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1.0 GENERAL

The P-9( )/( )-( ) hydraulic propeller governor is a single acting governor developed for hydraulically variable pitch propellers with feathering and reversing capabilities. Produced by AVIA Propeller, Czech Republic, for MT-Propeller, Straubing, Germany (see Fig. 1).

1.1 MODEL DESIGNATION:

P - 9 X X - X X
1 - 2 3 4 - 5 6

Legend:

1  P = Propeller Governor
2  9 = Manufactured for MT-Propeller by AVIA Propeller
3  5 = Pressure to increase pitch. CCW facing engine mounting pad
4  6 = Pressure to increase pitch. CW facing engine mounting pad
5  7 = Pressure to decrease pitch. CCW facing engine mounting pad
6  8 = Pressure to decrease pitch. CW facing engine mounting pad

4  = Special arrangements
    0 = Standard
    1 = Feathering
    2 = Higher Pump Capacity
    3 = Electronic Control
    4 = Accumulator Connection / Standard
    5 = Accumulator Connection / Feathering
    6 = Synchrophasing
    7 = Electronic Control (3) + Accumulator Connection Standard (4) + Electric Feathering
    8 = Feathering (1) + Electric Control (3)

5  = Application Number, Settings of Control Lever and Relief Valve Pressure etc.
6  = Derivate of standard governor
    A = Old Style head
    D = Dual solenoid (reversing + feathering)
    H = for Horizontal installation of dual solenoid governor

S/No.  03 G 003 - F / D
a  b  c  d  e

a  = Year of Manufacture
b  = Governor
c  = Consecutive Number
d  = Modification Status
e  = Modification Status for FADEC Governor only
2.0 DESIGN INFORMATION

Also refer to Fig. 2, 3, 4, and 5

The governor is a dual pressure single acting system. It is designed for oil pressure to decrease pitch.

The governor has one relief valve with two pressure settings.

The low pressure setting is for normal operation and the high pressure relief valve setting is for reverse/beta range.

In low pressure operation the necessary increase of the engine oil pressure is assured by a gear pump in the governor, which increases the oil servo pressure.

Flyweights and a speeder spring move a pilot valve, allowing servo oil to flow to or from the piston in the propeller. In "on-condition" there is no oil flow.

A speed adjusting lever changes the pre-load of the speeder spring. This results in an engine/propeller speed change.

The high pressure mode is activated via a magnetic beta valve, which is installed on the governor.

In this condition the pressure rises up approximately twice and pushes the blades into full reverse.

During high pressure mode the propeller rpm is not controlled by the governor because the constant speed section is cut out.

The negative thrust is set by increasing and decreasing the engine power (rpm).

After the electric signal is switched off, the governor returns into normal operation pressure mode for constant speed operation.

“Dual solenoid” derivate can use feathering solenoid valve to speed up transient from reverse. The governor contains a gear pump, a relief valve, a pilot valve, flyweights, the beta valve and a solenoid valve. Dual solenoid derivate also contains electric feathering solenoid valve.

The flange type of the governor is in accordance with ADN 20010 standard, refer also to Fig. 5. The solenoid valve is installed on the top of the governor. “H” derivate of the governor has solenoid valve assembly installed aside of the body.

The solenoid valve controls the beta valve, which changes from low pressure to high pressure mode via an electric signal, which is produced by a switch inside the cockpit. If the high pressure mode is selected, the pilot valve is inoperative. The second solenoid valve of “D” and “H” derivate returns propeller from reverse to positive thrust and also it can be used for feathering.

The control lever is installed on the head of the governor, its angular position can be changed by turning the cover assembly.
- Figure 1 -

P-9( )-( ) Propeller Governor - General View

1 – reversing solenoid valve
2 – feathering solenoid valve
3 – speed adjustment lever
4 – electronic speed control
Figure 3

P-9( )-( ) Propeller Governor P-9( )-( ) (Dimensions)

All dimensions are millimeters with inches in brackets.
- Figure 3-1 -

P-9( )-( )D

All dimensions are millimeters with inches in brackets.
- Figure 3-2 -

P-9( )-( )H

All dimensions are millimeters with inches in brackets.
**Figure 4**

P-9( )/-( ) Propeller Governor (longitudinal sectional view)

**Legend:**

1. Speed adjusting lever
2. Return spring
3. Speed adjusting shaft
4. Speeder spring
5. Head with flyweights
6. Shaft
7. Relief valve plunger
8. Governor body
9. Gear pump
10. Governor base
11. Pilot valve
12. Governor drive
13. Pressure changing valve
14. Switching valve
15. Solenoid
16. Contacts
P-9( )1-( ): Propeller Governor with Feathering  
(Longitudinal Sectional View)

This Propeller Governor is identically with Governor Fig. No. 4 except additionally following parts for feathering are installed:

1: Check Nut  
2: Lift Rod  
3: Feathering Bracket
- Figure 5 -
Governor Flange ADN 20010

Designation of Channels:

1. Oil supply from the engine oil system
2. Propeller oil supply
3. Return oil from the propeller hub and from the internal leakage of the governor into the engine oil system
3.0 OPERATION

3.1 Normal operation (on-speed)

Refer to page 12.

If the governor is in on-speed condition, the actual speed and selected speed are equal, force of the speeder spring is balanced with force of the rotating flyweights. The pilot valve plunger covers ports so oil cannot flow to or drain from the propeller servo piston. Oil from the gear pump overcomes relief valve spring force and is circulated through the open relief valve plunger back to the inlet side of the pump.

3.2 Overspeed

This condition occurs when actual propeller speed is greater than selected. The flyweights pivot outward and they overcome the force exerted by the speeder spring. Flyweight toes lift the pilot valve plunger, uncovering ports in the shaft, allowing oil in servo to drain from the propeller servo piston. The propeller servo piston increases pitch, engine load is increased and propeller speed is reduced until selected speed is obtained. The flyweights return to a normal position and the pilot valve plunger covers ports in the shaft blocking the flow of oil to or from the propeller servo piston. The governor is back in on-speed condition.

3.3 Underspeed

This condition occurs when actual propeller speed is less than selected speed. A decrease in centrifugal force causes the rotating flyweights to pivot inward under force exerted by the speeder spring. The pilot valve plunger is forced down uncovering ports in the shaft allowing pressurized oil to flow to the propeller servo piston. The propeller servo piston decreases pitch, thus reducing load on the engine and increasing propeller speed until selected speed is obtained. The flyweights return to a normal position and the pilot valve plunger covers ports in the shaft, blocking the flow of high pressure oil to or from the propeller servo piston. The governor is back in on-speed condition.
Fig. 6 - Schematic Diagram of Governor Operation

Normal Operation

1. Gear oil pump
2. Engine oil supply
3. Drain line (to sump)
4. Control line for propeller servo
5. Reversing valve
6. Solenoid valve
7. Speed adjusting lever
8. Speeder spring
9. Flyweights
10. Pilot valve
11. Relief valve
- Figure 6a -  
Schematic Diagram of Dual Solenoid Governor Operation

Normal Operation

1. Gear oil pump
2. Engine oil supply
3. Drain line (to sump)
4. Control line for propeller servo
5. Reversing valve
6. Solenoid valve
7. Speed adjusting lever
8. Speeder spring
9. Flyweights
10. Pilot valve
11. Relief valve
12. Feathering valve
3.4 Reversing

Refer to page 19!

Via an electric signal to the solenoid beta valve, the switching control valve changes the position, the reversing valve moves to reversing position and thus relief valve changes its setting to high pressure.

At the same time, control line for propeller servo will be connected with governor high pressure line and pushes the propeller into full reverse.

In this condition the pilot valve is inoperative; therefore the propeller is not controllable by the constant speed section in the governor.

The negative thrust must be produced by increasing and decreasing the engine power (engine rpm).
- Figure 7 -
Schematic Diagram of Governor Operation Reversing Operation

1. Gear Oil Pump
2. Engine Oil Supply
3. Drain Line (to sump)
4. Control Line for Propeller Servo
5. Reversing Valve
6. Solenoid Valve
7. Speed Adjusting Lever
8. Speeder Spring
9. Flyweights
10. Pilot Valve
11. Relief Valve
4.0 GOVERNOR SPECIFICATION

4.1 Basic Parameters

4.1.1 Weight       max. 1.7 kg (3.747 lbs)
4.1.2 Dimensions   see Fig. 3
4.1.3 Drive        from engine
4.1.4 Governor rotation facing base CCW / CW
4.1.5 Propeller speed control lever
4.1.6 Governor drive ratio according to engine manufacturer
4.1.7 Operating liquid piston engine oil from engine oil system
4.1.8 Operating voltage 24 or 12 V

4.2 Technical Data

4.2.1 Supply oil pressure 1.02 bar to 8.50 bar
(15 psi to 125 psi)

4.2.2 High pressure relief valve setting,
38,5 ± 1,5 bar
(558 ± 22 psi)
at 90 % of max. governor rpm,
oil temperature 75 ± 3°C (170°F)

4.2.3 Low pressure relief valve setting,
17 bar +/- 1 bar
245 psi +/- 10 psi
at max. governor rpm,
oil temperature 75 ± 3 °C (170°F)

4.2.4 Range of operating oil temperatures for
full accuracy +20 to + 80°C (+68°F to +176°F)

4.2.5 Full range of operating oil temperatures
-25°C to + 120°C (-13°F to +248°F)

4.2.6 Pump capacity at 1.750 + 10 governor rpm,
min. 7 l/min (7,5 qu/min)
3 ± 0,3bar(43,5 psi) input oil pressure,
75± 3°C (170°F) oil temperature,
output pressure at output approx.10 + 0,5 bar (145±7psi)

4.2.7 Range of governed speed 1.000 to 3.500 rpm

4.2.8 Internal leakage at 1.750 rpm,
max. 2.0 l/hour (2,1 qu/min)
output pressure 18 ± 1 bar,
temperature 75 ± 3°C (170°F)

4.2.9 Governor stability ± 0,5 %

4.2.10 Total control arm angular travel max. 90°

4.2.11 Table of Governor Types:
For all governor types please refer to MT-Propeller Governor List E-1057.
### 4.3 Operational Conditions

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### 5.0 GOVERNOR INSPECTION BEFORE INSTALLATION ON THE ENGINE

Inspect the governor for damage after unpacking, should any damage appear, notify the supplier, as well as the transport forwarding company.

### 6.0 INSTALLATION INSTRUCTION

Prior to installation of a new or overhauled governor, rotate the drive gear to assure free rotation.

6.1 Clean engine and governor flange with solvent or gasoline. Both surfaces must be dry and clean. Remove all surface defects.

6.2 Install a new governor mounting gasket, with the screen on the inlet (supply) port of the governor, turn the governor drive gear to align with the splines in the engine drive, install the governor in place, when fully seated, the drive gear must be fully engaged in the engine, install mounting bolts and or nuts and lock washers and torque to 20-24 Nm (180-200 inclb).

**Warning:**

Improperly installed bolts or nuts may cause improper operation and or oil leakage.

6.3 Connect control rod to governor control lever (according to the instruction in the aircraft service manual).

6.4 Plug in wiring for the reverse switching (beta) valve.

6.5 Perform a functional check and inspection for leakage according to chapter 11 in this manual.
7.0 CONTROL HEAD / LEVER ADJUSTMENT

It is possible to reposition the governor head, thus repositioning the control lever, without resetting the rpm setting established on the test stand.

7.1 Governor Head repositioning procedures,

7.1.1 Remove the safety wire from the six, cover retention screws (see Figure 8)

7.1.2 Loosen the screws equally to allow the head to be rotated beneath the clamping ring.

7.1.3 Rotate the head to the desired position.

7.1.4 Retighten the screws and safety wire the cover retention screws.
- Figure 8 -

Positioning of Governor P-9( )-( )-( ) Control Head

1. Cover screw
8. ADJUSTING THE GOVERNOR FEATHER RPM

8.1 Loosen the check nut, turn the lift rod in the CW direction to reduce the Feathering rpm, turn the lift rod in the CCW direction to increase the feathering rpm.
One quarter turn in either direction will increase or decrease the Feathering rpm (fifty (50) rpm.

8.2 Retighten and check nut.

9.0 ADJUSTING OF MAXIMAL PROPELLER RPM

Note:
Limited. Resetting the propeller governor maximum rpm is permitted as a normal maintenance procedure.

9.1 To adjust the maximum propeller governor rpm (see Figure 9) remove the safety lock wire from the stop screw check nut.

9.2 With the governor lever against the stop screw, a rotation of one turn in the clock wise direction will reduce the rpm approximately thirty (30) rpm, one turn in the counter clock wise direction will increase the rpm approximately thirty (30 rpm.

9.3 Re tighten the set screw check nut and torque check to 4-5 Nm (35-44inc.lb)

9.4 Re safety wire the maximum rpm set screw.
- Figure 9 -

Maximum rpm Setting Adjustment

1. Screw
2. Nut
10.0 AIRCRAFT FLIGHT CHECK

Consult the aircraft operations and pilot manuals prior to completing any static runs or propeller feathering checks.

10.1 PERFORM STATIC RUN-UP

Attention: Perform Static Run in an area which is clean, thus avoiding damage to the propeller blades.

Exercise the propeller by moving the Propeller Control Lever, through its full travel, three (3) to five (5) times which will remove all air from the system.

Lock aircraft brakes. Place cockpit propeller RPM lever in high position. Advance throttle slowly to maximum permitted engine manifold pressure limits. Record propeller RPM. If local wind conditions are over 2.5 m/s, 5 knots repeat check with aircraft pointed to opposite direction and average two numbers.
As a general rule, propeller should be 25-100 RPM blow the red line limit during check.

10.2 PERFORM FLIGHT TEST

During takeoff acceleration, record maximum propeller RPM.
When sufficient altitude is reached, level out aircraft, leaving propeller control in full RPM position. Maintain this setting for 3 to 5 minutes while monitoring propeller RPM.
Following this check, two conditions may exist which require adjustment:

10.2.a If during flight test the propeller rpm exceeds the applicable redline, reduce the rpm to match the redline, by moving the propeller control lever aft.
Land the airplane and shutdown the engine.
Remove the engine cowling and observe the control arm position relative to the high speed stop screw.
Adjust the stop screw until it contact the control leer. This will correct the rpm, from exceeding the redline.

10.2.b If the propeller is bellow red line limit with max RPM setting on the propeller cockpit control, note RPM and land. Remove engine cowling and adjust the governor high RPM screw, 1 turn counterclockwise will result in approximately 25 RPM higher. Perform another flight to confirm adjustment were sufficient.

Remove engine cowling and check for the oil leaks. Oil leaks aren’t permitted.
Make a record in governor installation record.
10.3 GENERAL

Static Run Up

There has been some confusion in the field concerning propeller low blade angle setting, the governor setting and how it relates to static run-up and take-off RPM.

As a general rule, engine redline RPM cannot be reached during a full power static run-up. Contrary to popular belief, the governor is not controlling the propeller at this time, the propeller is against its low pitch stop. Attempting to increase propeller static run-up RPM by adjusting the governor high RPM screw will have no effect and will probably result in a propeller overspeed during the take-off roll.

11.0 GOVERNOR FLANGE GASKET CHANGE

11.1 Remove governor from engine, chapter 13.

11.2 Install the governor with a new gasket to the engine. Surfaces must be clean and smooth. See chapter 5.

12.0 REMOVING THE GOVERNOR FROM ENGINE

12.1 Disconnect the control rod, refer to engine/aircraft service manual.

12.2 Disconnect current supply cable from solenoid, place shipping cap, if available, on solenoid.

12.3 If applicable, remove safety wire from flange-nuts. Remove nuts and washers.

12.4 Remove the governor from the engine. Protect the engine flange by appropriate means.

12.5 Secure governor flange with shipping cap. In case of necessity clean the governor with cleaning cloth using petrol. Pay attention that no petrol can enter the governor.

12.6 Put the governor into an appropriate box, store it as mentioned in chapter 16.
13.0 GOVERNOR LONG TERM STORAGE

13.1 Clean the governor with a soft brush or with a soft cloth, using a non-corrosive solvent.

*Note:*
Do not allow any cleaning solvents to enter the governor!

13.2 Coat all exposed surfaces with a light coat of engine oil

13.3 Treat the governor according the instruction in item 13 and store it according to chapter 16.

13.4 If the governor is inactive and mounted on an engine, it will be necessary to periodically check its condition.
14.0 TROUBLE SHOOTING

Propeller Surging or "Wandering" - Possible Causes:

14.1 EXCESSIVE TRANSFER BEARING LEAKAGE

Engines with excessive transfer bearing leakage can experience surging since the governor may not be able to get enough pressure to the propeller. This causes a delay in propeller responsiveness and by the time the propeller responds to earlier governor inputs, they have changed, resulting in propeller "wandering".

Solution: Perform a transfer bearing leakage test per engine manufacturer's instructions. If test indicates a high rate of leakage (even though it may still be on the high side of "acceptable" tolerance), this maybe your cause. Install the suspect governor on a known "good" aircraft, if problem disappears, engine work may be indicated.

14.2 MALFUNCTIONING MAGNETOS

See the engine manual.

14.3 DIRTY ENGINE OIL

Contaminants in dirty engine oil can cause blockage of close tolerance passages in governor, leading to erratic operation.

Solution: Timely engine oil changes should eliminate this problem.

14.4 EXCESSIVE "PLAY" IN AIRCRAFT PROPELLER CONTROL LINKAGE

Excessive "play" in the linkage between the governor and the cockpit control often leads to erratic operation. Specifically, if the propeller RPM is suddenly changing and holding a new setting on its own, this could indicate loose linkage.

Solution: Trace linkage and locate unsecured sections and tighten-up as needed. Please note that although linkage may appear to allow full governor control while the engine is off, it may not in the air. Engine vibration and "stretch" of the mount during operation can often aggravate the condition. Therefore, it is important the entire length of linkage be properly secured, even if both ends alone are tight.

14.5 EXCESSIVE PROPELLER FRICTION

(NOTE: This is rarely the cause of RPM malfunction.)

Propeller may be overly-resistant to pitch movement. This can be caused by either excessively tight shimming of the propeller blades, or internal corrosion or part failure, causing binding.

Solution: Check amount of blade "play" as defined below:

A total lack of blade "shake" may indicate excessively tight blade shims. If this is suspected, have the propeller checked by a qualified FAA-approved propeller repairman. Note that this check and any needed correction can usually be performed with the propeller installed on the aircraft.
15.0  SHIPPING AND STORAGE

15.1  Governors to be shipped / transported to the customer via common carriers must be packaged in plastic bags to prevent the oil within the governor, following testing, from contaminating the packaging materials and shipping container. The containers must be of sufficient durability to withstand the handling processes of transport. In case of returning the governor it is furthermore recommended to return all accessories and parts together with the governor. They will also be inspected and not considered to be missing.

15.2  Governors which are too placed in storage for a longer period of time, must be coated with anticorrosive protection, packaged in a plastic bag and placed in a container for long time storage. Store governor in a temperature controlled, non-calicle environment, where temperatures do not exceed -20°C to +35°C (-5°F to +95°F).

15.3  For governors to be exposed to corrosive atmospheres or salt water shall be coated with a light coating of engine oil

15.4  Before installation of a governor which has been in long term storage, introduce engine oil into the channels and orifices as per drawing on page 13 of this Manual, rotate the drive gear in both directions, allow any residual oil to drain which has been introduced into the governor, prior to completing installation.

16.0  MAINTENANCE

16.1  There is no maintenance required except for the procedures described in this manual.

16.2  In case of necessity, please, contact service center or governor manufacturer.