

# INSTRUCTIONS FOR THE PILOTS ABOUT THE USE AND FLIGHT TECHNIQUES OF THE YAK-1, YAK- 7, YAK-9 WITH M-105P, M-105PA Y M-105PF ENGINES

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Instruction developed by:  
*Major Engineer STEPANETS*  
*Major PROSHAKOV*  
*Major Engineer POLITIKIN*

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## **I. FLIGHT PREPARATION**

Before the flight, the mechanic must inform about the aircraft's aptitude for flight

### **Inspection and preparation of the aircraft**

1. Make an external inspection of the unit and check:

- a) Propeller. Make sure there is no external damage (holes, scratches) on the blades or bushing, and that there are no visually perceptible deformation of the blades; match of the markings on the blade and bushing, which corresponds to the minimum level of oil in the cap of the prop (for the Vish-61P prop model corresponds fine step, to the Vish-105 model the coarse pitch , this operation is only mandatory in winter);
- b) Hood and hatches. Make sure the seals are tight;
- c) Landing gear. Check the tire pressure, make sure they are not damaged, that the dampers are correct and in the same level in both legs;
- d) Pitot. Pitot cover has to be withdrawn;
- e) Fuel and oil. The level of fuel in the tanks, when they fully loaded should be 50mm below the upper end of the bore; the quantity of oil is measured by the mechanical meter (bar) and must be 30 liters;
- f) Flaps. Having no damage, freely moving and have no dead zones;
- g) Tail's Stabilizer. Has no external damage;
- h) Tailwheel. That the damper is pressurized, and the tire has the correct pressure.

**2. Before sitting in the cockpit check:**

- a) No strange objects inside;
- b) The magnetos are disconnected;
- c) Safeties on the trigger (button) of the cannon and machine guns are placed;
- d) The cockpit cover and windshield are clean and undamaged

**3. Once in the cockpit** place your feet on the pedals (under seat), adjust the seat to your height ensuring ease of operation of the gun sight, and fasten seat belts.

**4.** Ensure the ease of opening and closing of the movable part of the hood.

**5.** Check the movement of the flight stick and pedals, and the correct angle of the rudders.

**6.** Adjust the elevator trim in the neutral position.

**7.** Check that the levers of flaps and landing gear are in neutral position

**8.** Open the fuel cock valve by placing it in position "Both tanks open" for the Yak-7 and Yak-9, and if the aircraft is not equipped with 3-position valve, place it into position "Open"

**9.** Check the air pressure in the tanks on board: in the main tank, the pressure has to be 50 kg / cm<sup>2</sup>, and in the emergency tank 32 kg / cm<sup>2</sup>.

**10.** Make sure the brake system is hermetic. When fully tightened the brake pedals in neutral, and when is pressed only one pedal, there should be no air leaks (do not hear characteristic sound).

**11.** Activate and test electrical equipment. Activate the batteries ("red") and landing gear switches; verify the correct operation of indication system of the landing gear watching the bulbs.

**12.** Check the engine operation:

a) the correct movement of the throttle;

b) position of the control lever mixture (fully backward);

c) position of the change lever of the supercharger (must be put in first stage);

d) position of the prop pitch control (rotary or lever) (fully forward);

d) water and oil radiators must be closed.

**13.** Set the altimeter to zero.

**14.** Check the clock

**15.** If you expect to open fire, before takeoff, is necessary:

a) set the gun sight scale to zero and ensure that day and night illumination are operational;

b) verifying that the gun sight (optical and mechanical) are properly regulated;

c) load the machine guns;

d) load the cannon; by pulling firmly until the handle stop charging the cannon and release it immediately;

e) if the aircraft provides electrical system of shooting control, activate the switch of weapons found in the electrical panel.

**16.** Before high altitude flights:

a) adjust the mask;

b) check the condition of the hose and connect it to the oxygen equipment and mask;

- c) ensure that there is enough oxygen in the tank; when open the valve fully, if the tank is fully loaded, pressure should reach 130-150 kg / cm<sup>2</sup>;
- d) ensure that the system is airtight; the pressure in the system should remain unchanged;
- e) verify the emergency system of oxygen supply, and that the flow indicator works correctly; round the flag, the flow gauge needle should rise between brand 8-10; after performing the verification, completely close the flag.

**17. Before a night flight:**

- a) Check the correct operation of the lighting of the cockpit, the instrument panel and the navigation lights;
- b) if the aircraft is equipped with the landing light, check the status of the bulb and make sure the mounting angle is correct;
- c) Do not forget to have a penlight on the aircraft.

**Preparing for starting engine**

**18.** Verify the existence of the chocks under the tires.

**19.** Before the first start of the engine with compressed air, check if the air tank is properly connected.

**Motor priming**

**20.** Put the pump control in "pump priming" position and create in the power system a fuel pressure of 0.3-0.4 kg / cm<sup>2</sup>.

**21.** Put the pump control in "priming the cylinders" position and prime the pumping suction system from 4 to 6.

During the winter or in cold weather, you have to pump 2 or 3 times more, while manually turning the propeller 2 or 3 turns.

**22.** Put the pump drive in 'On' position.

**Start**

**23.** Put the throttle in position corresponding to 600-700 rpm

**24.** When starting with compressed air should do the following:

- a) open the tank valve aboard;
- b) activate the onboard power grid;

c) to order "Out of propeller", after receiving response "Affirmative, out of propeller" open the boot valve (if started with the deposit of the aerodrome, give the "Air" order );

d) when the propeller makes one turn, press the button on contact; hold the button for 10 seconds at most.

When the engine starts, turn the magneto, release the button and close the boot valve.

**25.** When the autostarter (starter truck) is used, you must do the following:

a) to order "Connect the starter to the propeller";

b) activate the onboard power grid;

c) to order "Out of propeller", after receiving response "Affirmative, out of propeller" give the order to rotate the propeller with the starter.

**26.** When the propeller start moving, press the contact button. When the engine starts, turn the magneto and release the power button.

Attention! If within 5 seconds after startup, the oil pressure do not reaches 1.5 kg / cm<sup>2</sup>, the engine must be stopped to detect and resolve the cause of the low pressure.

When the oil pressure is high, open the engine's additional lubrication injector (during both winter and summer).

### **Warming up the engine**

**27.** The engine warming must be made at 800-1000 rpm until reaching temperatures:

M-105PA		M-105PF	
Water	40°	Water	60°
Oil	40°	Oil	40°

During the winter, using oil dissolved in gas, makes the engine warming to 900-1200 rpm until the water temperature reaches the following values (irrespective of the oil temperature):

M-105PA ..... 40°  
M-105PF ..... 60°

To accelerate engine warming, gradually increase the revs, observing the operation of it (should work without interruptions) and the oil pressure does not exceed 11 kg / cm<sup>2</sup>.

**28.** After ending the engine warming, close the oil injector.

## Testing the engine

29. Give the order to hold the aircraft tail to avoid the rise of it.

30. Open oil and water radiators.

31. Pull the throttle fully.

32. Try the engine operating at nominal power. If successful, the gauge readings at rated power shall be as follows:

Revs	2600—2700 r.p.m.
Compression for M-105P y M-105PA	910+40(-20) mmHg
Compression for M-105PF	1050+10(-20) mmHg
Fuel pressure	0,25 —0,40 kg/cm <sup>2</sup>
Oil pressure	5 — 9 kg/cm <sup>2</sup>
Oil with dissolved gas pressure shall not be lower	4 kg/cm <sup>2</sup>

33. During testing the engine should not run more than 20 seconds at full throttle, the water temperature should not exceed 100 ° C and the oil 110 ° C

34. Reduce the gas to 2400-2500 rpm and checking the operation of the magneto and the spark plugs alternately turning one of the two magnetos. Running on a single magneto engine speed should not decrease by more than 110 rpm

35. Reduce the throttle up to 2400 rpm and test the performance of the propeller and the speed controller R-7; for that, change the propeller pitch fine to coarse, and vice versa.

During the winter, to warm the oil within the group of cylinders propeller must make 2 to 3 changes of propeller pitch; then place the command (either rotary or lever) fully forward.

### Attention!

1) If the take off occurs first after changing the engine or R-7 and when the adjusting the maximum speed limiter has not been tested yet, fix the limit at 2500 rpm

2) It is forbidden to keep the engine at 1800 rpm at full throttle for more than 5 seconds.

36. At 2000-2200 rpm change the speed of the supercharger from the first to the second stage and test the operation of the engine at, no more than 2500 rpm; then return to the first stage of the supercharger.

Evidence of speed change and of the normal work of the engine at the second supercharger stage are:

- a) jump of the supercharging level (arrow) at the time of change;
- b) conservation of the nominal supercharging level at the increase the revs to 2500 rpm

**Attention!**

1 The change of the supercharger stages when on the ground should not be made more than twice per engine test; must be performed with an interval of not less than 1-2 minutes between each change.

2 Make sure that after changing the stage, the supercharger lever is at the extreme end of its travel.

37. In the aircrafts with flow valves, must be checked separately the engine operation with the group of fuel tanks left and right.

38. In the Yak-1 aircraft before taking off on a combat mission must be connected to the fuel tanks to inert gas system: for it must completely close the valve. Leave the valve in the intermediate position is categorically prohibited.

**Radio preparation**

39. Connect pins "TLF" and "larynx" to the corresponding connectors on the radio panel.

40. Connect the cable to the plug on the helmet and adjust the laringófonos.

41. Enable the "Battery" and "Radio" switches. The switch on the radio panel must be in "PRM" (reception) position. Check that the fasteners are placed in the main and secondary wave.

42. Check the operation of the receiver to full revs the engine and check the level of interference (a hearing).

43. A full engine speed change the switch to "PRD" position (transmission) and check the operation of the transmitter.

44. After checking the radio, turn off the "Radio" switch.

**II. TAKEOFF AND CLIMB**

**Taxiing**

45. Fully open the water and oil radiators.

46. Unlock the tail wheel, pushing the corresponding lever.

47. Give the "chocks away" (stretching both arms) order and, after receiving confirmation, "Affirmative, off-block" start taxiing.

**48.** For a better forward visibility, move the plane zig-zag.

**49.** Check the operation of the brakes during taxi. When the aircraft is totally still and the control the airplane is fully pulled back, the brakes endure engine revs until 1900-2000 rpm

**50.** If there are strong crosswinds, make the taxiing in a straight line and with the rear wheel locked.

**Before takeoff**

**51.** Check the position of the mixture lever, fuel valve and control (rotary or lever) of the prop pitch.

**52.** Block the tail wheel and move the aircraft about 5 meters straight.

**53.** Check the data of thermometers. The water and oil temperature should be between 60°C and 90°C. The recommended temperatures of water and oil during takeoff rises at 70-80 ° C .

**54.** Ensure there is no obstacles on the runway. Close the hood.

**Attention!**

All phases of the flight, except for the landing must be made using the enclosed cockpit, since the engine noise in the enclosed cockpit is reduced by 30%, increases the flight speed 15-20 km / h, and reduces fuel consumption by up to 20 kg / h.

**Takeoff and climbing**

**55** Gently push the throttle fully forward; at the same time, push the flight stick forward, raising the tail to its normal position (half tail down).

**56.** After separating from land, keep the plane flying low up to 250 km / h, and then start to gain altitude.

**57.** Raise the landing gear, checking its position by the bulbs and mechanical indicators on the wings; then place the landing gear handle in neutral.

**58.** Remove pressure on the flight stick using the trimmer.

**59.** During the climb set the revs in a range between 2550 to 2700 rpm, depending on the temperature of the water and oil, maintaining the following optimum speeds:

0 to 4.000m	260 km/h
4.000 to 5.000m	250 km/h
5.000 to 6.000m	240 km/h
6.000 to 7.000m	230 km/h
7.000 to 8.000m	220 km/h
8.000 to 9.000m	210 km/h

9.000 to 10.000m To Service Ceiling	200 km/h 190—180 km/h
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**60.** Once you reach at 3000m with the M-105Pa engine and 2,000m with the M-105PF engine, put the second stage of supercharger.

**61.** During climb uses the mixture control: for the M-105Pa engine, as a rule, after the 4.000m; for the M-105PF engine after the 3.000m.

If the engine emitting smoke because a rich mixture, use the mixture control regardless of flight altitude.

**62.** Do not allow the water temperature exceeds 110 ° C for more than 10 minutes and the oil 115 ° C for more than 5 minutes. If temperatures exceed the permitted parameters, coarse the prop and make the ascent to higher speeds.

**63.** The maximum oil temperature without time limit must not exceed 110°C. The recommended water temperature and oil is between 90°C and 100°C.

**64.** The pressure of the oil at 100 ° C and 9000m altitude must be in a boundary between 4-9 m / cm<sup>2</sup>.

If the oil temperature exceeds the 100 ° C, is allowed the pressure reduction up to 3.5 kg / cm<sup>2</sup> at all altitudes.

**65.** When weather conditions cause freezing, activate the pitot tube heating.

### **Weapons preparation**

**66.** Remove the triggers safeties from cannon and machine guns.

**67.** Verify proper gun sight lighting. If the lighting is not sufficient, activate electric lighting.

### **III. LEVEL FLIGHT**

**71.** To pass from climb to level flight, you should follow the following sequence:

- a) with the throttle set the flight speed to at least 250 km / h for all altitudes;
- b) by the prop pitch control (rotary or lever) set the corresponding revs to the speed;

If after putting coarse pitch propeller, the speed varies, adjust it to the desired speed using the throttle.

**72.** Flying at speeds less than 0.9 of the maximum speed above 1000m altitude is convenient to use the mixture control.

Once cruising flight is stable, start opening slowly control of the mixture till notice signs of malfunction of the engine. After notice these symptoms, you should go slowly

closing the mixture until the engine normal operation is restored. Leave the mixture on that position and proceed with the flight.

**73.** If the flight regime is altered by increasing the speed, it is necessary:

- a) close the mixture control (if it was open);
- b) using the pitch propeller control increase the engine revs till the corresponding to the new flight speed;
- c) with throttle, increase airspeed.

Note: aircraft with the unified gas and propeller pitch control, must move both levers (gas and propeller pitch) simultaneously.

**74.** To achieve the maximum speed (when you met with the enemy, to make pursuit, for air combat or out of it) should do following steps:

- a) close the mixture;
- b) at all altitudes set the revs at 2650-2700 rpm; if the engine expels oil, reduce rpm to 2,550 rpm;
- c) close the water and oil radiators, fixing in position "with the flow";
- d) flying above 3,000 m with M-105Pa engine and above 2000m with M-105PF engine, put the second stage supercharger.

**75.** The operational flights, ferry flights, sorties (before the engage with the enemy), patrol missions, waiting (in a fixed area), flights performed in the Air Reserve Regiments, in order to achieve the greatest range and duration of flight, must be made in the following regimes:

<b>Engine revs:</b>	1.700 r.p.m.
Airspeed:	
- till 5.000m:	280 km/h
- above 5.000m:	270 km/h

**76.** In exceptional cases, when there is a need that a lone plane stays in the air as long as possible, be allowed to fly at a speed of 260-280 km / h and from 1500 to 1600 rpm at an altitude up to 3000m. In this case increases the flight duration.

**77.** When long flights are performed without changing the flight regime at low outside air temperatures, it is necessary periodically every 20-25 minutes to warm the oil in the cylinder group propeller; this is achieved by varying the revolutions.

The instruments that control the operation of the engine need to be observed regularly

**78.** In level flight the instrument readings should be as follows:

<b>Oil temperature:</b>	
Max:	110°C
Recommended:	90-100°C
Min:	40°C
<b>Water temperature:</b>	
Max:	110°C for 10 minutes
Recommended:	90-100°C
Min:	
- for M-105P	40°C
- for M-105PF	60°C

The oil pressure at all altitudes should be between the limits 4-9 kg / cm<sup>2</sup>. If the oil temperature exceeds the 100 ° C, is allowed the reduction of oil pressure to reach 3.5 kg / cm<sup>2</sup>.

The fuel pressure (for carburetor without a float) should be between 0.25-0.4 kg / cm<sup>2</sup>.

**79.** During level flight and ascent phase the rotations must be performed at speeds that exceeding 10-20 km / h the optimal rate of climb.

### **The use of cannon and machine guns**

**80.** Flying the Yak-1, to shoot with machine guns should pull the trigger underneath; to fire the cannon, the top needs to be pulled. In the Yak-7 to the 43 series top button activate the cannon, while the front one activate the machine guns; in the Yak-7 after the 43 series and the Yak-9 after series 4 the top button shoots the machine guns, while the front one shoots the cannon.

**81.** Opens fire with bursts of no more than 10 to 15 shots each.

**82.** In case of weapons failure, leave the triggers (buttons), reloading takes place and keep shooting.

**83.** If the gun starts firing alone, you should reload.

## **IV. FLYING**

### **Turn**

**84.** Before starting the turn, stabilize the aircraft in level flight at a speed of 320-340 km / h. This same speed must be maintained when making a turn with twist 65-70°.

Making a left turn the plane tends to lower the nose, while with the right turn tends to lift.

The plane is stable making turns and passes easily from one side to another. If you are in a turn and you pull the stick in excess, and the speed of 270-280km / h is reached, the aircraft becomes unstable; if you keep pulling the stick, the aircraft wing drops.

When you pull the stick in excess and lose speed (the characteristic symptom is when the plane starts to shake) should push the stick forward and put the aircraft in level flight. If the plane goes into a spin, is carried out according to standard procedure.

### **Combat turn**

**85.** To perform the combat turn must be given full throttle, increase the speed to maximum, then create a roll up  $50^\circ$  simultaneously lifting the tail. The exit of the combat turn is effected at 230-240 km / h at full engine power.

During combat turn, the plane wins till 1000m altitude.

The forces applied to the rudders are normal.

### **Half Barrel**

**86.** When the half barrel takes place, the speed at all altitudes should not be less than 240 km / h by the indicator.

To effect the half barrel, to gently pedal 1/3 of its travel and pull the stick slightly diagonal and in direction of roll. In this way the airplane turns upside down vigorously.

When missing  $30-40^\circ$  to be upside down, slow down the rotation of the aircraft placing the rudders in opposite position: give the opposite pedal and put the plane in the opposite direction to the rotation of the aircraft. When the plane stops turning, put the rudder in neutral and slightly pulling the stick, put it into a tailspin. When the aircraft reaches sharply 300-350 km / h, remove it gently chopped putting in horizontal flight. You can not make sudden movements with the rudder during the exit.

During half barrel the plane loses altitude 500-600m.

### **Barrel**

**87.** To perform the barrel, at the time of entering the maneuver, the aircraft must fly at 300 km / h.

The nose of the plane should be slightly raised above the horizon (about  $10-15^\circ$ ). Depress and forcefully stretch the pedal and the stick in the direction of rotation, while slightly pulling the stick back and the aircraft in the direction of rotation (ie, diagonal). The aircraft begins to spin rapidly on its axis. Before the aircraft is set to normal position (when you are about  $30-40^\circ$ ), place the rudder in output position of the maneuver, that is, giving the opposite pedal and pulling the stick in the opposite direction to the rotation, exceeding the position neutral thereof. When the plane stops turning, put the pedals in neutral position. The imprecision committed during exit of the maneuver should be corrected by the ailerons.

The technique of realizing the right and left barrel is the same, only thing is that the right barrel goes smoother. For the right barrel out with the same intensity as the left,

there is more energy to move the controls of the aircraft during the entry into the maneuver..

### **Immelman**

**88.** To make the immelman, we must accelerate the aircraft with a slight angle of descent to reach 450-460 km / h by the indicator.

As the aircraft approaches the culminant point, being inverted (upside down), and when the top of the airplane is level with the horizon, give the pedal and the stick simultaneously in the direction of the turn that is desired.

The rudders should be put into starting position of the maneuver when missing 20-30 ° until the aircraft is put horizontally. Should then be put in neutral. The output speed of the Immelman considered normal is 230-240 km / h.

When performing immelman the plane gains altitude of 800-900m.

### **Spin**

#### **Spin entry**

**89.** Unintended spin in all cases occurs because of the mistakes made in flying techniques (pull too much the stick in any flight regime). Flying at high altitudes and high angles of attack, the aircraft reacts more to errors, made by the pilot, and enters in spin more easily. The downward spin occurs momentarily. The character of the spin depends on the flight speed: at high speed the aircraft makes a unique barrel and then goes into a spin; at low speeds the aircraft makes a half roll or fall sharply in the wing, then going into a spin.

Spin entry intentionally and with the aim of learning should take place at an altitude of 4,000 m; previously should stabilize the aircraft in level flight with the trimmer and fly at 300-320 km / h. Before entering into a spin, you should plan to enter, reducing the speed to 180 km / h.

The airplane goes into a spin when the pedal is at 1/3 of its travel toward the spin and at 1/3 of the stick travel, stretched backwards relative to the neutral position.

#### **Spin regime**

**90.** The airplane goes into a spin with a longitudinal slope to the following angles to the horizon:

- The right spin: 40-50 °;
- The left spin: 50-60 °.

The nature of the spin is not uniform; rotation is energetic, jumpy. The plane, after giving every turn, slows the spin and lift the nose at 10-15 ° to the horizon.

During the spin the stick tends to get close to the pilot; to keep it in the neutral position, apply some effort. When the airplane goes into a spin, do not pull the stick, but must keep it in neutral.

### **Spin exit**

**91.** To exit from the spin, you must first give power to the pedal opposite to the direction of the spin, and then push the stick forward beyond its neutral position. Just as the airplane stops spinning, you must immediately put the pedals in neutral position and push the stick forward beyond its neutral position; gain speed reaching 330-350km / h and take the aircraft gently from the dive.

### **Dive**

**92.** The dive must be made starting with a twist or a half roll to prevent the fall of oil pressure.

It allows for any dive angle, reaching the output speed of 650 km / h by the indicator.

During the dive disallow propeller overrev above 2800 rpm

During prolonged dives not allow the water to cool:

- For aircraft equipped with M-105P engine - below 40 ° C;
- For aircraft equipped with M-105PF engine - below 60.

The output should be done gently stretching the stick and at a speed not inferior to 340-350 km / h.

Dont make sudden movements with the rudder during exit of the dive, otherwise the airplane, regardless of speed, starts to wobble a wing to the other and the exit of the dive will be longer.

## **V. FINALIZACION DE VUELO**

### **Preparaciones para aterrizar**

**96.** Poner los seguros a los gatillos (botones) del armamento y apagar el interruptor del armamento en el panel eléctrico.

**97.** Verificar la presión en el sistema neumático: debe estar entre 40—50 kg/cm<sup>2</sup>.

**98.** Poner la hélice en paso fino.

**99.** Bajar el tren en vuelo horizontal y a una velocidad de 250—260 km/h; para ello:

- a) poner el mando de la válvula del tren en posición “Plegado” manteniéndola durante 2—3 segundos (para crear contrapresión en los cilindros del sistema de levantamiento del tren);

- b) poner el mando de la válvula del tren en posición “Desplegado”
- c) verificar el correcto despliegue del tren observando el encendido de los indicadores luminosos verdes y por la posición de los indicadores mecánicos en las alas.

**100.** Si el tren no se despliega de forma normal, se debe desplegar en modo de emergencia; para ello:

- a) colocar la válvula del despliegue normal del tren en posición neutral o en posición “Desplegado”;
- b) estirar la palanca del despliegue de emergencia;
- c) cuando las patas se caigan libremente hacia fuera, abrir la válvula del depósito de aire de emergencia para que las patas se anclen en los cierres;
- d) verificar el correcto despliegue del tren mediante indicadores luminosos y mecánicos.

### **Planeo**

**101.** Cerrar la tapa del radiador de agua y no permitir que su temperatura baje:  
- para el motor M-105P por debajo de 40°C;  
- para el motor M-105PF por debajo de 60°C.

**102.** Durante el planeo efectuado en línea recta y a una velocidad de 210—220 km/h desplegar los flaps, colocando el mando de la válvula de los mismos en posición “Desplegado” (empujándolo hacia delante).

**103.** Si falla el sistema neumático, los flaps pueden ser bajados usando el aire del depósito de emergencia; para ello:

- a) cerrar la válvula del depósito de aire de abordo y de la red neumática;
- b) colocar el mando de la válvula de los flaps en posición “Desplegado” (empujándolo hacia delante);
- c) abrir la válvula del depósito de emergencia.

**104.** Quitar presión sobre la palanca del avión mediante el trimmer de altitud.

**105.** Alcanzar la velocidad de planeo de 200 km/h por el indicador.

**106.** Si se aterriza de noche y en un aeródromo sin iluminación, encender el faro de aterrizaje estando a unos 70—100m de altitud.

**107.** Precisar el cálculo de aterrizaje, utilizando el motor (hacerlo a una altitud no inferior a 25m).

## **Salida al segundo círculo**

**108.** Si existe necesidad de efectuar el segundo círculo, hay que darle a la palanca de gas, suavemente y llegando al tope.

Si se da a la palanca de gas con los flaps bajados, hay que compensar la tendencia del avión a entrar en picado; para ello se debe utilizar la palanca del avión y el trimmer del timón de altitud.

Cuando se alcance una velocidad de 220—230 km/h, se debe comenzar a ganar altitud.

**109.** Los flaps se deben retirar a una altitud mínima de 100m y a una velocidad mínima de 250 km/h; esto es debido a que tras plegar los flaps el avión pierde unos 30—50m de altitud.

**110.** Para reducir la pérdida de altitud al plegar los flaps, se puede poner la válvula de los flaps en posición media (neutral) en vez de la posición “Plegado”. Bajo la acción de la corriente frontal del aire los flaps se plegarán suavemente y la pérdida de altitud no será tan brusca.

## **Aterrizaje**

**111.** Cuando se aterriza con los flaps bajados, el alineamiento del avión se debe comenzar estando a 5—6m de altitud. Se debe aterrizar sobre los tres puntos.

**112.** Durante el recorrido los frenos deben usarse de manera suave; no permitir frenados bruscos para evitar que el avión levante la cola.

**113.** La tendencia del avión a variar la dirección de carreteo durante el frenado debe ser compensada mediante pedales.

**114.** Tras finalizar el recorrido, desbloquear la rueda de cola; para ello, empujar la palanca correspondiente hacia delante.

**115.** Plegar los flaps, poniendo la palanca de la válvula en posición “Plegado”.

**116.** Observar la pista de aterrizaje, y posteriormente comenzar el carreteo hacia el aparcamiento.

## **Parada del motor**

**117.** Abrir las tapas de los radiadores.

**118.** Dejar la hélice VISH-61P poniéndola en el paso fino; la hélice VISH-105 se debe dejar en paso grueso. Para ello, en caso de la hélice VISH-105:

a) dejar el mando (giratorio o palanca) del control del paso de hélice totalmente hacia atrás;

b) mediante la palanca de gas alcanzar las revoluciones del motor hasta 1500—1700 r.p.m. y mantenerlas durante 10—15 segundos.

**119.** Enfriar el motor trabajando a pequeño gas (450—500 r.p.m.) durante 2—3 minutos hasta que la temperatura del agua baje de 90°C.

**120.** Aumentar las revoluciones del motor hasta los 700—800 r.p.m., apagar el encendido y mover suavemente la palanca de gas a un tercio de su recorrido hacia delante.

**121.** Apagar la batería.

**122.** Apagar los interruptores de la “Radio” y de la calefacción del tubo Pitot.

### **Tras el vuelo**

**123.** Informar al técnico de Zvenó sobre el funcionamiento del motor, del avión, del armamento y de los equipos especiales.

**124.** Dar indicaciones al mecánico del avión sobre la reparación de los defectos detectados en el avión.