CHAPTER

34

NAVIGATION AND PITOT STATIC

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GENERAL

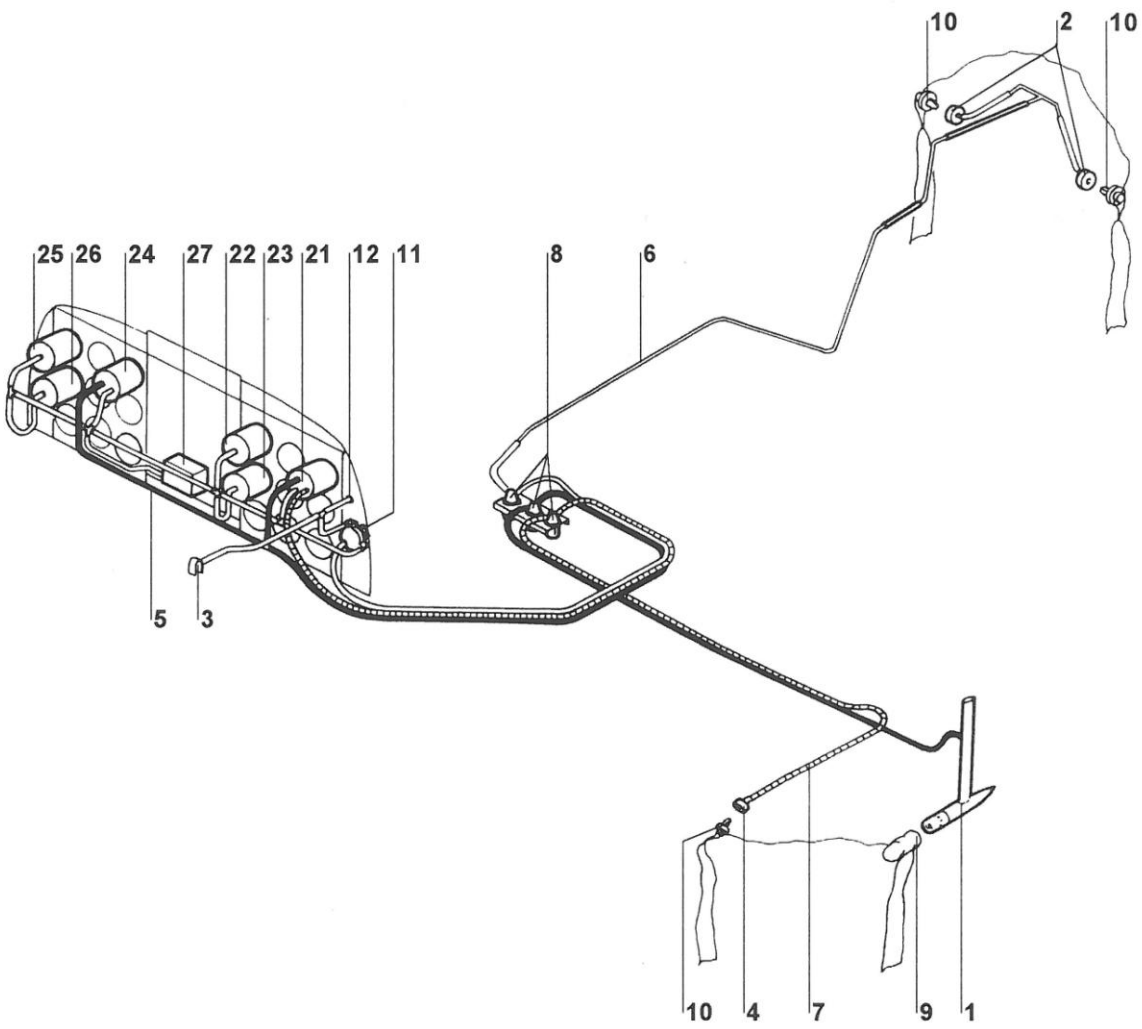
The pitot pressure is supplied to airspeed indicators from pitot probes. The static pressure is supplied to barometric instruments from the static vents. The alternate static pressure is supplied from the vents located in firewall and in cockpit. The pressure for stall warning system is supplied from the stall probe.

Technical specification of the COMM/NAV equipment (technical description, servicing and maintenance and wiring diagrams) are described in Chapter 95 (SUPPLEMENTS).

PITOT - STATIC SYSTEM

DESCRIPTION AND OPERATION

The pitot pressure is supplied to airspeed indicators from the pitot tube (Fig. 34-1, item 1) that is under the port wing.
The static pressure for barometric instruments (airspeed indicators, altimeters, vertical speed indicators and altitude encoder) is supplied from static vents (2) that are in the rear fuselage section.
The alternate static pressure (subsection 34-11-00) is collected by vent (3) in the firewall and from the cockpit.
The pressure for stall warning system (subsection 34-12-00) is collected by stall warning probe (4) located under the port wing near the leading edge.
The pitot pressure pipeline (5), static pressure pipeline (6) and pipeline of stall warning system (7) are provided with water traps (8). The water traps are accessible after opening the access port doors (Fig. 52-5, item 25) in the bottom engine cowling.
The pitot probe (Fig. 34-1, item 1) and static probes (2;4) are equipped with anti-icing heaters (section 30-30-00).
Protection of probes and vents during airplame parking:
- the pitot probe is protected by canvas cover (9)
- the static vents and stall warning probe are provided during parking with plugs (10).



1 ... pitot tube
2 ... static pressure probes
3 ... alternate static pressure vent
4 ... stall warning probe
5 ... pitot pressure pipeline
6 ... static pressure pipeline
7 ... stall warning pressure pipeline
8 ... water traps
9 ... canvas cover
10 ... plugs
11 ... static pressure selector
12 ... adjusting screw

For information only:
21 ... airspeed indicator with stall warning
22 ... altimeter I
23 ... vertical speed indicator
24 ... airspeed indicator II
25 ... altimeter II
26 ... vertical speed indicator II
27 ... altitude encoder

Fig. 34-1 Pitot - static and stall warning systems

MAINTENANCE

REMOVAL / INSTALLATION

REMOVAL OF PITOT-STATIC SYSTEM PLUMBING

Simple removal are not issued in this manual.

INSTALLATION OF PITOT-STATIC SYSTEM PLUMBING

Installation demands

a) Degrease and blow the new plumbing hrough with compressed air.

NOTE

The pipes of stall warning system (Fig. 34-1, item 7) are painted with black color.

b) The piping may exhibit maximum 0,5 mm (0,02 in) dents with flush transitions. The reduction of rated diameter in the spot of bend is allowed to be maximum 15%.

c) Minimum radius of hose bend is 28 mm (1,1 in).

d) The artifical leather inserted under the clips fixing the piping to airplane structure should protrude symmetrically on both sides of clip.

e) Maintain and make sure the instrument ports are connected to correct pipelines:

- Altimeter, vertical speed indicator, enconding altimeter are to be connected to static pressure pipeline (6)
- Airspeed indicator:
  - port D - couple to pitot pressure pipeline (5)
  - port S - couple to static pressure pipeline (6)
  - port M - couple to stall warning pipeline (7).

NOTE

Port M is used in airspeed indicator equipped with stall warning (21).

f) The hoses behind the instrument panel should be long enough to enable sliding out and tilting of instrument panel.

g) Check tightness of pitot-static system after installation.

INSPECTION / CHECK

TIGHTNESS CHECK OF PITOT-STATIC SYSTEM

1. TIGHTNESS CHECK OF STATIC AND STALL WARNING PRESSURE SYSTEMS

a) Set static pressure selector valve (Fig. 34-2, item 7) to **MAIN** position.

b) Plug one static pressure vent (5) in rear fuselage section with plug (6).

c) Connect static pressure tester (1), detail A to static pressure (5) and stall warning pressure (4) vents.

d) Shut vent valve (3) and open shut-off valve (2).

e) Generate underpressure corresponding to about 300 km/h (160 knots) according to airspeed indicator (8) by tester (1) in both pipelines.

f) Close shut-off valve (2) and observe altimeter (9). The drop of indicated altitude should not exceed 30 m (100 ft) per minute.

g) Equalize slowly the pressure in both pipelines with ambient air pressure as follows:
- turn slowly the static pressure selector valve (7) over to **ALT. STAT. SOURCE** or open slowly the vent valve (3) and shut-off valve (2) position to prevent damage of coupled instrument.

h) Disconnect tester (1) from the stall warning (4) and static pressure (5) vents and remove plug from static pressure vent (6).

i) Set static pressure selector valve (7) to **MAIN** position.

2. TIGHTNESS CHECK OF PITOT PRESSURE SYSTEM

a) Connect tester (1) to face hole of pitot probe (Fig. 34-3, item 4).

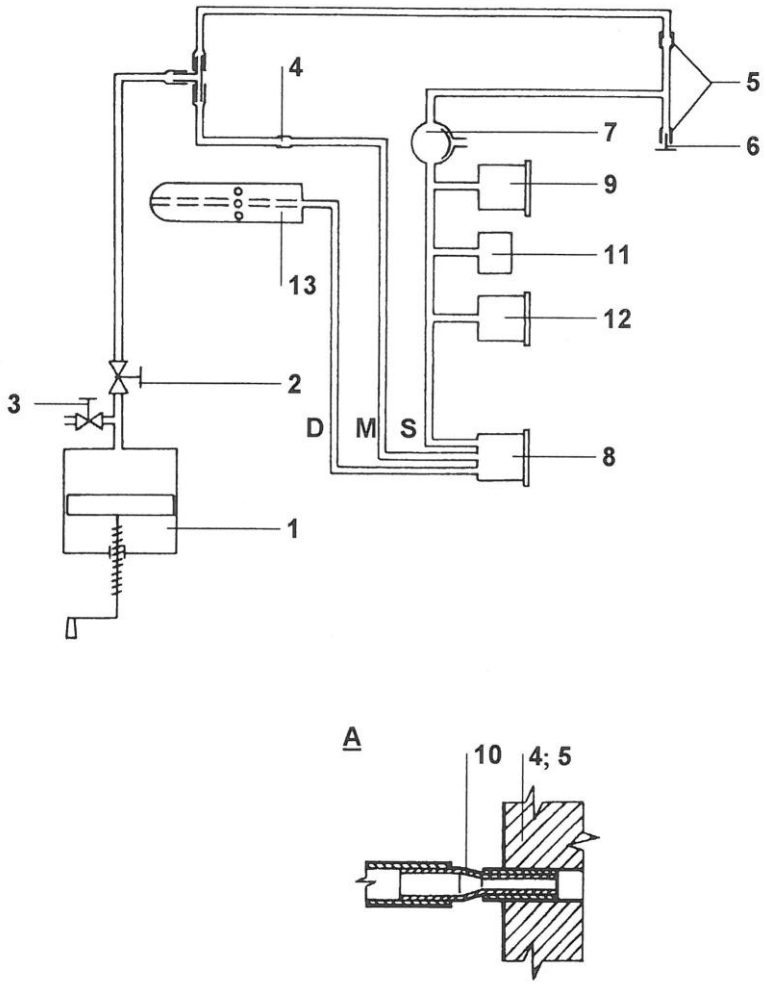
b) Close vent valve (3) and open shut-off valve (2).

c) Generate pressure by means of tester (1) corresponding to 300 km/h (160 knots) according to airspeed indicator.

d) Close shut-off valve (2) and observe airspeed indicator (5) reading. The drop of speed should not exceed after three minutes 2 km/h (1 knot).

e) Equalize pressure in pipeline slowly as follows:
- open slowly the vent valve (3) and shut-off valve (3) to prevent damage of airspeed indicator.

f) Disconnect tester (1) from pitot probe (4).



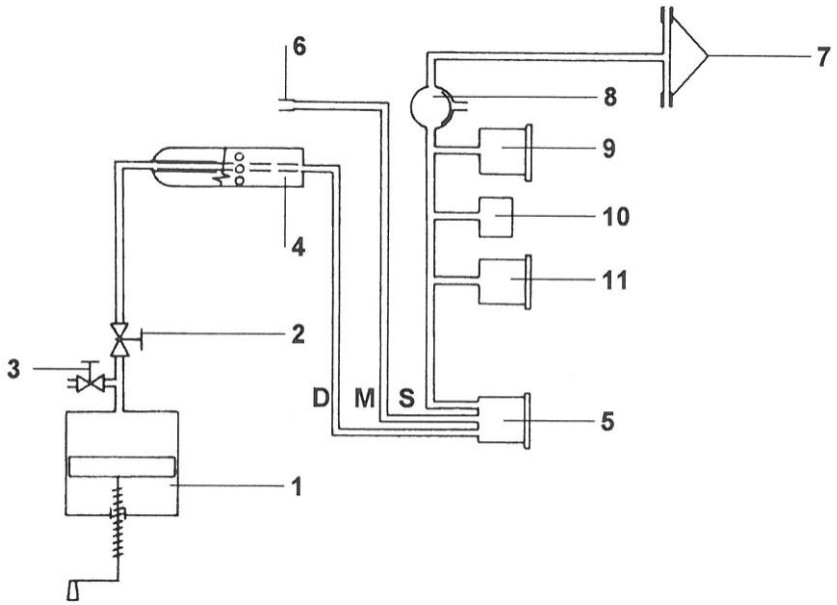
A ... connection of tester to probes 4 and 5
D; M; S ... marking of airspeed indicator ports

1 ... tester
2 ... shut-off valve
3 ... vent valve
4 ... stall warning vent
5 ... static pressure vents
6 ... plug
7 ... static valve selector
8 ... airspeed indicator with stall warning annunciator
9 ... altimeter
10 ... adaptation piece

For information only:
11 ... altitude encoder
12 ... vertical speed indicator
13 ... pitot tube

Fig. 34-2 Tightness check of static and stall warning pressure pipelines

EFFECTIVITY: All



D; M; S ... marking of airspeed indicator ports

1 ... tester
2 ... shut-off valve
3 ... vent valve
4 ... pitot tube
5 ... airspeed indicator with
stall warning annunciator

For information only:
6 ... stall warning pressure vent
7 ... static pressure vent
8 ... static pressure selector valve
9 ... altimeter
10 ... altitude encoder
11 ... vertical speed indicator

Fig. 34-3 Tightness check of pitot pressure system

CHECK OF PITOT-STATIC SYSTEM WATER DRAINAGE

CAUTION

REMOVE AND INSTALL THE WATER TRAPS (Fig. 34-1, item 8) WITH INCREASED CARE TO PREVENT DAMAGE OR TUCK UP OF SEALING RING BETWEEN TRAP VESSEL AND TRAP BODY. REPLACE FAULTY SEALING RING.

CHECK TIGHTNESS OF PITOT-STATIC SYSTEM AFTER DRAINING THE WATER TRAPS.

Proceed if water is detected in water traps as follows:

a) Unscrew trap vessel from the body, drain water, clean and dry the vessel.

b) Screw the clean vessel upon the trap body.

c) Lock the water traps mutually after tightness check of pitot-static system with safety wire to prevent unintentional release.

APPROVED REPAIRS

REPAIR OF PITOT-STATIC SYSTEM

CAUTION

MAKE TIGHTNESS CHECK AFTER ANY REPAIR OF PITOT-STATIC SYSTEM.

Fault	Remedy
1) Hoses and pipes a) mechanical defects, b) expired rubber hoses (section 05-10-00).	Replace faulty hoses and pipes. Replace expired rubber hoses (life time of silicon hoses is not limited.
2) Water traps a) faulty trap vessel, b) faulty, broken or cracked sealing ring.	Replace faulty vessel. Replace faulty sealing ring.

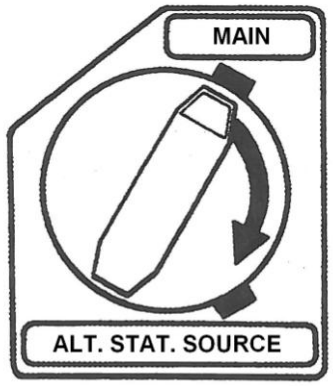
ALTERNATE SOURCE OF STATIC PRESSURE

DESCRIPTION AND OPERATION

The main static pressure system may be if necessary turned over by selector valve (Fig. 34-1, item 11) to alternate static pressure source. The alternate static pressure is taken by altemate static pressure vent (3) that are in firewall and aircraft cockpit. The correctness of alternate static pressure may be adjusted by screw (12) to be in correspondence with static pressure in main static pressure system. Lock the alternate static pressure adjusting screw with lacquer and covered by sheet guard. The alternate static pressure valve (11) and adjusting screw (12) are located in left instrument panel.

The original position of alternate static pressure valve (11) is locked with 0,3 mm copper wire and seal.

Positions of alternate static pressure valve:



- static pressure from the main static pressure vents

- static pressure from the alternate static pressure vents

EFFECTIVITY: All

MAINTENANCE

INSPECTION / CHECK

CHECK OF FREE MOVEMENT OF ALTERNATE STATIC PRESSURE VALVE ON GROUND

a) Release alternate satatic pressure valve locking (Fig. 34-1, item 11).

b) Check free movement of alternate static pressure valve by repeated resetting the valve to end positions.

c) Set valve of alternate static pressure to MAIN position and lock it with 0,3 mm (0,01 in) cooper wire and seal.

NOTE

In case the static system tightness check should follow the check of valve free movement it is recommended to lock the valve after the pitot-static system tightness check.

SERVICEABILITY CHECK OF ALTERNATE SOURCE OF STATIC PRESSURE

a) Airplane configuration and engine mode of operation

- airplane occupied by two persons
- fuel tanks full
- Flaps in **RETRACTED** position
- heating and venting controlled pushed in, i.e. venting shut and turned to ▲ position, i.e. hot air blows fwd section of sliding canopy
- engine idle run
- flight altitude 3000 ft
- airpseed 130 km/h (70 knots) IAS.

b) Set the alternate static pressure valve (Fig. 34-1, item 11) to **ALT. STAT. SOURCE** position and the airspeed should not change for more than ± 2 km/h (± 1 knot).

c) Adjust alternate static pressure if necessary to provide indicated speed within allowance issued in previous point b).

- unscrew locking and open guard of adjusting screw (12).
- screw in the adjusting screw to reduce IAS or unscrew the adjusting screw to increase IAS.
- lock adjusting screw with lacquer and cover it with sheet guard.

d) Set valve of alternate static pressure source to **MAIN** position and lock it with 0,3 mm (0,01 in) cooper wire and seal.

STALL WARNING ANNUNCIATOR

DESCRIPTION AND OPERATION

CAUTION

IN CASE THE **STALL WARN. INACTIVE** ANNUNCIATOR IS LIT IN FLIGHT THE ELECTRIC CIRCUIT OF STALL WARNING IS OFF AND THE STALL WARNING SYSTEM IS OUT OF OPERATION.

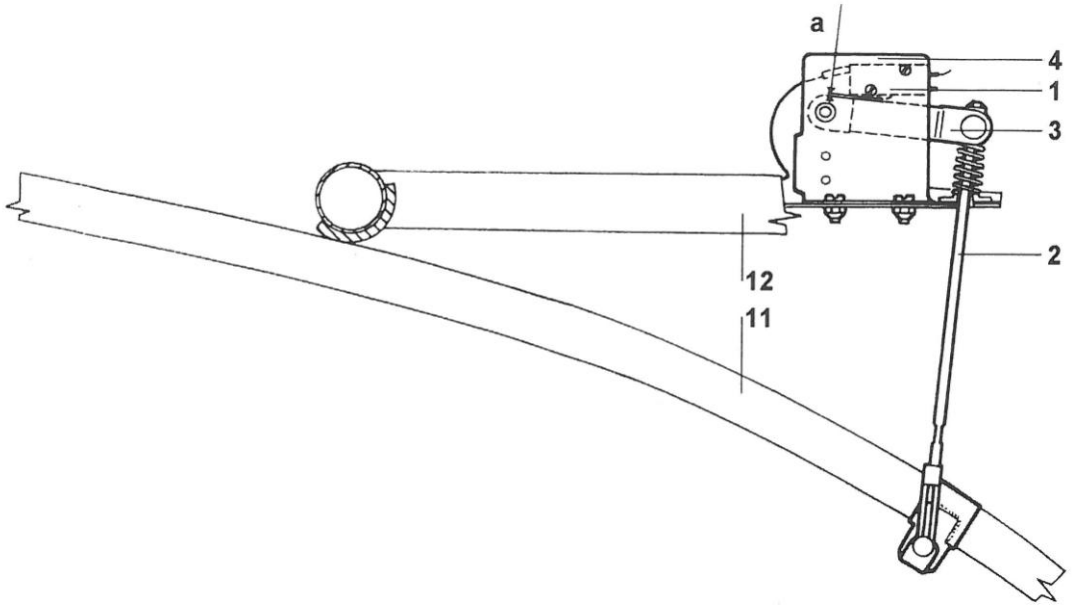
The airspeed indicator with stall warning annunciator (Fig. 34-1, item 21) is equipped with pressure capsule and switch controlling the stall warning annunciation. The stall warning pressure capsule responds to difference pitot pressure from pitot probe (1) and pressure supplied by stall warning pressure vent (4). The annunciator switch at critical speed, higher for about 9 to 18 km/h (5 to 10 knots) than the actual stalling speed switches on the warning audio warning signal.

On the ground the stall warning circuit is turned off. The circuit turning off is ensured by weight-on-wheel switch (Fig. 34-4, item 1) controlled (turned on and off) by pushrod (2) joined to right main landing gear leg (11). In case the stall warning circuit is turned off the **STALL WARN. INACTIVE** light annunciator in light annunciation panel is lit.
The weight-on-wheel switch turns the stall warning annunciation circuit after take-off and the **STALL WARN. INACTIVE** light annunciator extinguishes.

NOTE

The airplane registerd in GFR are not equipped with **STALL WARN. INACTIVE** light annunciator.

EFFECTIVITY: All



a ... play between lever (3) and micro-switch pushbutton (1)
when the landing gear is not loaded (a = 0,5 mm)

1 ... micro-swich
2 ... pushrod
3 ... lever
4 ... holder

For information only:
11 ... right leg of main landing gear
12 ... main fuselage beam

Fig. 34-4 Weight-on-wheel switch controlling stall warning circuit

REPAIRS

Fault	Possible reason	Remedy
The stall warning annunciation is operating on the ground.	Incorrectly adjusted or faulty weight-on-wheel micro-switch (Fig. 91-6, item D8) in starboard wing above the main landing gear leg.	Check weight-on-wheel micro-switch adjustment that should be off on the ground
		Check micro-switch seviceability by ohmmeter and replace faulty part.
The stall warning annunciation system is out of operation in flight as well as during check on ground.	Faulty relay (Fig. 91-6, item D10) switching warning horn D9). Up to S/N 0045 incl.	Press **SIGNALLING CHECK** push button and make sure the relay solenoid is fed with the voltage of board electric network. Replace relay if the voltage correct.
	Fault in electric circuit switch (Fig. 91-6, item D10) switching warning horn (D9). From S/N 0046 incl.	Repair or replace defective parts.
	Faulty horn (Fig. 91-6, item D9).	Press **SIGNALLING CHECK** push button and make sure the horn is fed with the voltage of board electric network. Replace horn if the voltage correct and horn is out of operation.

EFFECTIVITY: All

MAINTENANCE

ADJUSTMENT / CHECK

ADJUSTMENT OF STALL WARNING SPEED ANNUNCIATION

The audio warning of stalling speed should be turned on at IAS higher for 9 to 18 km/h (5 to 10 knots) than the actual airplane stalling speed in pertinent airplane configuration and should be in operation up to the actual airplane stall. In case the stall warning does not meet the above requirements it is necessary to adjust it. It is recommended to request either the pilots or authorized repair shop to adjust stalling speed value.

Procedure of stalling speed adjustment in flight:

The stall warning speed adjustment is made with the airplane flight weight of 1080 kg (2380 lb) as follows:

a) Verify stalling speed at 920 m (3000 ft) altitude in calm air and following airplane configurations:

Item No.	Engine mode of operation	Flap position	Stalling speed IAS	
			Designation	km/h (knots)
1	Iddle run	0° (**RETRACTED**)	V_{S1}	
2		37° (**LANDING**)	V_{SO}	
3	Take-off run	0° (**RETRACTED**)	V_{S1}	
4		37° (**LANDING**)	V_{SO}	

Record measured stalling speeds.

b) Set the airplane airspeed to the value measured and recorded in table, item No. 1 (iddle run, flaps in **RETRACTED** position) and increase airspeed for 15 ± 2 km/h (8 ± 1 knots), i.e. as follows:

$V_{S1}{}^{+17}_{+13}$ km/h ($V_{S1}{}^{+9}_{+7}$ knots).

Turn and remove adjusting screw guard upon the face of airspeed indicator. Turn the adjusting screw by means of removed guard being inserted with its recess upon the quadrant of adjusting screw until the audio warning is heard.

Recommendation

Join the adjusting screw guard by long thread to the adjusting screw to prevent its loosing in flight.

c) Increase the airspeed until the audio warning signal stops.

d) Reduce gradually the airspeed to verify the correct airspeed of warning signal switching according to paragraph b).

e) Check the stall warning speed in all above listed airplane configurations (paragraph a).

f) Insert guard upon the face of the airspeed indicator, turn it and lock with safety wire.

INSPECTION / CHECK

SERVICEABILITY CHECK OF STALL WARNING SPEED ANNUNCIATION

NOTE

The serviceability check of stall warning annunciation should be carried out after removal, installation and/or replacement of any stall warning speed system element and in case the systém remains switched after landing i.e. audio signal remains switched.

Procedure

a) Lift the airplane by fuselage jacks so that the landing gear wheels are not in touch with the ground and thus the micro-switch (Fig. 34-4, item 1) turns the stall warning system on:
   - turn **MASTER**, **BATTERY** and **FLIGHT INSTR.** switches on. At that moment the audio stall warning horn should be heard and white **STALL WARN. INACTIVE** light annunciator should be extinguished.

   NOTE

   The airplane registerd in GFR are not equipped with **STALL WARN. INACTIVE** light annunciator.

b) Airplane is on the landing gear so that the weight-on-wheel switch turns the stall warning circuit off:
   - turn **MASTER**, **BATTERY** and **FLIGHT INSTR.** switches on and press **SIGNALLING CHECK** push button. The stall warning horn should produce audio warning and all the annunciation lights should be lit.

EFFECTIVITY: All

MAGNETIC COMPASS

DESCRIPTION AND OPERATION

The magnetic compass serves for determination of airplane heading.
The internal space of cylindrical vessel-compass bowl-is provided with reading window in the face of bowel and it is divided by flat partition into two parts. In the bottom part of bowel, filled with damping anti-freeze liquid, there is a float with compass card. The upper part of bowel serves for equalization of volumetric changes of damping fluid during temperature changes. The compass card revolves upon tipped pivot elastically suspended in sapphire cup. The compass card scale is illuminated with bulbs. In the bottom the compass is equipped with compass deviation corrector.

The magnetic compass is located upon left instrument panel glareshield. The second (optional) magnetic compass may be installed upon right instrument panel glareshield.

MAINTENANCE

ADJUSTMENT / CHECK

COMPASS COMPENSATION

General:

a) The compass compensation is carried out:
- during annual inspection
- after the additional instrument, electric appliance and/or avionics installation
- after the compass or engine replacement
- in other cases that effecting compass accuracy.

b) Carry the compass compensation at the place far, at least 100 m (330 ft) from electric leads, steel constructions and buildings.

Recommendation

The most suitable way of compass compensation is to use compas rose with marked headings suitable for the task.

c) The personal attending the compass compensation should not have ferromagnetic items with them, e.g. knives, tools etc.
The screwdriver used for adjustment should be made from non-magnetic material e.g. from bras.

d) The compass compensation should be made with the airplane in configuration usually used in flight, i.e. engine running, electric network switched on, and communication and navigation equipment running.

e) The A deviation is analyses is carried out in case of compass replacement or if the detected deviation at one of checked headings exceed 5^{o}.

f) The B and C screw-like adjusters are accesible from the compass face. The point upon the adjuster indicates neutral position of compensation device when directed to designation letter.

Procedure of compass compensation:

1) Correct deviation A in cases described in paragraph e) as follows:

a) Turn the airplane gradually through 45^{o} to N; NE; E; SE; S; SW; W; NW and record the δN; δNE; δE and etc. Calculate A deviation using following formula :

$$A = \frac{\delta N + \delta NE + \delta E + \delta SE + \delta S + \delta SW + \delta W + \delta NW}{8}$$

NOTE

In formula substitute negative or positive deviation as detected, i.e. western deviations are negative (-) while eastern deviations are positive (+).

b) Release compass fixing screws and turn with the compass to remove calculated deviation A. Fix the screws after deviation removal again.

EFFECTIVITY: All

2) Correct B and C deviation as follows:

   a) Turn the airplane gradually to N and E and record deviation in these headings.

   b) Turn the airplane to S heading, record deviation δS and using the C corrector reduce deviation to avegage of deviation C:

$$\frac{\delta N + \delta S}{2}$$

   c) Turn the airplane to W heading, record δW deviation and correct compass reading with B corrector to reduce B deviation to average value:

$$\frac{\delta E + \delta W}{2}$$

3) Turn the airplane gradually through 30^o and record actual deviations. The record on compass compensation should contain:

   a) airplane type and serial number.

   b) engine type and production number.

   c) the residual deviation in 30^o, 60^o, 90^o, ... 360^o (by 30^o).

   d) date and signature of authorized professional.

NOTE

In case the residual deviation exceed 5^o, it is necessary to carry out A, B and C corrections according to previous paragraphs.

4) Make out the compas deviation placard containing airplane registry and date of compass compensation.

NOTE

The compass deviation placard is placed above the left instrument panel and if the second magnetic compass is installed, above the right instrument panel.

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