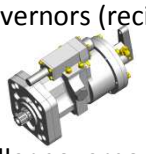
PROPELLER GOVERNOR

A – TYPES AND VERSIONS

1- Standard constant speed propeller governors (reciprocating engines) 

2- Dual pressure reversing governors 

3- Turbine engine constant speed propeller governors 

4- Overspeed governor 

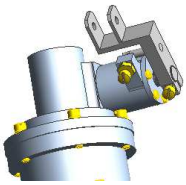
5- Other propeller control system units 

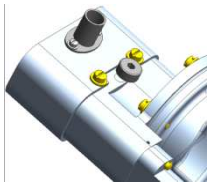
1 – STANDARD PROPELLER GOVERNORS (RECIPROCATING ENGINES)

Standard propeller governors are used to control constant speed at common hydraulic constant speed propellers, either non-counterweighted or counterweighted. These governors have optional mechanical or electric feathering, unfeathering, accumulator fitting, synchrophasing etc.

The governors can be equipped with three different control head:

I – mechanical axial as standard 

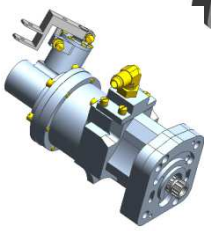
II – so called “old style head”, especially used to replace old governors. 

III – electric control – no mechanical connection necessary, especially useful for FADEC 

There are different versions of design and parameters.

a – Basic version, used for majority of applications, with standard pump and small governor body. It can be equipped optionally with feathering, accumulator fitting.

b - Increased pump capacity version, especially for governors replacing old “Hamilton” governors.



c - Version, which is dimensionally identical with standard Woodward or McCaulley governors.

d- Electric control with optional electric feathering valve

<u>DESIGNATION SYSTEM for P-8( )-( ) governors</u>

Type designation sample: P – 8 7 1 - 14 A
r s t u v

r – shows series of the governor design. 8 = standard hydraulic propeller governor
s – model : 5 – non-counterweighted propeller, CCW drive
6 – non-counterweighted propeller, CW drive
7 – counterweighted propeller, CCW drive
8 – counterweighted propeller, CW drive
t – options : 0 – no option
1 – mechanical feathering
2 - …
3 – electric speed setting
4 – accumulator fitting
5 – mechanical feathering and accumulator fitting (1+4)
6 - …
7 – electric speed setting and electric feathering and accumulator fitting
8 – mechanical feathering and accumulator fitting with one-way valve (open IN)
9 – electric feathering and mechanical speed setting
u – governor adjustment : maximum propeller speed setting, lever position etc.
v – special arrangement : no - standard arrangement
A - “old style” control head
B - big body for final dimensions equal to standard “Woodward” governor
C - increased pump capacity
D - …
F - “F” shape control lever
R - “Rotax” electric control head arrangement

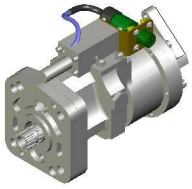
2 – DUAL PRESSURE REVERSING PROPELLER GOVERNORS

The dual pressure reversing propeller governors are used to control constant speed and reversing for reversing hydraulic constant speed with dual piston reversing system. These governors have optional mechanical or electric feathering, synchrophasing. This reversing system can be used with any aircraft engine, where hydraulic constant speed propeller can be installed.

The governors can be equipped with three different control heads – see STANDARD GOVERNORS.

The reversing propgovernors have two design versions: with one solenoid or with two solenoids.

a - Design with one solenoid – basic – ensures reversing mode of operation by energizing of the reversing valve. It can be optionally equipped with mechanical feathering.



b - Design with two solenoids. One solenoid is used for reversing, the second solenoid is used for electric feathering. This solenoid, in combination with auxiliary electronic units, can assists at switching off the reverse, making this process adjustable. In combination with electric control head, such a governor could be controlled by wire.

DESIGNATION SYSTEM for P-9( )-( ) governors

Type designation sample: P – 9 7 1 - 14 A
r s t u v

r – shows series of the governor design. 9 = dual pressure reversing hydraulic propeller governor
s – model : 7 – counterweighted propeller, CCW drive
8 – counterweighted propeller, CW drive
t – options : 0 – no option
1 – mechanical feathering
2 - …
3 – electric speed setting
4 – accumulator fitting
5 – mechanical feathering and accumulator fitting (1+4)
6 - …
7 – electric speed setting and electric feathering and accumulator fitting
8 – mechanical feathering and accumulator fitting with one-way valve (open IN)
9 – electric feathering and mechanical speed setting
u – governor adjustment : maximum speed setting, lever position etc.
v – special arrangement : no - standard arrangement
A - “old style” control head
B - N/A
C - N/A
D - …
F - “F” shape control lever
R - “Rotax” electric control head arrangement

3 – TURBINE ENGINE CONSTANT SPEED REVERSING PROPELLER GOVERNORS

The turbine engine constant speed reversing propeller governors are used to control constant speed, feathering and reversing/beta mode of operation for constant speed propellers used with GE-H80 engine and Walter M-601 engine, single acting or dual acting. These governors can fully replace original M-601 (LUN-7816 or LUN-7815) to improve / decrease load of reverse control mechanism. The governors can be optionally equipped with speed sensor, pitch-lock, synchrophasing.

4 – OVERSPEED GOVERNORS

The overspeed governors are used as a safety device with turboprops engines. The overspeed governor controls propeller speed at primary propeller governor failure usually not to exceed 103%. The overspeed governor is equipped with speed setting reset, which provides possibility to check overspeed governor functionality at normal engine propeller speed range.

5 – OTHER PROPELLER CONTROL SYSTEM UNITS

Avia Propellers offers also other instruments for propeller control systems. The feathering pump is an example. The feathering pumps reflects current development in electronic drives, thus our new models are have extremely good power-weight ratio. These feathering pumps can be used also as unfeathering pump if necessary.

B – DESCRIPTION AND FUNCTION

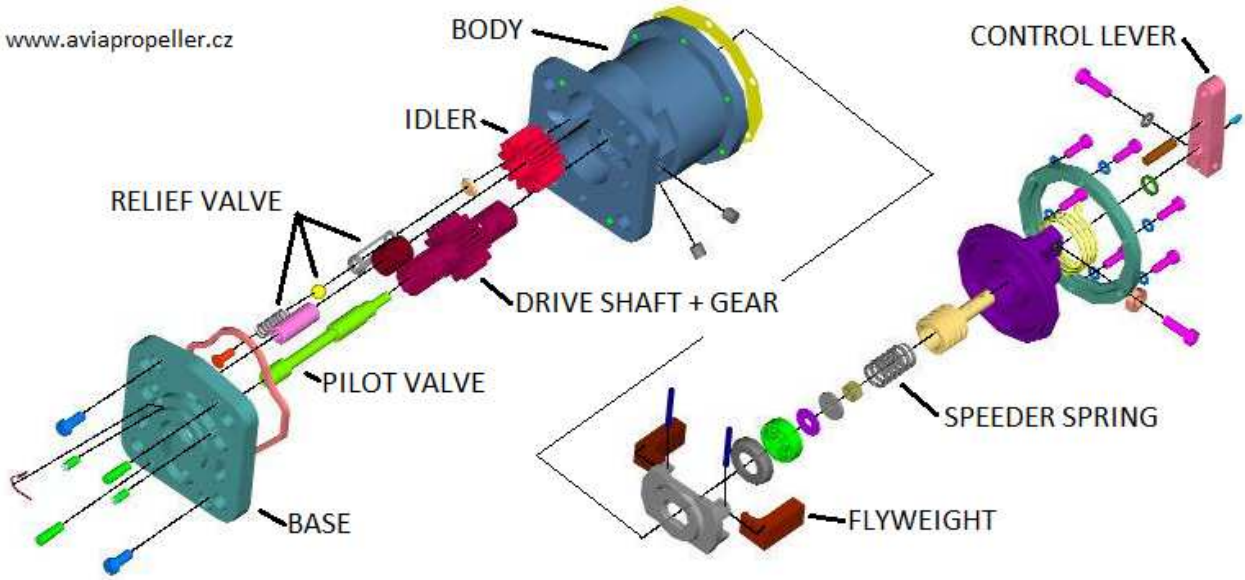
The **Avia Propeller** aircraft propeller governors **P-8( )( )-( )** and **P-9( )( )-( )** are base mounted centrifugal propeller governors for use with hydraulic constant speed propellers on single or twin engine aircraft.

They regulate propeller speed by continually varying the pitch of the propeller blade to match propeller torque (and, hence, engine load) to engine developed torque as changes occur in flight conditions. The governors are single-acting using oil pressure either to increase or decrease pitch. Pitch change in the opposite direction is accomplished by the force of the propeller blade twisting moment and servo spring, or propeller counterweights.

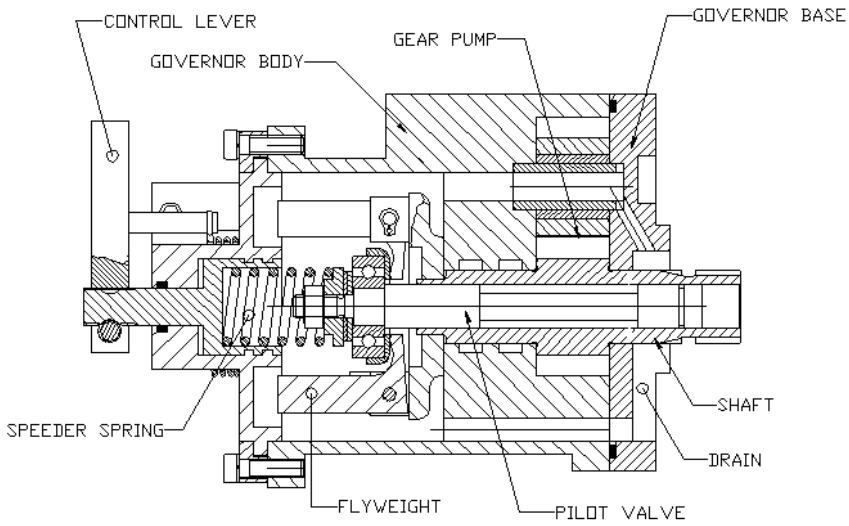
The principal parts of each governor are a gear-type oil pump with pressure relief valve, flyweights pivoted on a rotating flyweight head, a spring-loaded pilot valve positioned by the flyweights, an external control lever that varies the spring load on the pilot valve, and reversing valve used with P-9( )( )-( ) series governor.

The body, cover and base are made of aluminum alloy. The body contains the necessary passages to channel oil to the propeller pitch changing mechanism, and the base is designed to fit the standard AND20010 engine pad.

The sensing element of the governor is a set of pivoted flyweights mounted on a rotating flyweight head and linked mechanically to the engine gears, through a hollow drive gear shaft.



The flyweights, actuated by the centrifugal force developed by the speed of the rotation, position a pilot valve so as to cover or uncover ports in the drive gear shaft and control the flow of oil to and from the pitch changing mechanism of the propeller. The centrifugal force exerted by the flyweights is opposed by the force of an adjustable speeder spring. The load exerted by the speeder spring determines the engine rpm required to develop sufficient centrifugal force in the flyweights to center the pilot valve. Oil to operate the propeller's pitch changing mechanism is supplied by a gear-type oil pump at a pressure value limited by a relief valve.



ON SPEED:

In this condition the forces action on the engine-governor-propeller combination are in a state of balance. The speed adjusting control lever has been set by the pilot to obtain the desired engine rpm. The propeller blades are at the correct pitch to absorb the power developed by the engine. The centrifugal force of the rotating flyweights exactly balances the force of the speeder spring. The pilot valve is located in the drive-gear shaft, so that the control ports between the oil pump and the propeller pitch changing servo are covered. Pressure oil from the gear pump is circulated through open governor relief valve back to the inlet side of the pump.

OVERSPEED:

This condition occurs when airspeed or horsepower is increased and engine rpm increases above the onspeed value - set by the speed adjusting control lever. The rotating flyweights pivot outward as their increase centrifugal force overcomes force exerted by the speeder spring.

Counterweighted Propeller using Pressure to Decrease Pitch. (see Fig. 2)

The flyweight toes raise the pilot valve plunger, uncovering ports in the driver gear shaft that permit pressure oil to flow from the propeller pitch changing mechanism. This allows propeller counterweights to take the propeller blades toward a higher pitch. The load on the engine is increased and engine speed is reduced.

Propeller using Pressure to Increase Pitch. (see Fig. 3)

The flyweight toes raise the pilot valve plunger, uncovering ports in the drive gear shaft that permit pressure oil to flow to the propeller pitch change mechanism. This moves the propeller blades to a higher pitch and load on the engine is increased and engine speed is reduced.

This, in turn, reduces centrifugal force exerted by the flyweights in opposition to the force of the speeder spring. The flyweights return to an on-speed position and the pilot valve plunger covers ports in the driver gear shaft, blocking flow of pressure oil to or from the pitch changing mechanism of the propeller – return to on-speed condition.

UNDERSPEED:

An underspeed condition occurs when the airspeed or horsepower is decreased and engine rpm falls below the rate established by the setting of the speed adjusting control lever. The decrease in the centrifugal force of the rotating flyweights causes them to pivot inward under the force exerted by the speeder spring.

Counterweighted Propeller using Pressure to Decrease Pitch. (see Fig. 2)

The pilot valve plunger is forced down uncovering the ports in the drive gear shaft that allow pressure oil to flow to the pitch changing mechanism or the propeller. This overcomes the force of the propeller counterweights and decreases the pitch of propeller blade.

Propeller using Pressure to Increase Pitch. (see Fig. 3)

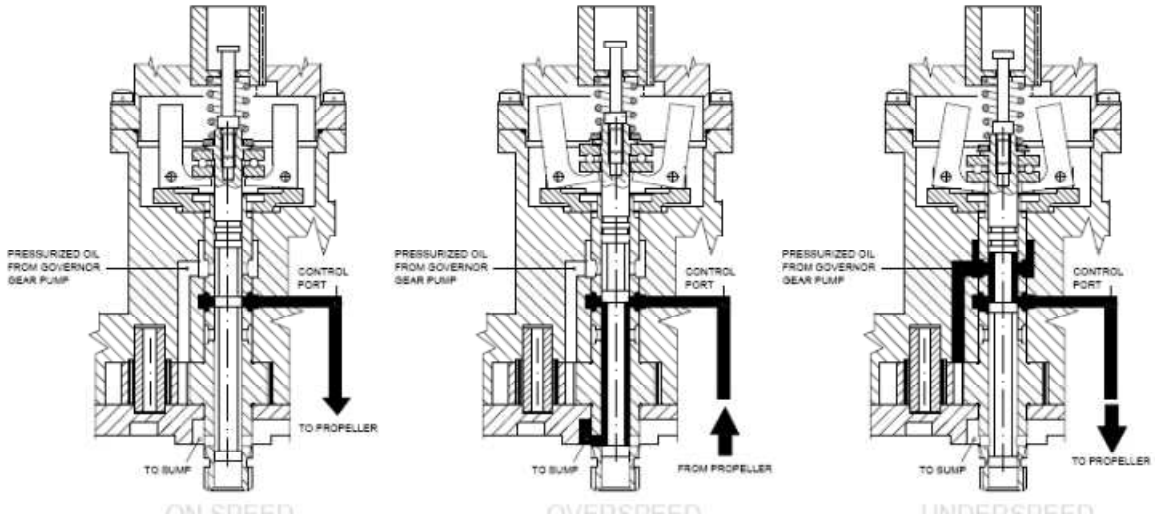
The pilot valve plunger is forced downward, uncovering the ports in the driver gear shaft, thus allowing oil to flow from the pitch changing mechanism of the propeller to sump. This permits the centrifugal twisting moment of the blades to decrease propeller pitch.

This reduces the load on the engine, thereby increasing engine speed and the centrifugal force developed by the rotating flyweights. The flyweight toes lift the pilot valve plunger to cover the control ports. At this point the forces acting on the engine-governor-propeller combination are again balanced and the engine is back to the on-speed setting.

NOTE

LOSS OF OIL FROM THE PROPELLER PITCH CHANGING MECHANISM DUE TO ENGINE TRANSFER RING LEAKAGE WILL RESULT IN CHANGED SPEED SETTINGS.

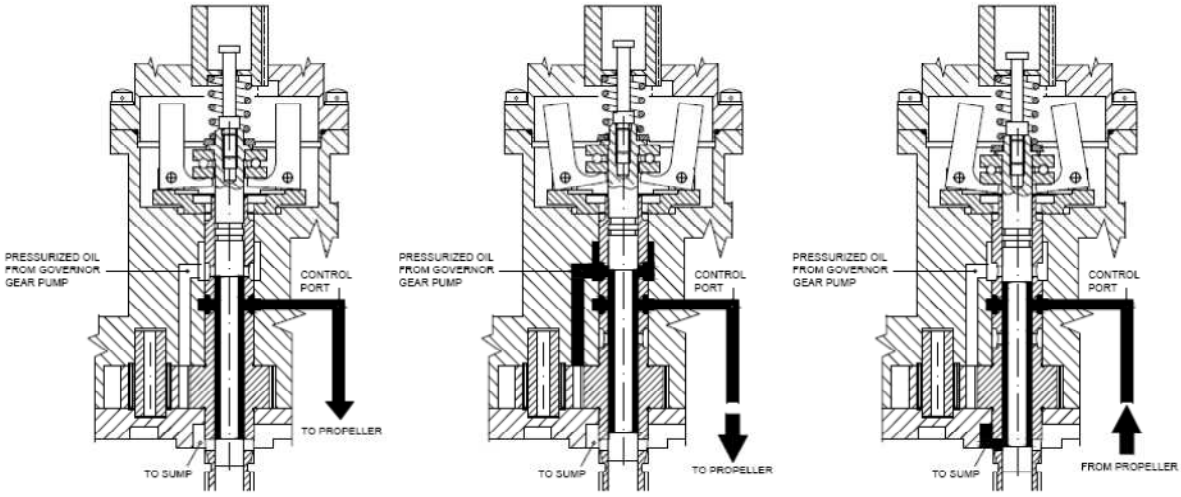
Pressure to decrease pitch Type Pilot Valve



ON-SPEED OVERSPEED UNDERSPEED

Fig. 2

Pressure to increase pitch Type Pilot Valve



ON-SPEED OVERSPEED UNDERSPEED

Fig. 3