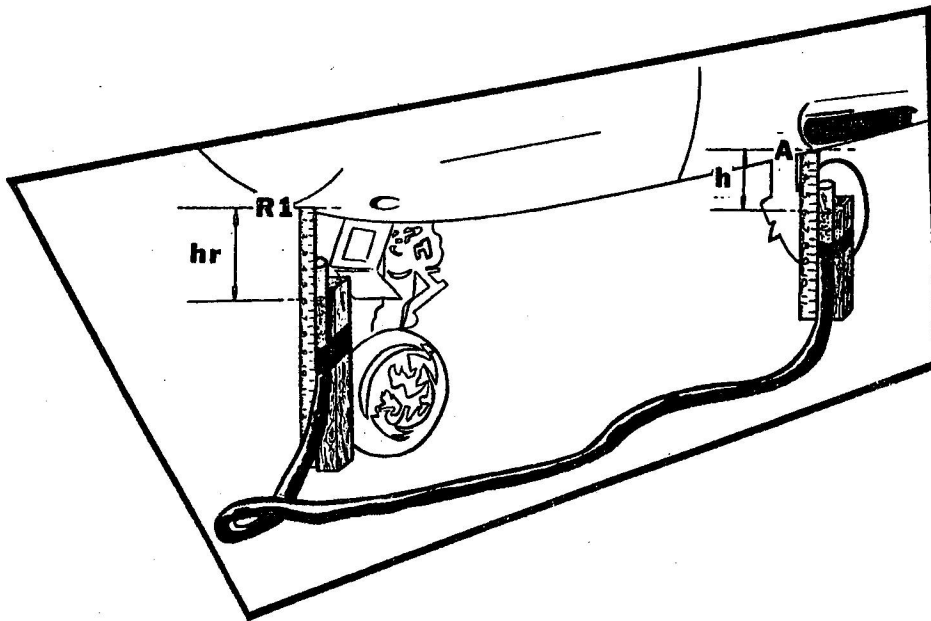
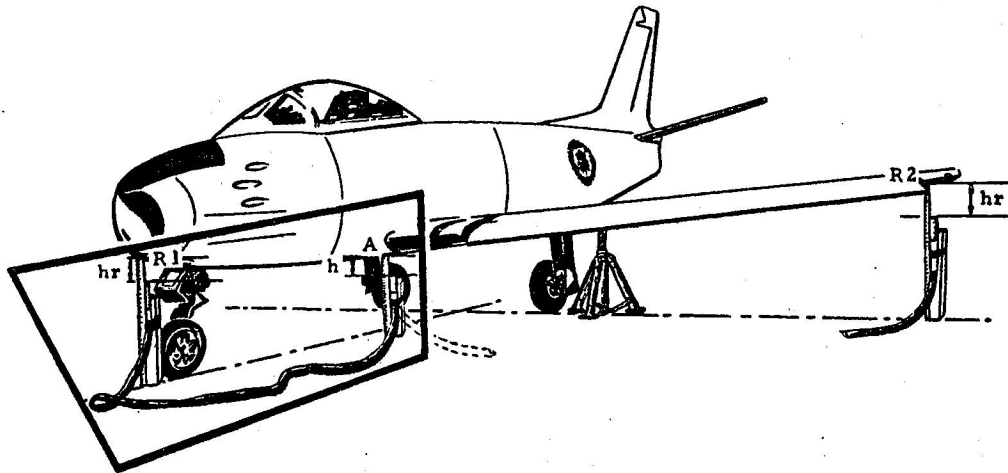
6 Alignment and symmetry checks shall be performed when any of the following conditions have occurred:

- (a) Heavy landing (when warranted by the results of inspection in accordance with para. 7 of this EO).
- (b) Abnormal loads have been placed on flying surfaces and/or fuselage due to the "G" limits being exceeded, or other causes.
- (c) When a major structural component is changed.
- (d) When the flying characteristics of the aircraft are such as to cause doubt in the correctness of the aircraft alignment.

7 A visual inspection of the aircraft shall be carried out after a heavy landing or when there is possibility that "G" limitations of the aircraft have been exceeded. Special attention is to be given the following (where applicable) for signs of cracks, ripples or failure:

- (a) Power plant mounting.
- (b) Tail pipe supports.
- (c) Centre section fairings.

Symmetry Check -- Water Level Method



A...DATUM POINT

R...REFERENCE POINTS

h...DATUM MEASUREMENT

hr..REFERENCE MEASUREMENTS

Figure 1 Symmetry Check - Water Level Method

- (d) Slats.
- (e) Drop tank attachment points.
- (f) Flying control surfaces and the hinge points.
- (g) Fuselage and wing skin.
- (h) Popped or pulled rivets or sheared bolts.

EQUIPMENT REQUIRED

8 The following list of equipment is only of a general nature. Special equipment required will be detailed in the applicable aircraft EO.

- (a) Wing jacks and pads.
- (b) Nose or tail jack and pads.
- (c) Spirit level and levelling bar.
- (d) Two-foot scale.
- (e) Six-foot scale or rod.
- (f) Six-foot steel tape.
- (g) Fifty-foot steel tape.
- (h) Two plumb bobs and lines.
- (j) Chalk line and chalk.
- (k) Transit or surveyors' level.

ALIGNMENT CHECK

9 Both alignment and symmetry checks are to be performed in still air and preferable on a hard, smooth, level surfaced floor.

10 With the aircraft located on a hard level surface, proceed to jack the aircraft and level it in the longitudinal plane using the spirit level and levelling brackets. Similarly adjust the lateral level of the aircraft by means of the wing jacks. Check the longitudinal and lateral level to ensure the aircraft is accurately levelled before any measurements are taken.

11 Using the applicable aircraft diagrams, locate the required reference points on the aircraft and project these points to the floor plane using the plumb bob and line. Mark and connect these projected points using a chalk line to mark the floor. Measure and record the distance between the connected reference points using the steel tape, which has been pulled taut before measurements are taken. Check the dimensions obtained and compare these with the dimensions quoted in the applicable EO.

NOTE

If discrepancies are found between actual dimensions and those quoted in the applicable EO, a structural check and investigation must be made to determine the cause.

SYMMETRY CHECK

12 Level the aircraft in the same manner as that detailed in para. 10. Locate the transit or surveyors' level on the right-hand side of the aircraft midway between the wing tip and tailplane. Ensure that the site chosen is such that the line of sight to the datum point and right-hand reference points is not blocked by parts of the aircraft or jacking equipment.

13 Locate the aircraft datum point and place a steel rule against it, ensuring that the rule is at right angles to the plane of the floor by means of a plumb bob held against the aircraft near the datum point. Take a sight through the level on the rule and record the reading. Repeat this process for all right-hand reference points and record the readings.

14 Move the transit or level to the left-hand side of the aircraft and repeat the procedure as outlined in paras. 12 and 13 for all left-hand reference points.

15 The actual dimensions between the datum point and the reference points are obtained by subtracting the datum point reading from each of the recorded reference point readings. The plane of the datum point is considered as the zero dimension. In the calculation of vertical measurements, a positive value indicates the reference point is above the datum point, and a negative measurement indicates the reference point is below the datum point.

NOTE

If discrepancies are found between actual dimensions measured and those quoted in the applicable EO, an investigation must be made to determine the cause.

SYMMETRY CHECK - WATER LEVEL METHOD

16 The following instructions detail an alternative means of performing an aircraft symmetry check where a transit or level is not available or is not practical. This symmetry check method is based on the principle that "liquid always seeks its own level". Refer to Figure 1.

EQUIPMENT REQUIRED

17 In addition to the equipment as detailed in para. 8, less item (k), the following equipment is required to carry out a symmetry check by the water-level method:

- (a) Approximately fifty feet of plastic garden hose. Where possible transparent hose is preferable to facilitate the removal of all air bubbles from the hose.
- (b) Two lengths of heavy walled glass tubing, such as water gauge tubes as used in steam or hot water boilers. If available, straight lengths of heavy plastic tube may be substituted.
- (c) Two standard twelve-inch steel rules.
- (d) Two locally manufactured tripods, or lengths of two by two lumber approximately three feet in length. The height of the tripods or supports will be dependent on the aircraft being checked.

- (e) A vegetable or mineral dye may be added to the water for water level contrast, if desired, e. g. ink.

PROCEDURE

18 Fill the plastic hose with water ensuring that no air bubbles remain in the hose, as this condition would cause erroneous readings. Install the glass or plastic tubes in each end of the hose and top up the complete assembly until the water level in both ends is within three or four inches of the open tube end.

19 Locate the aircraft datum point and support one end of the hose assembly under the point by attachment of the hose to the tripod or wooden support. Keeping the other end of the tube at approximately the same height, move it to the reference point for which a measurement is required. The second tripod or wooden support is then used for the support of this end.

20 With the hose assembly, set up as above, for each reference point that a measurement is required, measure the following:

- (a) Distance from datum point to water level.
- (b) Distance from reference point to water level.

NOTE

Care is to be taken that the heights of the gauge tubes are not varied during the taking of measurements (a) and (b) above.

21 The actual dimensions of the reference points required are obtained as indicated in para. 15.

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

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