CIAIAC
Comisión de Investigación
de Accidentes e Incidentes
de Aviación Civil

TECHNICAL REPORT
A-033/1997

Accident occurred on 25 June 1997 to Aircraft SUKHOI 26M, registration RA01295, in Barberá del Valles (Barcelona)

MINISTERIO
DE FOMENTO

Technical report

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SUBSECRETARÍA

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Foreword

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances in which happened the event being investigated, with its causes and its consequences.

In accordance with the provisions of Law 21/2003 and Annex 13 to the Convention on International Civil Aviation, the investigation has exclusively a technical nature, without having been targeted at the declaration or assignment of blame or liability. The investigation has been carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report has originally been issued in Spanish language. This English translation is provided for information purposes only.

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Abbreviations

00 °C	Grados centígrados
00° 00′ 00″	Grados, minutos y segundos
Ac	Altocumulus
ACC	Area Control Centre
ADF	Automatic Direction Finder
AIP	Aeronautical Information Publication
APP	Approach Control
ATC	Air Traffic Control
CAT I	Category I ICAO
Ci	Cirrus
CRM	Crew Resource Management
CTE	Commander
CTR	Control Area
Cu	Cumulus
CVR	Cockpit Voice Recorder
DH	Decision Height
DME	Distance Measuring Equipment
E	East
EPR	Engine Pressure Ratio
EM	Emitter
ETA	Estimated Time of Arrival
FAP	Final Approach Point
FDR	Flight Data Recorder
ft	Feet
g	Acceleration due to gravity
GPWS	Ground Proximity Warning System
h. min: seg	Hours, minutes and seconds
HP	Horsepower
hPa	Hecto-pascal
IAS	Indicated Air Speed
IFR	Instrumental Flight Rules
ILS	Instrumental Landing System
IMC	Instrumental Meteorological Conditions
INTA	National Institute of Aerospace Technology
Kms	Kilometres
Kts	Knots
Kw	Kilowatts
lbs	Pounds
m	Metres
MAC	Mean Aerodynamic Chord
mb	Milibars
MDA	Minimum Descent Altitude
MDH	Minimum Descent Height
METAR	Meteorological Actual Report
MHz	Megahertz
MM	Middle Marker
N	North
N/A	Not Applicable
NDB	Non Directional Beacon
MN	Nautical mile
OM	Outer Marker
P/N	Part Number
PF	Pilot Flying
PNF	Pilot Not Flying
QNH	Air pressure adjustment to make the altimeter mark the altitude of the airport above sea level during landing and take off

Abbreviations

RVR	Runway Visual Range
S/N	Serial Number
S	South
Sc	Stratocumulus
Shp	Shaft Horsepower
SVFR	Special Visual Flight Rules
TWR	Control Tower
U T C	Universal Coordinated Time
VIP	Very Important Passenger
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Radio-Range
W	West

1. FACTUAL INFORMATION

1.1. History of the flight

On the 25th of June of 1997, a Sukhoi 26M aircraft with registration number RA01295, took off from the Sabadell airport at 18:40 hours[1] with one crew member on board. It was supposed to carry out an acrobatic training flight and return to the airfield. It had a normal take off, but upon reaching 1000 feet of altitude it communicated to the control tower that it was having engine problems and that it would attempt to return to the airfield.

The pilot attempted to return to the field and began to turn towards the left. According to witness testimonies the engine stopped and the aircraft went into a flat spin. Just before the impact, an attempt was made to restart the engine.

The impact occurred approximately 1 kilometre away from the end of runway 13.

1.2. Injuries to persons

Injuries	Fatal	Serious	Minor/none
Crew	1		
Passengers			
Others			

1.3. Damage to aircraft

The aircraft was completely destroyed as a result of its impact against the ground.

1.4. Other damage

There were no other damages worthy of mention.

[1] All times in the report are UTC. To obtain local time on the date of the accident, 2 hours must be added to the UTC time.

1.5. Personnel information

1.5.1. *Pilot in command*

Age/Sex:	36 years old/Male
Nationality:	Spanish
License:	Commercial Aeroplane Pilot
Number:	17647
Total flight hours:	1105

1.6. Aircraft information

The Sukhoi 26M is a single-seat aerobatic airplane. It incorporates composite materials and has a mid-fixed wing and spring-type nonretractable landing gear with a tail wheel.

This aircraft is used for training and acrobatic competitions.

The high thrust-to-weight ratio in combination with an optimum aerodynamic wing load and an adequate directional control on the three main axes of the aircraft allows to the pilots to perform aerobatics of any category of complexity.

The aircraft has a 9-cylinder M-14P radial engine with a power of 360 hp.

1.6.1. *Airframe*

Manufacturer:	SUKHOI
Model:	26M
Manufacturing number:	01-03
Year of manufacture:	1989
Registrater:	RA012995
M.T.O.W.:	832 kg
Owner:	Acrobatic Club Barcelona Sabadell
Operator:	Acrobatic Club Barcelona Sabadell

1.6.2. *Airworthiness certificate*

The airworthiness certificate was issued by Russian authorities as the aircraft was registered in this state.

Number:	96/35
Type:	Acrobatic
Date of issue:	22-06-1989
Renewal date:	30-12-1996
Expiration date:	01-07-1997

1.6.3. *Maintenance record*

The aircraft had passed a 100 hour inspection 5 days before the accident on 06-20-1997.

1.6.4. *Engine*

Manufacturer:	VEDENEYEV
Model:	M-14P
Power:	360 hp
Serial number:	K9142003

The engine, like the aircraft, had passed a 100 hour inspection 5 days before the accident.

1.7. Meteorological information

It is not relevant in this accident.

1.8. Aids to navigation

The flight in question was a local one for acrobatic training. No navigation aids were planned to be used.

1.9. Communications

The aircraft took off and kept in contact with the Sabadell Airport Control Tower using a frequency of 128.8 MHz throughout the duration of the flight.

The communication equipment of the Control Tower and the aircraft worked properly.

1.10. Aerodrome information

The Sabadell Airport has a runway with a dimension of 900x30 metres and a heading of 13/31. It has an asphalt surface.

There are threshold lights at both ends. In addition, there are runway edge lights and runway end lights.

In the airfield there is a NDB with a frequency of 367 KHz and a 40 nautical mile range.

All the facilities were working properly.

1.11. Flight recorders

The aircraft did not have flight recorders. They are not mandatory for this type of aircraft.

1.12. Wreckage and impact information

The aircraft fell from a height of 1000 feet in a flat spin and consequently hit to the ground in a levelled attitude with an acceleration of strong vertical component and a slight component towards the left. The forces that generated the damage to the aircraft were, as a result, perpendicular to the ground. This kept the wreckage from scattering.

During the impact, the engine mount broke. It was found split in two at the height of the firewall.

The three-blade propeller had two blades broken and laying on the ground while the third blade was practically intact, which indicates that it was not turning at the moment of impact.

The main landing gear had yielded until the wing hit the floor and the wing root area cracked through the upper side.

As was mentioned before, all of the wreckage was found close together and there was no evidence that the aircraft had moved on the ground.

The tail area, as well as the tail wheel, did not suffer any breakage.

The fuel was spilled after the crash.

1.13. Medical and pathological information

The aircraft pilot died as a consequence of the aircraft's impact with the terrain.

1.14. Fire

There was no fire. Regardless, firefighters intervened and doused the aircraft with carbonic foam for the purpose of preventing one.

1.15. Survival

Given the accident's characteristics, there was practically no chance of survival for the occupant of the aircraft.

1.16. Test and research

1.16.1. *Inspection of the Powerplant*

According to witness testimonies, the aircraft engine was not running at the moment of impact. Although it konked seconds before the impact without being able to restart.

This fact, together with the communication the pilot made to the Control Tower indicating that he had problems with the engine and that he was going to attempt to return, led to focusing the investigation on the powerplant.

The engine, the gearbox, and the oil and gasoline pumps were disassembled, verifying that all of the transmission axles were correct.

With respect to the gasoline pump, the flow pressure was verified to be correct.

It was observed that both the inlet and pressure gasoline filters did not have any obstructions. At the same time it was observed that they did not contain any gasoline, which was abnormal.

The carburetor and the inlet filter were dismantled and nothing out of the ordinary was observed. It was also verified that the emergency shutoff valve, the antireturn valve and the fuel valve were functioning properly. Some of the flight controls were bent due to the impact of the accident.

Lastly, the fuel tank was dismounted and it was verified that the fuel tank inlet flexible hose was plugged up by the rubber which had worn out and was obstructing the flow of fuel.

1.16.2. *Aircraft Trajectory*

The aircraft took off from runway 13 and began to ascend. During this time it continued to be aligned with the axis of the runway. At a height of 1000 feet the engine stopped and the aircraft lost control and fell to the ground in a flat spin. The aircraft hit the ground without moving on it, since no marks were present.

1.16.3. *Witness Testimonies*

According to the testimonies of the witnesses, the engine was stopped and just before the impact, the engine konked, failing to restart. This indicates that the pilot tried unsuccessfully to restart the engine.

1.17. Additional Information

1.17.1. *Fuel System of SU-26M Aircraft*

Its main component parts are:

1. Main Fuselage Tank
2. Fuel quantity gage
3. Fuel Shutoff Valve
4. Gravity Fuel Filter
5. De-aerator Tank
6. Fine fuel filter
7. Fuel Pressure Transmitter
8. Engine Primer

The main tank is gravity-filled through the filler neck located on top of the tank.

When the engine is running, the fuel flows by gravity from this tank through the control valve, through the fuel shutoff valve (which is usually open), and through the fuel filter until it reaches the engine fuel pump. The pump drives the fuel with a pressure of 0.15 to 0.50 Kgf/cm^2 so that it can then pass to the carburettor through the de-aerator tank and the fine fuel filter.

The amount of fuel in the main fuselage tank can be verified visually and through the fuel indicator of the cockpit.

1.17.2. *Primer System in the SU-26M Aircraft*

The MP14 engine is started using a compressed air system that is able to start the aircraft engine both on the ground and in flight.

Its main components are:

1. Air Bottle
2. Recharge Connection
3. Push-type Valve
4. Safety Valve
5. Check Valve
6. Flow restrictor

In order to start the motor, the START button on the panel to the left of the pilot must be pushed. Once this button has been pushed, the compressed air passes through the push-type valve inside the air distributor on the engine and therefrom into the engine cylinders in the order of cylinder firing.

The system gets recharged from a compressed air supply on land through a recharge connection that is located on the right side of the fuselage. The compressed air bottle is pressurized at 50±5 Kgf/ cm^2.

1.17.3. *Description of Flat Spin*

All aircraft can enter a spin if, while flying «in a stall», that is, with an angle of attack that is equal to the stall, or in the poststall with an angle of attack greater than the stall one, they begin a combined movement of yaw and roll. Usually, with only one action on the rudder they enter into a spin. This spin is even easier to produce when the centre of gravity is close to the longitudinal neutral point (neutral stability point), but it is always stable. The lateral stability is preserved until the stall is reached. This instability, resulting from the fact that the angle of attack is greater than that of the stall, is ideal for a spin to result. Longitudinally unstable manual flight is impossible. Spins are classified as follows:

1. Very steep spin, when the angle of attack is greater than that of the stall and less than 35°.
2. Steep spin, when the angle of attack is greater than that of the stall and has a value between 35° and 70°.
3. Flat spin, when the angle of attack is greater than that of the stall and greater than 70°.

In the case considered here, because of the manner in which the aircraft hit the ground, it is a flat spin. Taking into account the 1000 feet altitude at which it was produced, it probably wasn't a fully developed spin since with an acrobatic airplane a flat spin develops in a steep spin, with or without any action on the part of the pilot. The turn towards the left that he initiated without the engine running is probably the cause of the stall and subsequently of the spin.

1.17.4. *SU-26M Maintenance*

The maintenance program for this aircraft is the one specified by the manufacturer and is applied according to the requirements of the State of Registration (Russia).

Inspections are carried out on this type of aircraft at 25 hours, 50 hours, 100 hours and 300 hours.

According to the information obtained from the manufacturer, the tank's inlet flexible hose is part of the fuselage's fuel tank and has the same service life as the tank. This service life is included in the fuselage tank certificate. The manufacturer did not provide information about the duration of this service life.

On the other hand, the manufacturer indicated that no maintenance for the flexible hose had been deemed necessary.

According to information obtained verbally and without any supporting documentation from sources familiar with the maintenance of this type of aircraft, the initial service life of the fuselage tank is between 5 and 7 years. Regardless, this service life may vary if the inspector carrying out the service check deems it appropriate.

Similarly, these same sources also indicated that the Russian authority does not have any guarantee that the documentation used by maintenance providers is up to date.

1.17.5. *Use of Aircraft with Foreign Registrations in Spain*

In May of 1999, the Civil Aviation Authority (Dirección General de Aviación Civil) issued an internal memo informing about the conditions imposed by the current legislation (Law 48/1960, July 21, on Air Navigation) on the use of aircraft with foreign registration on Spanish territory.

The memo mentions «innocuous transit» as the only operation this type of aircraft is permitted to perform on general terms. The term used, «innocuous transit», is taken directly from the law (second article) but there is no definition given for this concept either in the law or in the memo. Only in the memo are a couple of activities cited as examples of those not included in this classification: parachuting and acrobatics.

Mention is also made in the memo of cases that are exceptions to the aforementioned restriction:

1. Aircraft registered in countries belonging to the European Union
2. Aircraft with «special authorization»

The requirements or conditions that dictate the concession of the authorizations mentioned in the second case are not included in the document.

Lastly, the memo concludes by offering to anyone interested the opportunity to obtain more information from the DGAC about the «viability of the issue or convalidation off the Airworthiness Certificate» for imported aircraft.

2. ANALYSIS

2.1. Hystory of the flight

The aircraft took off from runway 13. Immediately after doing so it began to have engine problems and communicated this to the Control Tower. The pilot reported his intention to return to the airfield to land. According to what witnesses testified, the engine stoped and although the pilot tried to, he was not able to start the engine. The aircraft entered into a flat spin and fell to the ground.

The aircraft hit the ground with the engine stopped, as confirmed by witness testimonies and by the state in which the blades were found, that is, the three-blade propeller had two completely broken blades and the third blade practically intact.

The impact with the ground was produced as a pancake landing without any displacement on the ground since there were no marks left on the terrain. In addition, the main landing gear opened due to the aforementioned pancake landing. It was concluded, after observing that the tail wheel was moved to the right of its nominal position, that the landing took place with a slight component towards the left.

The main damages were caused by a vertical acceleration component when the ground was hit, causing the main landing gear to open and then the fuselage to hit the ground. This resulted in the engine mount breakage and caused it to fly off through the firewall. The wing had cracks at the height of the root which indicates that they had been submitted to vertical forces in the negative direction of the Z axis of the aircraft.

2.2. Personal actions

2.2.1. *Actions by the pilot in command*

Upon taking off the pilot noticed engine problems and when the engine stopped, he centred all of his attention on starting it again; in fact he succeeded in making an attempt to start the engine, as was testified by witnesses of the accident. The engine starter system is located on the left panel of the aircraft, so it is likely that the pilot focused on restarting the engine instead of flying the aircraft.

As has already been mentioned, this aircraft is for acrobatic flight, so it is very manoeuvrable and not very stable. The moment the engine stopped, the aircraft entered into a flat spin. The impact against the ground was immediate since it was only 1000 feet from the ground and there was little chance of recovery.

2.2.2. *Inspection of the wreckage*

The powerplant was inspected, especially the fuel system. There was no fuel in the inlet and pressure gasoline filters which indicated that the engine had stopped due to a lack of gasoline.

The removal of the fuel tank showed that the flexible inlet hose for feeding the engine circuit had been obstructed by its own rubber, which had worn out, preventing the fuel from flowing from the fuel tank.

2.3. Aircraft with foreign registration flying on Spanish territory

In relation to the use of foreign aircraft on Spanish territory, the circumstances surrounding this accident have allowed for a close study of the national regulations on the subject and the evaluation of its knowledge and application.

An internal memo of the DGAC, dated in 1999, offers orientative information about how the current legislation handles these types of situations. While the information contained in the memo can be considered useful for the general public, it seems to be lacking in information when it does not distinctly define the conditions that regulate, in a wide and precise manner, these operations.

On the other hand, the dissemination of this information does not seem to assure that the DGAC personnel in charge of applying it have the adequate knowledge and much less that the citizens which might be interested in the matter would have.

3. CONCLUSIONS

3.1. Findings

— The pilot was qualified for the flight and had a valid license.
— The aircraft had a valid Certificate of Airworthiness, issued by the Russian authorities, as State of Registry.
— The aircraft had a 100 hour inspection performed 5 days before the accident.
— Upon taking off, the aircraft communicated to the Control Tower its intention of returning to the airfield because of engine problems.
— Witnesses of the event affirmed that the aircraft engine stopped and that an attempt was made to start the engine before hitting the ground.
— Upon inspecting the fuel tanks it was observed that the flexible inlet hose was plugged up and was impeding the flow of fuel from the main tank to the engine.

3.2. Causes

The probable cause of the accident was the engine stopping due to a lack of fuel feed produced by the plugging up of the flexible inlet hose from the main tank to the feed circuit.

4. SAFETY RECOMMENDATIONS

REC 39/02. It is recommended that the Aeronautical Authority of the Russian Federation prescribe, apply and revise, if deemed appropriate, the conditions under which all maintenance, inspection, modification and repair work that affect the airworthiness of model SU-26M aircraft registered in this State should be carried out.

REC 40/02. It is recommended that the DGAC inform, through the official channels of general dissemination, and through the appropriate administrative provisions in the most complete and precise manner possible, on the conditions that apply to the use of aircraft with foreign registration on national territory in cases of general aviation activities of a private nature.

APPENDICES

APPENDIX A
Photographs

Photograph 1. *Left side aircraft view*

Photograph 2. *Back aircraft view*

Photograph 3. *Front aircraft view*

Photograph 4. *Powerplant detail*

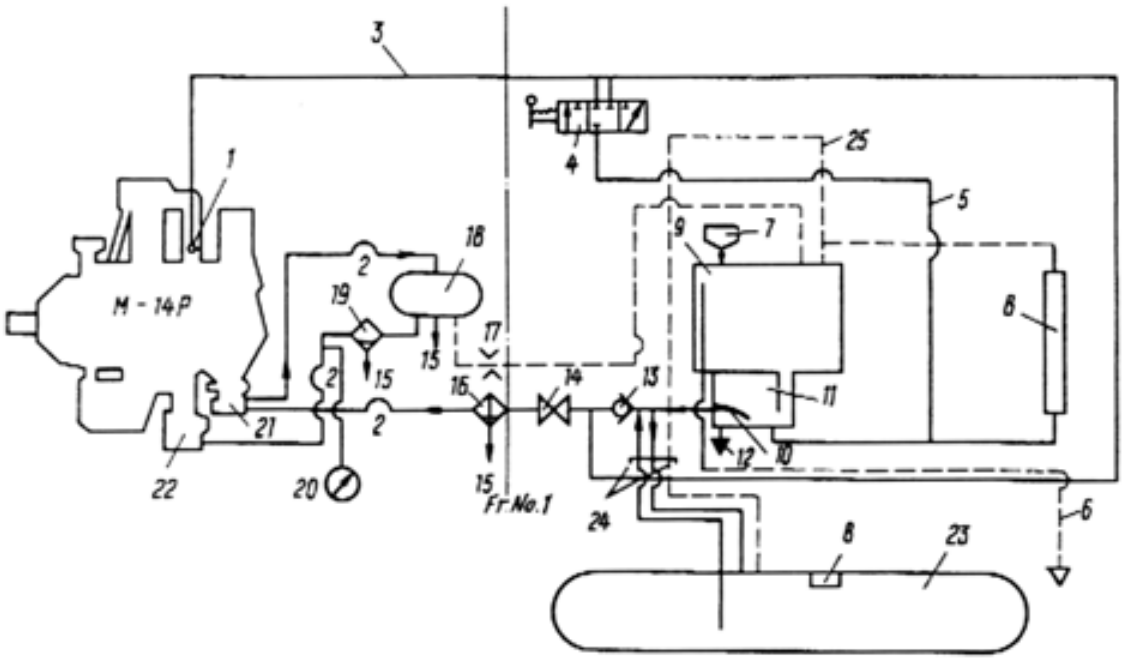
Photograph 5. *Aircraft wing detail*

Photograph 6. *Instrument Panel detail*

Photograph 7. *Left wing detail*

Photograph 8. *Right wing detail*

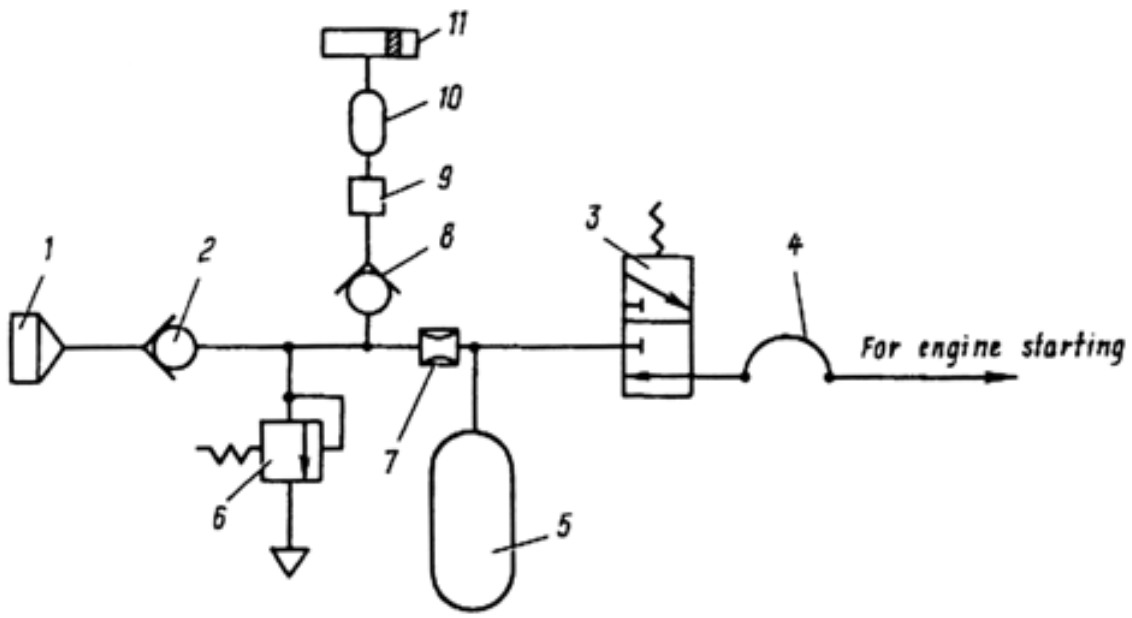
APPENDIX B
Fuel system. Functional schematic



1. Connection for Filling Fuel into Engine Mixture Collector
2. Flexible Hose
3. Priming Line
4. Engine Primer
5. Pipeline for Drawing Fuel into Priming Line
6. Fuselage Tank Vent Line
7. Tank Filler Neck
8. Fuel Quantity Gage
9. Fuselage Tank
10. Tank Fuel Outlet
11. Fuel Reservoir of Fuel Tank
12. Tank Drain Valve
13. Check Valve
14. Fuel Fire Shutoff Valve
15. Filter Drain Plug
16. Gasoline Filter
17. Flow Restrictor
18. De-aerator Tank
19. Fine Fuel Filter
20. Fuel Pressure Transmitter
21. Engine Gasoline Tank
22. Engine Carburettor
23. External Tank
24. Connection for Connecting External Tank
25. External Tank Vent Line

Fuel system. Functional schematic

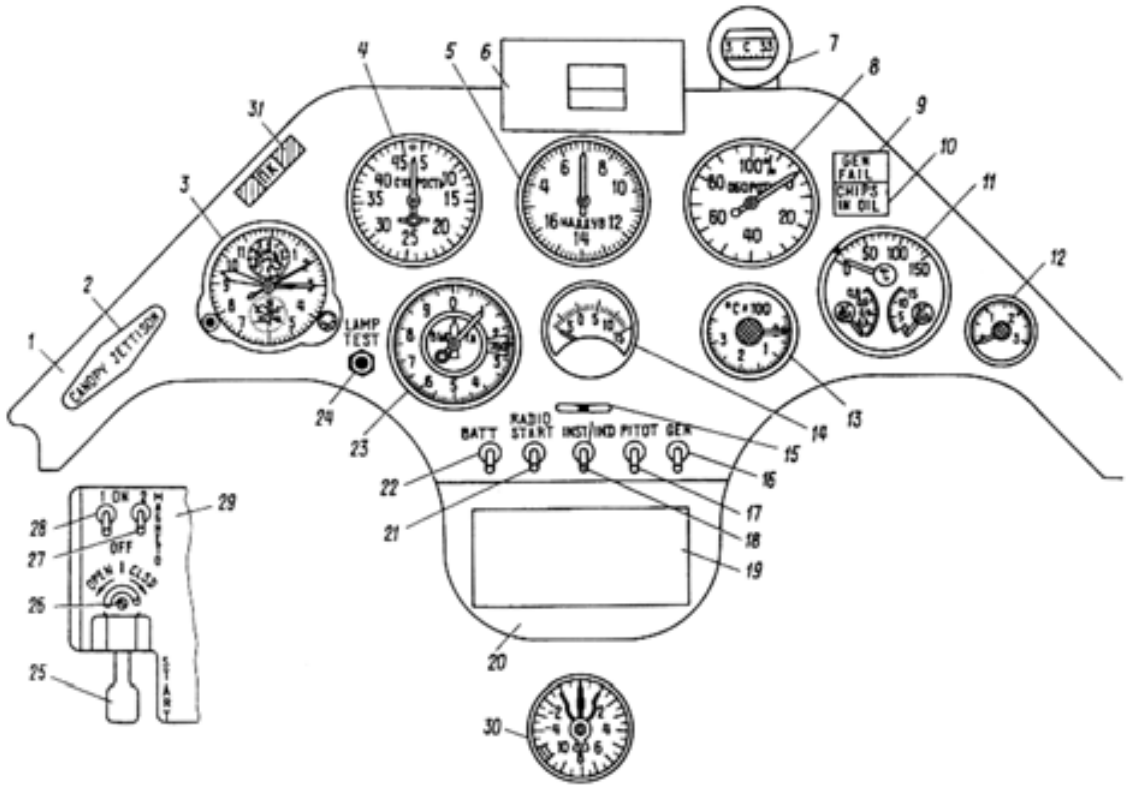
APPENDIX C
Engine starter system functional schematic



1. Charging Connection
2. Check Valve
3. Push-Type Valve
4. Plexible Hose
5. Air Bottle
6. Safety Valve
7. Flow Restrictor
8. Check Valve
9. Filter
10. Gravity Filter
11. Engine Compressor

Engine starter system functional schematic

APPENDIX D
Instrument panel



1. Central Panel
2. Canopy Emergency Jettisoning Handle
3. AChS-1M Airplane Clock
4. US-450K Airspeed Indicator
5. MV-16K Pressure-Vacuum Gage
6. Map Holder
7. KI-13 Compass
8. ITE-1T Tachometer Indicator
9. TS-5M-1 Annunciator
10. TS-5M-1 Annunciator
11. UKZ-1 Indicator from Set of EMI-3K Three-Pointer Indicator
12. V-1 Voltmeter
13. TTsT-13K Thermocouple
14. TUE-48 Temperature Indicator
15. 1273-59 Slip Indicator
16. AZK1M-10 Circuit Breaker
17. AZK1M-5 Circuit Breaker
18. AZK1M-2 Circuit Breaker
19. Place for Radio Station
20. Bottom Detachable Panel
21. AZK1M-5 Circuit Breaker
22. AZK1M-5 Circuit Breaker
23. VD-10K Altimeter
24. KNR Button
25. Engine Start Button
26. Cockpit Heating Control Valve
27. VG-15K-2s Switch
28. VG-15K-2s Switch
29. LH Panel
30. AM-10 Accelerometer
31. Fuel Fire Shut-Off Valve

Instrument panel