

CHAPTER

37

VACUUM

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GENERAL

The airplane may be optionally equipped with vacuum-drive gyro instruments as artificial horizon and directional gyro (section 37-10-00) or vacuum-driven artificial horizon only (section 37-11-00) or vacuum-drive directional gyro only (section 37-12-00). The source of vacuum for instrument driving is the engine driven vacuum pump.

EFFECTIVITY: All

37-00-00

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VACUUM-DRIVEN GYRO INSTRUMENTS

(optional)

DESCRIPTION AND OPERATION

The power source of vacuum driven gyro instruments (Fig. 37-1; item 1;2) is the engine driven vacuum pump (3) that is screwed to rear engine side upon vacuum pump drive pad (11).

The air sucked through vacuum filter (4) being fixed to console (5) in left instrument panel, passes through vacuum-driven artificial horizon (1), directional gyro (2), vacuum governor (6) and vacuum pump (3).

The vacuum pressure gauge (7) indicates difference of pressure in front of and behind the vacuum-driven gyro instruments. This difference, as the vacuum filter (4) clogs, gradually drops and vacuum indicator (7) indicates smaller value. The adjustment of vacuum to operational value is made by vacuum governor (6) that is located upon firewall (12) under the cover of instrument panel.

Installation diagram

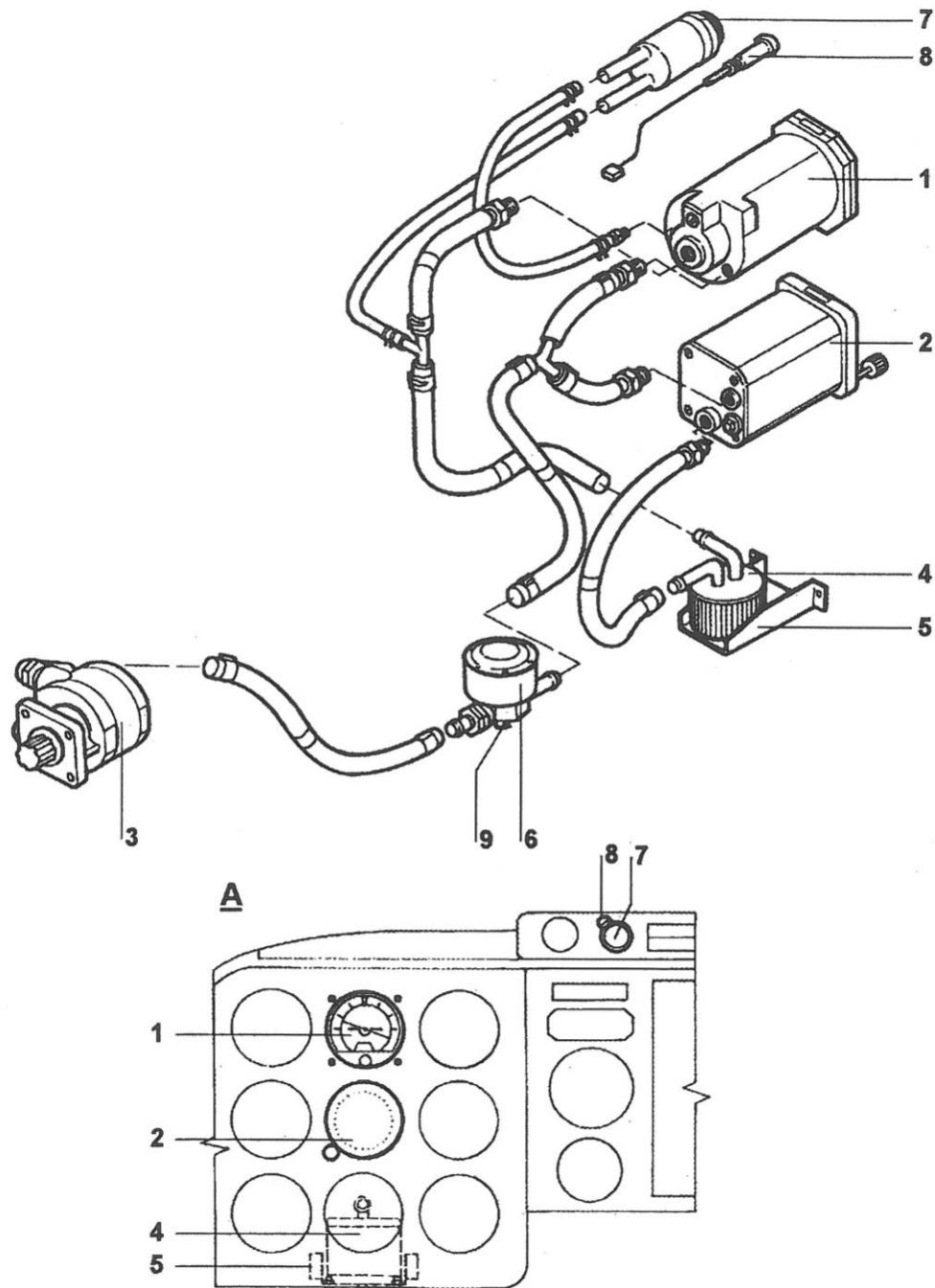


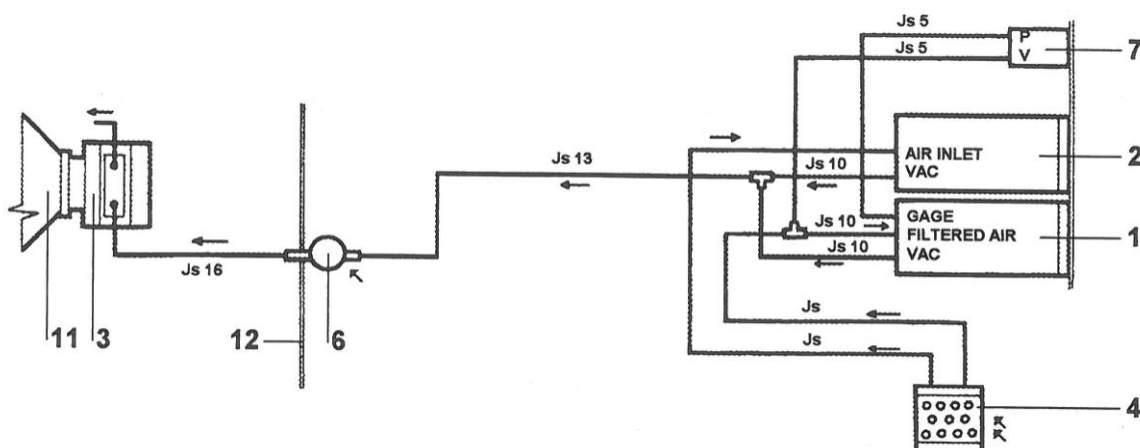
Fig. 37-1 Vacuum-driven gyro instruments
(page 1 of 2)

EFFECTIVITY: All

37-10-00

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2011-02-02

Operational diagram



A ... location of vacuum-driven gyro instruments in instrument panel

- 1 ... vacuum driven artificial horizon
- 2 ... vacuum driven directional gyro
- 3 ... vacuum pump
- 4 ... vacuum filter
- 5 ... console
- 6 ... vacuum governor (with filter element)
- 7 ... vacuum indicator
- 8 ... illumination of vacuum indicator
- 9 ... adjusting screw

For information only:

- 11 ... Lycoming vacuum pump drive
12 ... firewall

*Fig. 37-1 Vacuum-driven gyro instrument
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MAINTENANCE

REMOVAL / INSATALLATION

REMOVAL OF VACUUM SYSTEM

Preparatory works

- a) Tilt left instrument panel (section 31-10-00).
- b) Release conductor harness behind left instrument panel to enable access to vacuum filter (Fig. 37-1, item 4).

Removal of vacuum filter

- a) Unscrew nut upon the vacuum filter bottom (4) of filter fixing to console.
- b) Remove vacuum filter (4) from the console (5), open clips and pull hoses from the vacuum filter ports.

INSTALLATION OF VACUUM SYSTEM

Installation instructions

CAUTION

PREVENT ACCESS OF OIL AND GREASE (FAT) INTO THE VACUUM SYSTEM AS IT MAY DAMAGE THE VACUUM PUMP (Fig. 37-1, item 3).

- a) Blow the hoses of vacuum systém before installation with compressed air. Make sure the hoses are not flattened in bends.
- b) Use teflon stripe as the sealing means of screwed pipe couplings. Make sure no remains of sealing stripe has entered the vacuum hoses and/or instruments.

NOTE

Remove all the remains of teflon sealing stripe and use one during any pipe coupling installation.

- c) Tighten all the pipe couplings with maximum 2 Nm (1,5 lbft) torque.
- d) Check serviceability of vacuum system after any assembly or installation.

Installation of vacuum filter

- a) Remove plugs from vacuum filter ports (4).
- b) Insert hoses upon vacuum filter ports (4) and fix them with clips.
- c) Fit the vacuum filter (4) upon the console (5) and fix the filter with nut and washer at the bottom of filter body.

EFFECTIVITY: All

Final works

- a) Fix cable harness behind left instrument panel with fixing stripes.
- b) Tilt in left instrument panel (section 31-10-00).
- c) Adjust vacuum governor (6) as follows:
 - set engine speed to 1500 RPM and adjust pressure according to vacuum indicator (7) to 2/3 of green scale sector
 - make sure the vacuum does not exceed upper limit of indicator green sector at engine take-off speed
 - lock adjusting screw of vacuum governor.

INSPECTION / CHECK

SERVICEABILITY CHECK OF VACUUM SYSTEM

1. Serviceability check of vacuum system without use of tester

- a) Check reading of vacuum pressure gauge (Fig. 37-1, item 7) at engine 1500 RPM – the pointer of instrument should point to 2/3 of green scale segment. Adjust vacuum if necessary by adjusting screw (9) of vacuum governor (6).
- b) Make sure the vacuum magnitude does not exceed at the engine take-off run the upper limits of gauge green scale.
- c) Lock adjusting screw by bending the tab washers.

2. Serviceability check of vacuum system with VACUUM TEST KIT

NOTE

The detailed data on tester are issued in 343 Test Kit Instruction Manual for Pneumatic / Vacuum Systems and in Maintenance Instruction Manual.

Procedure of test

- a) Remove upper and side engine cowlings (section 71-10-00, REMOVAL / INSTALLATION).
- b) Place tester upon engine mount structure.
- c) Uncouple the hose (Fig. 37-2, item 12) of airplane vacuum system from the vacuum pump (11) and join it to the ejector (1).
- d) Shut the shut-off valve (6) by moving the slider controller (7) to the very end in the direction to governor.
- e) Shut the governor (5) by turning the adjusting screw (4) anti-clockwise.
- f) Join source of pressure air to the inlet port of governor (5).
- g) Open the supply of pressure air to the tester.
- h) Move slider controller (7) of shut-off valve to OPEN position to the very end in the direction to governor.
- i) Turn the adjusting screw (4) of governor (5) clockwise until the pointer of vacuum pressure gauge (2) of ejector stops moving. At this moment turn the adjusting screw twice more time round.
- j) Adjust pressure in vacuum system of airplane by adjusting screw (Fig. 37-1, item 9) of vacuum governor (6) so that the pointer of vacuum pressure gauge (7) may shows 2/3 of green scale segment.
- k) Check if the warning flag of vacuum driven artificial horizon disappears.

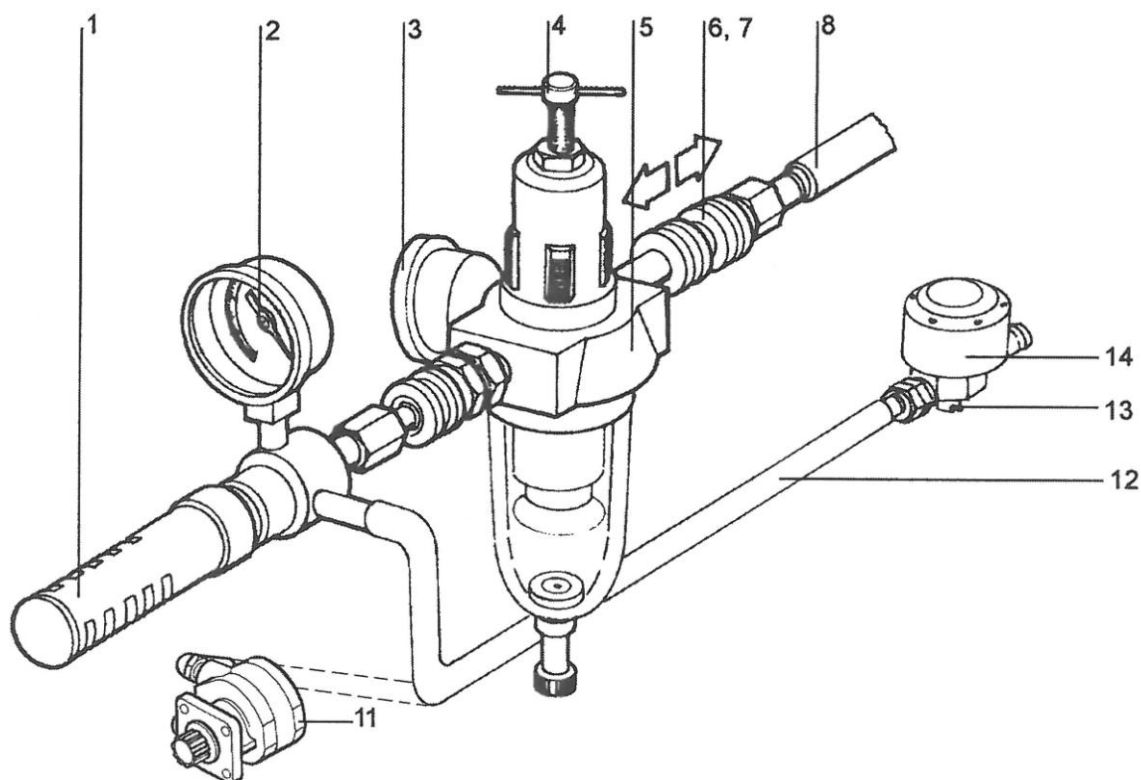
EFFECTIVITY: All

- l) Check reading of vacuum pressure gauge (Fig. 37-2, item 2) that is coupled to ejector. The magnitude of indicated vacuum read at this gauge may be greater for 1,5 in.Hg than that indicated by vacuum pressure gauge of airplane vacuum system (Fig. 37-1, item 7).

Example:

If the pointer of airplane vacuum pressure gauge indicates 5 in.Hg, than the vacuum indicated by vacuum pressure gauge coupled to ejector should not show more than 6,5 in.Hg. In case the indicated data are out of permitted allowance it is necessary to check free passage of airplane vacuum system. Some hose of system may be clogged or bent, remove detected fault.

- m) Shut supply of air pressure to tester.
- n) Check if the warning flag of vacuum driven artificial horizon (attitude indicator) is extended after gyroscope coast down, i.e. after 2 minutes since the moment of pressure supply shutting.
- o) Lock vacuum adjusting screw (Fig. 37-1, item 9) of vacuum governor (6) by tab washer.
- p) Install engine cowlings (section 71-10-00, REMOVAL / INSTALLATION).



Vacuum test kit:

- 1 ... ejector
- 2 ... vacuum pressure gauge
- 3 ... vacuum pressure gauge in governor
- 4 ... adjusting screw
- 5 ... governor
- 6 ... shut-off valve
- 7 ... sliding controller
- 8 ... hose of air pressure supply

For information only:

- 11 ... vacuum pump (upon engine)
- 12 ... hoses of airplane vacuum system
- 13 ... adjusting screw
- 14 ... vacuum governor (upon firewall)

Fig. 37-2 Diagram of VACUUM TEST KID coupling

APPROVED REPAIRS

REPAIR OF VACUUM SYSTEM

Fault	Remedy
1) Hoses a) damage, b) expired life time of rubber hoses (section 05-10-00).	Replace damaged or expired hoses.
2) Pressure indicated by vacuum indicator is below lower limit of green sector, i.e. below 4,5 inHg.	Adjust vacuum governor (Fig. 37-1, item 6) - see REMOVAL / INSTALLATION. In case the vacuum governor cannot be adjusted replace element of vacuum filter and filter element of vacuum governor. Adjust vacuum governor after filter element replacement.

Replacement of filter element of vacuum governor:

Pull off the original filter element from the vacuum governor and insert new B 3 - 5 - 1 filter element instead.

Recommendation

Release fixing nut upon the vacuum governor port on the front side of firewall and slide the vacuum governor into the cockpit to make the filter element replacement simpler. Tighten the fixing nut after filter element replacement.

EFFECTIVITY: All

VACUUM-DRIVEN ARTIFICIAL HORIZON

(optional)

DESCRIPTION AND OPERATION

The source of underpressure for vacuum driven artificial horizon (Fig. 37-3, item 1) is the engine driven vacuum pump (2) that is fixed to vacuum pump drive pad (10) upon the upper aft engine side.

The air is sucked through vacuum filter (4) fixed to console (7) upon the left instrument panel, and passes through vacuum driven artificial horizon (1), vacuum filter (3), and vacuum pump (2).

The vacuum indicator (5) indicates pressure difference upstream and downstream of artificial horizon (1). This pressure difference indicated by vacuum indicator (5) gradually decreases as the filter element (4) clogs. The underpressure adjustment to operating value is carried out by vacuum governor (3) that is located upon the firewall (11) under the cover of instrument panel.

Installation diagram

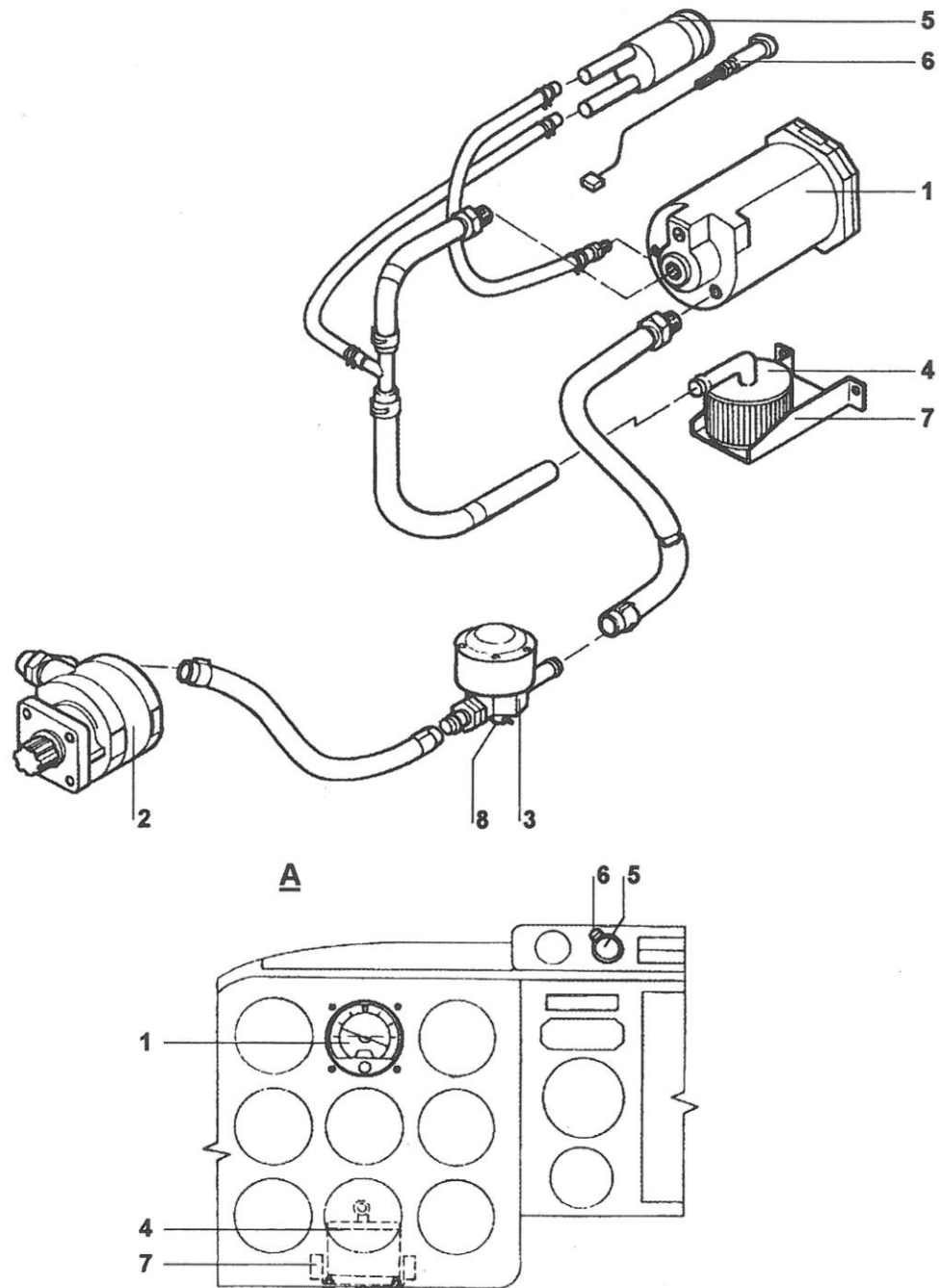


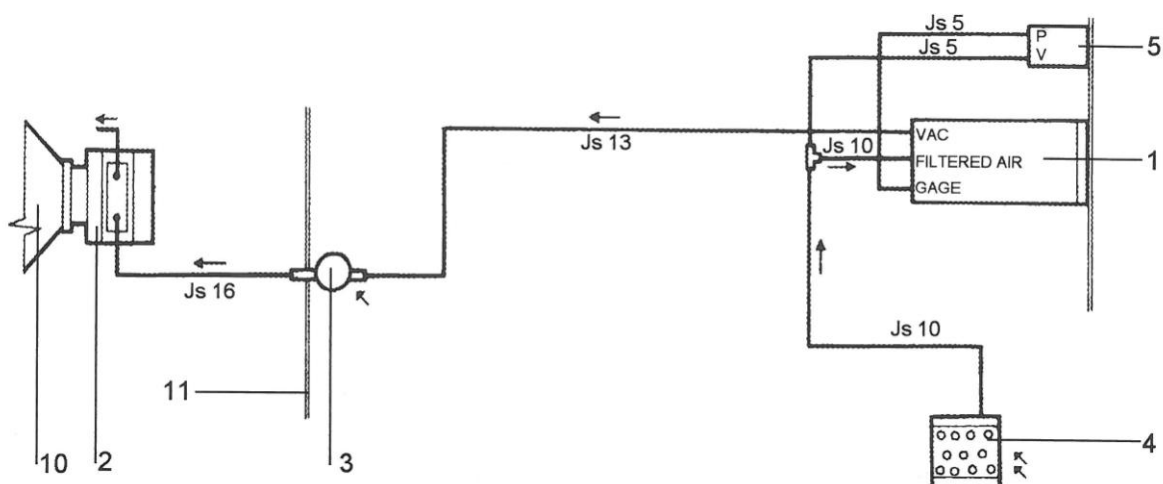
Fig. 37-3 Vacuum-driven artificial horizon
(page 1 of 2)

EFFECTIVITY: All

37-11-00

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2011-02-02

Operation diagram



A ... location of vacuum-driven artificial horizon in instrument panel

- 1 ... vacuum drive artificial horizon
- 2 ... vacuum pump
- 3 ... vacuum governor with filter element
- 4 ... vacuum filter
- 5 ... vacuum indicator
- 6 ... vacuum indicator illumination
- 7 ... console
- 8 ... adjusting screw

For information only:

- 10 ... Lycoming vacuum drive pad
- 11 ... firewall

*Fig. 37-3 Vacuum-driven artificial horizon
(page 2 of 2)*

EFFECTIVITY: All

MAINTENANCE

REMOVAL / INSTALLATION

REMOVAL OF VACUUM SYSTEM

Preparatory works

- a) Tilt out the left instrument panel (section 31-10-00).
- b) Release fixing straps of conductor harness behind left instrument panel to enable access to vacuum filter (Fig. 37-3, item 4).

Removal of vacuum filter

- a) Unscrew vacuum filter fixing nut (4) upon the bottom of filter fixing the filter to console (7).
- b) Remove vacuum filter (4) from the console (7). Remove hose fixing clips and pull the hose from the filter port.

INSTALLATION OF VACUUM SYSTEM

Installation instructions

CAUTION

PREVENT ACCESS OF OIL AND GREASE (FAT) INTO THE VACUUM SYSTEM AS IT MAY DAMAGE THE VACUUM PUMP (Fig. 37-3, item 2).

- a) Blow the vacuum system hoses with compressed air before their installation. The hoses should not be flattened in bends.
- b) Make threaded pipe couplings tight by teflon stripe. Make sure no remnants of teflon stripe enter the vacuum system hoses or instruments.

NOTE

Remove all the remnants of teflon sealing stripe before assembly or installation and use new teflon sealing stripe.

- c) Tighten all the pipe couplings with maximum 2 Nm (1,5 lbfft) torque.
- d) Make vacuum system serviceability check after any installation.

Installation of vacuum filter

- a) Remove plug from the vacuum filter port.
- b) Insert hose upon the vacuum filter port (4) and fix it with clip.
- c) Fit vacuum filter (4) to the console (7) and fix it with nut and washer upon the filter bottom.

EFFECTIVITY: All

Final works

- a) Fix the conductor harness with fixing stripes behind the left instrument panel.
- b) Tilt back the left instrument panel (section 31-10-00).
- c) Adjust vacuum governor (3) as follows:
 - adjust pressure, when the engine runs in 1500 RPM, indicated by vacuum indicator (5) to the 2/3 of instrument green scale sector.
 - make sure at engine take-off run the indicated pressure has not exceeded the green upper limit.
 - lock adjusting screw of vacuum governor.

INSPECTION / CHECK

SERVICEABILITY CHECK OF VACUUM SYSTEM

1. Serviceability check of vacuum system without use of tester

- a) Check reading of vacuum pressure gauge (Fig. 37-3, item 5) at engine 1500 RPM the pointer of instrument should point to 2/3 of green scale segment. Adjust vacuum if necessary by adjusting screw (8) of vacuum governor (3).
- b) Make sure the vacuum magnitude does not exceed at the engine take-off fun the upper limits of gauge green scale.
- c) Lock adjusting screw by bending the tab washers.

2. Serviceability check of vacuum system with VACUUM TEST KIT

NOTE

The detailed data on tester are issued in 343 Test Kit Instruction Manual for Pneumatic/Vacuum systems and in Maintenance Instruction Manual.

Procedure of Test:

- a) Remove upper and side engine cowlings (section 71-10-00, REMOVAL / INSTALLATION).
- b) Place tester upon engine mount structure.
- c) Uncouple the hose (Fig. 37-2, item 12) of airplane vacuum system from the vacuum pump (11) and join it to the ejector (1).
- d) Shut the shut-off valve (6) by moving the slider controller (7) to the very end in the direction to governor.
- e) Shut the governor (5) by turning the adjusting screw (4) anti-clockwise.
- f) Join source of pressure air to the inlet port of governor (5).
- g) Open the supply of pressure air to the tester.
- h) Move slider controller (7) of shut-off valve to OPEN position to the very end in the direction to governor.
- i) Turn the adjusting screw (4) of governor (5) clockwise until the pointer of vacuum pressure gauge (2) of ejector stops moving. At this moment turn the adjusting screw twice more time round.
- j) Adjust pressure in vacuum system of airplane by adjusting screw (Fig. 37-3, item 8) of vacuum governor (3) so that the pointer of vacuum pressure gauge (5) may shows 2/3 of green scale segment.
- k) Check if the warning flag of vacuum driven artificial horizon disappears.

EFFECTIVITY: All

- l) Check reading of vacuum pressure gauge (Fig. 37-2, item 2) that is coupled to ejector. The magnitude of indicated vacuum read at this gauge may be greater for 1,5 in. Hg than that indicated by vacuum pressure gauge of airplane vacuum system (Fig. 37-3, item 5).

Example:

If the pointer of airplane vacuum pressure gauge indicates 5 in. Hg than the vacuum indicated by vacuum pressure gauge coupled to ejector should not show more than 6,5 in Hg. In case the indicated data are out of permitted allowance it is necessary to check free passage of airplane vacuum system. Some hose of system may be clogged or bent, remove detected fault.

- m) Shut supply of air pressure to tester.
- n) Check if the warning flag of vacuum driven artificial horizon (attitude indicator) is extended after gyroscope coast down, i.e. after 2 minutes since the moment of pressure supply shutting.
- o) Lock vacuum adjusting screw (Fig. 37-3, item 8) of vacuum governor (3) by tab washer.
- p) Install engine cowlings (section 71-10-00, REMOVAL / INSTALLATION).

APPROVED REPAIRS

REPAIR OF VACUUM SYSTEM

Fault	Remedy
1) Hoses a) damage, b) expired life time of rubber hoses (section 05-10-00).	Replace damaged or expired hoses.
2) The pressure indicated by vacuum indicator is below green lower limit, i.e. below 4,5 in Hg.	Adjust vacuum governor (Fig. 37-3, item 3) - see. REMOVAL / INSTALLATION. In case the adjustment of vacuum governor is impossible it is necessary to replace filter elements of vacuum governor and vacuum filter (4). Adjust vacuum governor.

Replacement of filter element of vacuum governor:

Pull off the original filter element from the vacuum governor and insert new B 3 - 5 - 1 filter element instead.

Recommendation

Release fixing nut upon the vacuum governor port on the front side of firewall and slide the vacuum governor into the cockpit to make the filter element replacement simpler. Tighten the fixing nut after filter element replacement.

EFFECTIVITY: All

37-11-00

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VACUUM-DRIVEN DIRECTIONAL GYRO

(optional)

DESCRIPTION AND OPERATION

The source of underpressure for vacuum driven directional gyro (Fig. 37-4, item 1) is the engine driven vacuum pump (2) that is fixed to vacuum pump drive pad (10) upon the upper aft engine side.

The air is sucked through vacuum filter (4) fixed to console (7) upon the left instrument panel, and passes through vacuum driven directional gyro (1), vacuum filter (3), and vacuum pump (2).

The vacuum indicator (5) indicates pressure difference upstream and downstream of directional gyro (1). This pressure difference indicated by vacuum indicator (5) gradually decreases as the filter element (4) clogs. The underpressure adjustment to operating value is carried out by vacuum governor (3) that is located upon the firewall (11) under the cover of instrument panel.

Installation diagram

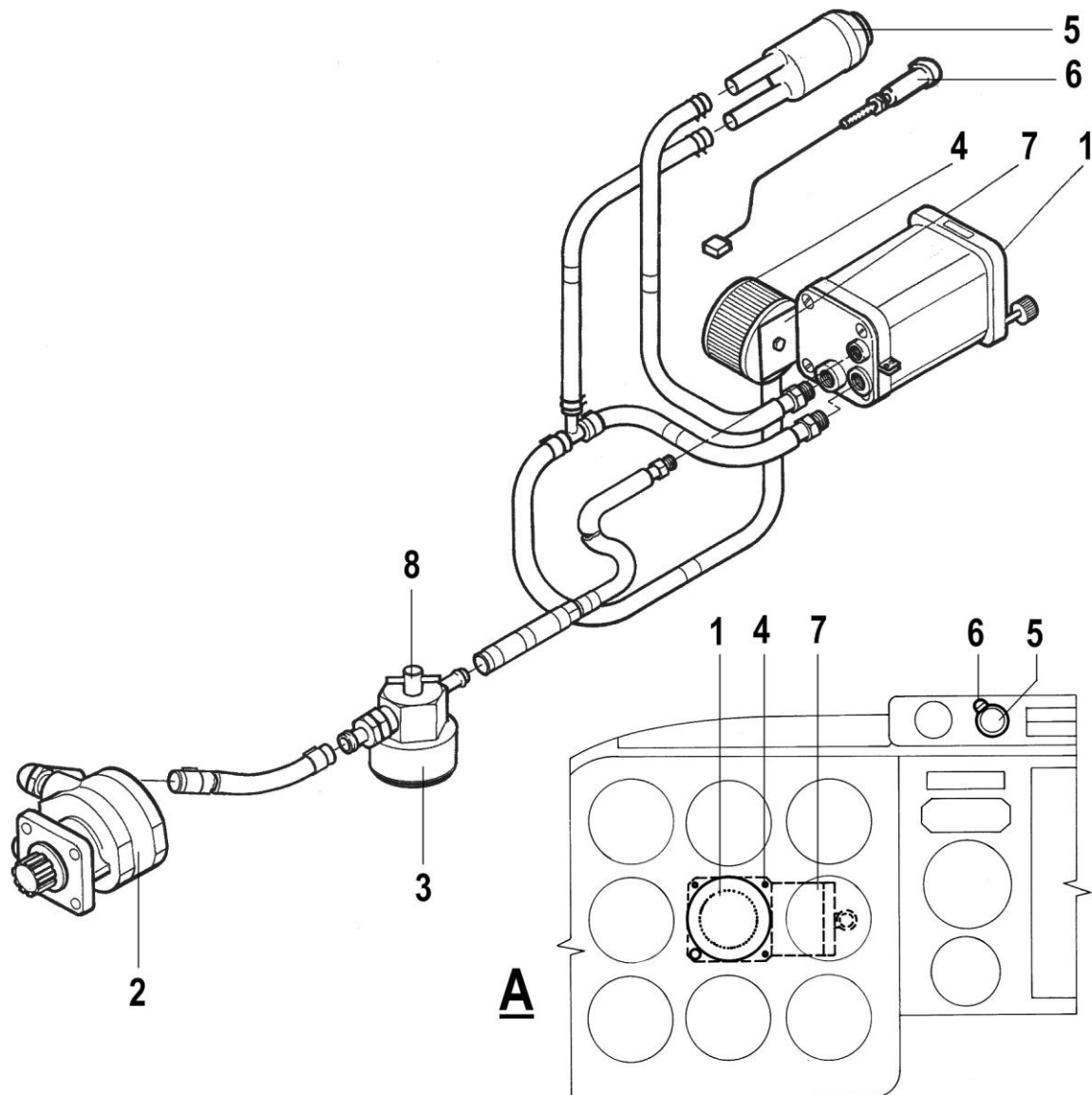


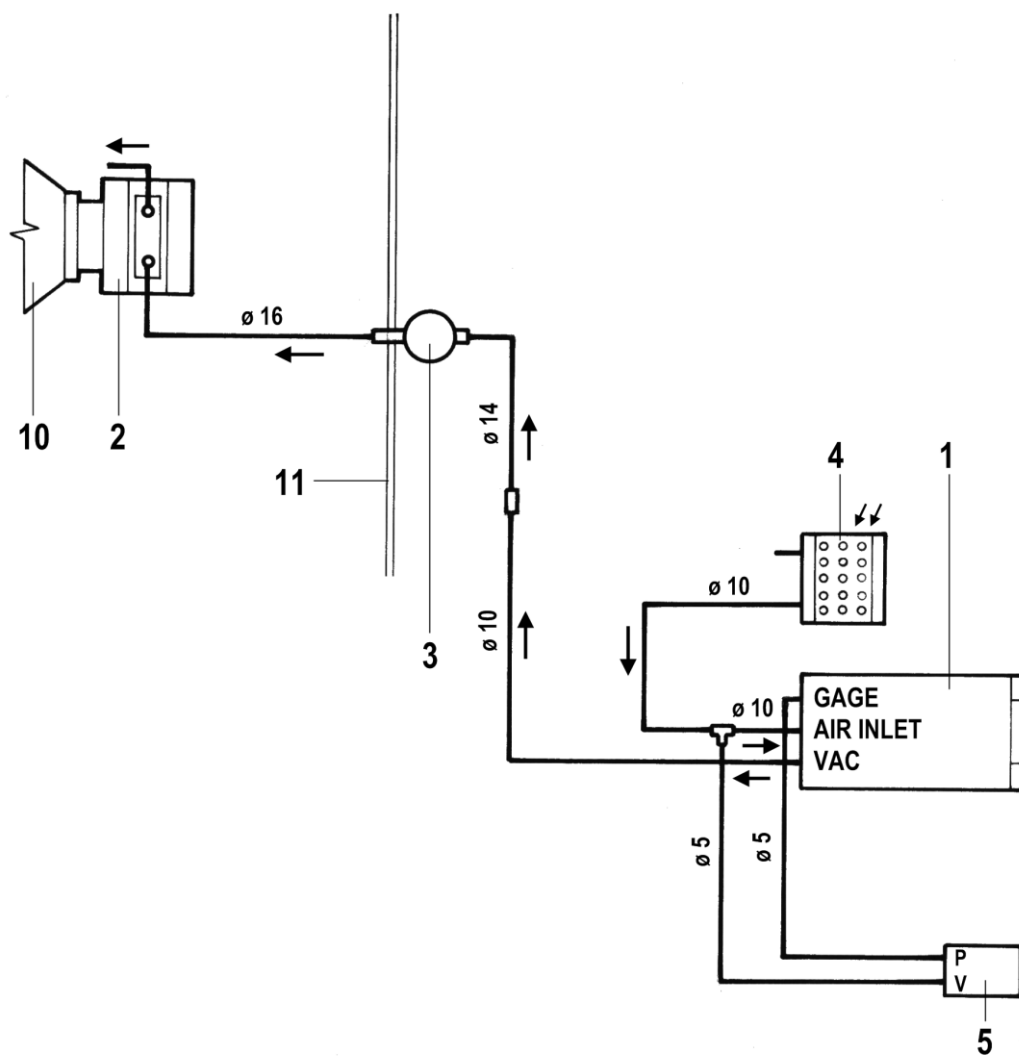
Fig. 37-4 Vacuum-driven directional gyro
(page 1 of 2)

EFFECTIVITY: All

37-12-00

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2011-02-02

Operational diagram



A ... location of vacuum driven directional gyro in instrument panel

- 1 ... vacuum drive directional gyro
- 2 ... vacuum pump
- 3 ... vacuum governor with filter element
- 4 ... vacuum filter
- 5 ... vacuum indicator
- 6 ... vacuum indicator illumination
- 7 ... console
- 8 ... adjusting screw

For information only:

- 10 ... Lycoming vacuum drive pad
- 11 ... firewall

Fig. 37-4 Vacuum-driven directional gyro
(page 2 of 2)

MAINTENANCE

REMOVAL / INSTALLATION

REMOVAL OF VACUUM SYSTEM

Preparatory works

- a) Tilt out the left instrument panel (section 31-10-00).
- b) Release fixing straps of conductor harness behind left instrument panel to enable access to vacuum filter (Fig. 37-4, item 4).

Removal of vacuum filter

- a) Unscrew vacuum filter fixing nut (4) upon the side of filter fixing the filter to console (7).
- b) Remove vacuum filter (4) from the console (7). Remove hose fixing clips and pull the hose from the filter port.

INSTALLATION OF VACUUM SYSTEM

Installation instructions

CAUTION

PREVENT ACCESS OF OIL AND GREASE (FAT) INTO THE VACUUM SYSTEM AS IT MAY DAMAGE THE VACUUM PUMP (Fig. 37-4, item 2).

- a) Blow the vacuum system hoses with compressed air before their installation. The hoses should not be flattened in bends.
- b) Make threaded pipe couplings tight by teflon stripe. Make sure no remnants of teflon stripe enter the vacuum system hoses or instruments.

NOTE

Remove all the remains of teflon sealing stripe before assembly or installation and use new teflon sealing stripe.

- c) Tighten all the pipe couplings with maximum 2 Nm (1,5 lbft) torque.
- d) Make vacuum system serviceability check after any installation.

Installation of vacuum filter

- a) Remove plug from the vacuum filter port.
- b) Insert hose upon the vacuum filter port (4) and fix it with clip.
- c) Fit vacuum filter (4) to the console (7) and fix it with nut and washer upon the filter side.

EFFECTIVITY: All

Final works

- a) Fix the conductor harness with fixing stripes behind the left instrument panel.
- b) Tilt back the left instrument panel (section 31-10-00).
- c) Adjust vacuum governor (3) as follows:
 - Adjust pressure, when the engine runs in 1500 RPM, indicated by vacuum indicator (5) to the 2/3 of instrument green scale sector.
 - Make sure at engine take-off run the indicated pressure has not exceeded the green upper limit.
 - Lock adjusting screw of vacuum governor.

INSPECTION / CHECK**SERVICEABILITY CHECK OF VACUUM SYSTEM****1. Serviceability check of vacuum system without use of tester**

- a) Check reading of vacuum pressure gauge (Fig. 37-4, item 5) at engine 1500 RPM the pointer of instrument should point to 2/3 of green scale segment. Adjust vacuum if necessary by adjusting screw (8) of vacuum governor (3).
- b) Make sure the vacuum magnitude does not exceed at the engine take-off fun the upper limits of gauge green scale.
- c) Lock adjusting screw by bending the tab washers.

2. Serviceability check of vacuum systém with VACUUM TEST KIT**NOTE**

The detailed data on tester are issued in 343 Test Kit Instruction Manual for Pneumatic/Vacuum systems and in Maintenance Instruction Manual.

Procedure of test:

- a) Remove upper and side engine cowlings (section 71-10-00, REMOVAL / INSTALLATION).
- b) Place tester upon engine mount structure.
- c) Uncouple the hose (Fig. 37-2, item 12) of airplane vacuum system from the vacuum pump (11) and join it to the ejector (1).
- d) Shut the shut-off valve (6) by moving the slider controller (7) to the very end in the direction to governor.
- e) Shut the governor (5) by turning the adjusting screw (4) anti-clockwise.
- f) Join source of pressure air to the inlet port of governor (5).
- g) Open the supply of pressure air to the tester.
- h) Move slider controller (7) of shut-off valve to OPEN position to the very end in the direction to governor.
- i) Turn the adjusting screw (4) of governor (5) clockwise until the pointer of vacuum pressure gauge (2) of ejector stops moving. At this moment turn the adjusting screw twice more time round.

EFFECTIVITY: All

- j) Adjust pressure in vacuum system of airplane by adjusting screw (Fig. 37-4, item 8) of vacuum governor (3) so that the pointer of vacuum pressure gauge (5) may shows 2/3 of green scale segment.
- k) Check reading of vacuum pressure gauge (Fig. 37-2, item 2) that is coupled to ejector. The magnitude of indicated vacuum read at this gauge may be greater for 1,5 in.Hg than that indicated by vacuum pressure gauge of airplane vacuum system (Fig. 37-4, item 5).
Example:
If the pointer of airplane vacuum pressure gauge indicates 5 in.Hg than the vacuum indicated by vacuum pressure gauge coupled to ejector should not show more than 6,5 in.Hg. In case the indicated data are out of permitted allowance it is necessary to check free passage of airplane vacuum system. Some hose of system may be clogged or bent. remove detected fault.
- l) Shut supply of air pressure to tester.
- m) Lock vacuum adjusting screw (Fig. 37-4, item 8) of vacuum governor (3) by tab washer.
- n) Install engine cowlings (section 71-10-00, REMOVAL / INSTALLATION).

APPROVED REPAIRS

REPAIR OF VACUUM SYSTEM

Fault	Remedy
1) Hoses a) damage, b) expired life time of rubber hose (section 05-10-00).	Replace damaged or expired hoses.
2) The pressure indicated by vacuum indicator is below green lower limit, i.e. below 4,5 in.Hg.	Adjust vacuum governor (Fig. 37-4, item 3) - see REMOVAL AND INSTALLATION. In case the adjustment of vacuum governor is impossible it is necessary to replace filter elements of vacuum governor and vacuum filter (4). Adjust vacuum governor.

Replacement of filter element of vacuum governor:

Pull the original filter element off from vacuum governor and insert new B 3-5-1 filter element instead.

Recommendation

Release fixing nut upon the vacuum governor port on the front side of firewall and slide the vacuum governor into the cockpit to make the filter element replacement simpler. Tighten the fixing nut after filter element replacement.

EFFECTIVITY: All