BRIEF FLIGHT MANUAL

DAR-Solo series

Sofia
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Introduction

This Manual is intended for everyone who flies and maintains the DAR-Solo series airplane with one of the offered engines:

Hirth F-33 BS (28 HP) – single cylinder, two-stroke engine, air-cooled

or

Polini Thor 250 DS (36HP) – single cylinder, two-stroke engine, water cooled

The Manual contains graphics aerodynamic characteristics of the DAR – Solo airplane with described standard engines.

LIMITATIONS AND SAFETY INFORMATION

Limitations

DAR Solo is an aircraft that falls in the LTF-UL Category.

It is designed to be used for any maneuvers as:

- Normal flying maneuvers;
- Stalls (except whip stalls); and
- Lazy eights, chandelles, and steep turns, in which the angle of bank is not more than 60 degrees.

The following limitations are imposed on the speeds and loading of the airplane:

V_{S1} = 55 km/h

V_{SF} = 51 km/h

V_{NE} = 150 km/h

V_A=109 km/h

V_F = 92 km/h

V_{FE}=83 km/h

Max Wind Limits = 5 m/s

Engine Limitation = no negative loads more 3 sec

MTOW = 260 kg

Empty Weight = 140 kg

Load Limitation = +4/-2

Empty CG = 44,5%

MTOW CG = 33%

- DO NOT FLY WITHOUT INSTALLED WING CENTRAL SECTION FAIRING!
- Do not overload the Airplane. The Max Gross Weight should not exceed 260 kg.

Safety

For your safety read this manual thoroughly and make sure you understand the capabilities and limitations of the airplane.

If you have any additional questions contact the manufacturer before operating the machine.

- Never fly when you don't feel prepared for the conditions of the flight!
- Never fly under influence of alcohol or drugs!
- Never fly if you have not performed a preflight inspection!
- Never exceed the limitations set by the manufacturer!

DANGER!

Always monitor your airspeed!
Never fly close to stall speed or exceed Vne!

General view of DAR-Solo

IGNITION

Before ignition you have to do the following:

– put the wheel chocks under the wheels;

– check the availability of a fire extinguisher;

– in start-up with an electrical starter (autonomous) the procedure must be done at the command "Clear Propeller". You must not push the START ignition button if you do not receive the "Clear" answer from the start-up supervisor!

– put the levers at min (at a temperature less than 10°C – at the support of the installed stop). Open (pull out) the mixture control (suction ducts).

– push the START button and hold down for no more than 5-7 seconds.

– After start-up hold choke open till the engine works in a steady motion and take them smoothly closed. At an air temperature greater than 20°C, the choke is not necessary to be used.

– After start-up you have to warm up the engine, to n=4500-5000 rev/min up to CHT=180°C (cylinder heads temperature – CHT) and then go for a trial run.

ENGINE WARM UP

When you reach CHT=180°C of CHT increase revolutions to n=5000 rev/min. The increase of revolutions has to be done smoothly, without interruption. After running at these rpm-s for 10 seconds, the lever have to be drawn backwards smoothly till a support end (lever to min) is reached, the rpm fall has to be monitored until they reach the minimal n_{min}=1800-2200. This operation must be done smoothly but in a slower than that of the lever motion. That is the normal way to do it having in mind the fixed pitch propeller and the two-stroke engine. After 10 seconds push the throttle lever forward to their maximum at a rate of 1.5-2 sec and wait till engine reaches maximum revolutions

n_{max}=7500(+/-100) rev/min. CHT must stay below 280°C. In 5 seconds draw in the lever to their minimum.

In case of unusual engine run (vibrations, interruptions, etc.), draw the lever in to their minimum and turn off ignition using the main switch.

TAXIING

You have to start taxiing with pedals in neutral position. Then increase engine revolutions smoothly to 5000 rev/min and ease off the brakes. Taxing must be done at a speed of 5-7 κm/h and engine revolutions of 5500-6000 rev/min. The taxiing speed has to be controlled by changing the revolutions of engine and brakes.

Avoid sharp turns or turns while airplane taxing.

FLIGHT

Take Off

Start taxiing to the runway and stop on the center line. Apply the brake. Set the flaps to 11°. Look around the cockpit from left to right. Check the instruments. Smoothly push the throttle to maximum position. Wait untill the engine reaches maximum RPM, be sure it works well and ease off the brakes.

In the first part of the take off run keep the heading by using the pedals.

CAUTION!

Do not use brake during take off!

When the speed increases above 20-25 km/h, the airplane starts to “obey” the rudder, too. Motion with pedals has to become slower and more careful. At a speed of 30-35 km/h ease pull the stick slightly (up to ½ of its move) . The nose wheel lifts smoothly (15-20 cm) with the increase of the speed to 40-45 km/h.

Continue the run on two wheels up to a speed of V=50 km/h and pull the stick lightly “clear the free-play”.

Upon reaching the speed of V= 55-60 km/h take off the airplane from the runway and hold angle of climbing.

Upon reaching the speed of V=60-65 km/h smoothly proceed to climbing at a speed of V_y=2-2.5 m/s.

At a H=50m decrease vertical speed to 0.5-1.0m/s and retract the flaps.

HORIZONTAL FLIGHT

Reduce the RPM-s down to 6800 and continue climbing at a speed of V=80-85 km/h and V_y=1.0m/s.

Turns along the pattern are done with banks of up to 30°, decreasing the vertical speed to V_y=0.5-1.0 m/s and applying power to increase the RPM by 500 before each turn.

In flight the RPM-s keeps 6800.

A speed of V=90-100 km/h is the cruise speed for a horizontal flight.

The maximal airspeed under turbulent atmosphere is V=121 km/h.

LANDING APPROACH

Upon flying over the traverse in the beginning of the runway mark the time. After 20-25 s decrease the airspeed to V=70 km/h, at a height of H=150 m start the third turn with a maximum bank of 30° and a plan to complete the turn at a height of H=120 m.

After leaving the turn set an airspeed of V=65(70) km/h and vertical speed of V_y=1.0-1.5 m/s; lower the flaps to 11°.

After 12-15 s (visual, watching closely runway approach) start the fourth turn at a height of H=80m, a speed of V=65(70) km/h and a bank of up to 30° with a plan to leave the turn at a height of H=50m and a speed of 60(70)km/h.

Maintaining that routine, drop the flaps to 22°.

After dropping the flaps keep the airspeed at V=60(65)km/h and vertical speed of V_y=1.5-2.0m/s, RPM 6500-7000 rev/min.

LANDING

At 5-7 m start smooth levelling of the airplane by pulling the throttles levers backwards on min. The leveling must finish at 0.5-1 m above the runway.

NOTE:

Landing must be on two points, with a smooth pulling back of the stick along the descend rate of the airplane.

The airplane touches down at a speed of V=55 km/h.

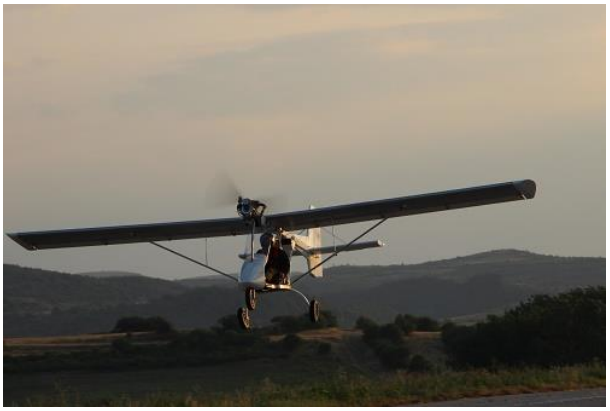
At the moment of touch down keep the stick in the same position as before, then pull the stick back.

Upon decrease speed smoothly drop the nose wheel. The pedals must be centered, before touch down of nose wheel.

Apply the brakes with the rate of decreasing speed.

NOTE:

1. Speed is given for G_{gross}=260kg in brackets respectively.
2. We do not recommend bank over 30° with a tank half-full of fuel.
3. When planning the landing keep the CHT above 140°C.



COMMON MISTAKES

Take-off

1. When you lose direction at more than 15° – abort the take-off! It has already gone beyond the limits.

2. When you try to take-off at a slower speed – wait untill you reach the speed needed for the airplane take-off. If speed increase is sluggish or you have doubts about it – abort the take-off and find the problem!

WARNING!

Do not try to take-off by all means!

3. When the climbing angle after take-off is large – the airplane will not gather speed, the initial rate being over V_y = 3m/s. Do not pull further, hold back and push the stick slightly forward. Fix the climbing angle and wait untill the vertical speed "calms down". Establish the necessary climb rate.

The actual speed supply of an engine working with its maximal capacity exceeds that of a motionless one with 5-7 km/h.

In flight follow that rule:

– "Release" the stick, "reduce" RPM – proceed to climb down;

– "Increase" RPM, "pull" the stick – proceed to climb up.

Landing

1. Irregular/unstable speed and project angle – after exiting the fourth turn, drop flaps at 22°, fix a visual project angle, examining the onset of landing runway. Fix the revolutions to n= 7000-7500 rev/min and wait to see V trend. According to whether speed increases or decreases, operate the rod keeping in that way speed and project angle.

2. Unreliable determination of levelling height – the result is an airplane levelled/alligned at an incorrect height.

WARNING!

If you start levelling at a wrong height – over 2 m, hold the stick, wait for the speed to decrease and with the rate of descend land the airplane!

NEVER try to get the airplane to the necessary height above the ground (0,5 -1 m) by moving the stick forward or backward – this will induce dangerous oscillations!

PROBABLE SPECIAL CASES

During take-off

Do not take off without a properly warmed-up engine – it is unreliable.

If you have doubts about engine operation – abort take-off.

If the engine stops after take-off at a height of up to 15 m – land forward in a direction with maximal drift up to 15° to the left and right and maximal banks of up to 10°. After touch down switch off ignition.

If there is a danger of colliding with an obstacle, do your best to meet the blow with the wing – by no means with the front!

If the engine stops after take-off at a height of over 50 m – turn to the left or to right up to 90° to land on a suitable place. Do not attempt a turn to 180° and landing in a direction opposite to that of take-off. Before landing drop the flaps to 22° (if possible), plan to land by parachuting. This applies especially to landing on an unsuitable place, with a soft ground, with grass, etc.

In flight

If you have doubts in engine operation – abort flight, ease off the engine operation and land.

You have to fear the speed loss more than the engine stop itself!

If the engine stops after the first turn set a speed of V=80(85)km/h and assess the chance to land on the runway. If you are not sure – choose a landing place.

From a height of H=100-150m you can fly straight for about 1km

Upon gliding, do the turns easily, with a maximal bank of up to 30° and a speed of 10km/h greater than that of an straight flight.

The radius of the turn is around 500-700m.

WARNING!

Once you have made your mind, do not change it! There is nothing more dangerous than changing your mind several times! You will not have time to do that!

If the engine stops after the fourth turn – assess the possibility to land on the runway. It might be possible to land before the runway (usually the approaches are clear).

Have in mind – land with flaps dropped to 11°, $K_{max}=7,5$.

It is better if you do not rise flaps to 0° to increase aerodynamic quality. This means rebalancing the airplane and establishing a new gliding speed (faster), corresponding to the new configuration, but which will lead to a loss of height with an engine out of motion. The height after exiting the fourth turn (around 80 m) is low enough.

WARNING!

In an emergency landing on an unprepared field make sure the seat belts are tight!

Do not take off with seat belts unfastened or unadjusted!

Fire

- **Upon Ignition**

In case of fire in the engine area:

- Pull the throttle to minimum;

- Switch off ignition;

- Leave the cabin as fast as you can;

- Take steps to extinguish fire.

- **In flight**

In case of fire in the engine area:

- Pull the throttle to minimum;

- Switch off ignition;

- Take steps to land immediately no matter what the result of the fire extinguishing is.

- After landing leave the cabin as fast as you can;

WARNING!

In landing with an unreliable engine pay special attention to the landing pattern!

Do not forget – you cannot go on a second round!

You do not have an engine!

Exploitation Limits

Stall Speed with throttles on min.

Flaps	0°	11°
V_{min}	50 km/h	45 km/h

Vertical Speed on climb (with Hirth F-33 engine)

V_x	50 km/h	60 km/h
V_Y	1.5 m/sec	1.0 m/sec

Vertical Speed on climb (with Polini 250 DS engine)

V_x	60 km/h	70 km/h
V_Y	3.0 m/sec	2.5 m/sec

Min Speeds in different configurations
Quiet whether

Flaps	0°	11°
$V_{take-off}$	55 km/h	50 km/h
$V_{planning}$	80-85 km/h	75-80 km/h
$V_{touch\ down}$	55 km/h	50 km/h

Side wind up to 5 m/sec

Flaps	0°	11°
$V_{take-off}$	60 km/h	60 km/h
$V_{planning}$	90 km/h	80 km/h
$V_{touch\ down}$	60 km/h	60 km/h

Maximal Speeds in different configurations

V ne (ne-never exceed)	150 km/h
V ne in turbulent atmosphere	130 km/h
Vne flaps 11°	90 km/h
Max side wind	5 m/sec

Practical ceiling

Configuration	MTOW	H absolute
Standard	260 kg	3200 m

Take off and Landing Distance

Flaps	0°	11°
Take off	65 m	65 m
Landing	60 m	60 m

Limits on max. weight G=260kg

Max limits in flight	+4/-2
Structural limit (by calculations)	+6/-3

Weight limits

MTOW	260 kg
Empty Weight	136 kg

Positions of CG (center of gravity)

CG position	33%

Notes: