COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 005/CENIPA/2015

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-NAB**
MODEL:	**EMB-710C**
DATE:	**10JAN2015**

NOTICE

According to the Law nº 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the different factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with Appendix 2, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree nº 21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of "non-self-incrimination" derived from the "right to remain silent" sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Taking into account the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

SYNOPSIS

This is the Final Report of the 10JAN2015 accident with the EMB-710C aircraft, registration PT-NAB. The accident was classified as “Engine Failure in Flight”.

During the initial climb, after the takeoff, the aircraft presented an engine failure in flight, lost altitude and, soon after, collided against a building.

The aircraft had substantial damage.

The pilot and one passenger died. Two passengers suffered serious injuries.

An Accredited Representative of the NTSB - National Transportation Safety Board, USA (State where the aircraft was designed), was designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

AD	Airworthiness Directive
ANAC	(Brazil's) National Civil Aviation Agency
ANP	National Agency of Petroleum, Natural Gas and Biofuels
AVGAS	Aviation Gasoline
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CG	Center of Gravity
CIV	Pilot's Flight Logbook
CM	Registration Certificate
CMA	Aeronautical Medical Certificate
DAC	Civil Aviation Department
DCTA	Aeronautics' Science and Technology Department
FAA	Federal Aviation Administration
IAM	Annual Maintenance Inspection
IS	Supplementary Instruction
MNTE	Qualification Type - Airplane Single-Engine Land
NTSB	National Transportation Safety Board
PN	Part Number
PPR	Private Pilot License -Airplane
RBAC	Brazilian Civil Aviation Regulation
SB	Service Bulletin
SWUZ	ICAO location designator - Brigadeiro Araripe Macedo Aerodrome - GO
TBO	Time Between Overhaul
TPP	Private Air Service
UTC	Universal Coordinated Time
US-Gal	American Gallon
VRF	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** EMB-710CI **Registration:** PT-NAB **Manufacturer:** Neiva	**Operator:** Private
Occurrence	**Date/time:** 10JAN2015 - 2104 UTC **Location:** 2, Padre Rosa St. - Airport Sector **Lat.** 16º15'19"S **Long.** 047º57'28"W **Municipality – State:** Luziânia - GO	**Type(s):** "Engine Failure in Flight" **Subtype(s):** Nil.

1.1 History of the flight.

The aircraft took off from Brigadeiro Araripe Macedo Airport, GO (SWUZ), at 2100 (UTC), in order to perform a local flight with one pilot and three passengers on board.

Shortly after take-off from SWUZ runway, during the initial climb, the aircraft presented engine failure, lost altitude and crashed into a building, away 1,317 meters from the departure aerodrome, in the urban area of Luziânia, GO.

The aircraft had substantial damage.

The pilot and one passenger died. Two passengers suffered serious injuries.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1	1	-
Serious	-	2	-
Minor	-	-	-
None	-	-	-

1.3 Damage to the aircraft.

The aircraft had substantial damage in the powertrain, wings, cockpit, landing gear and fuselage.

1.4 Other damage.

The building hit by the aircraft has suffered substantial damage.

During the trajectory covered by the aircraft until the last impact, it also hit a satellite dish, a residential power pole and the public lighting grid.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown	
	Pilot
Total	Unknown
Total in the last 30 days	01:15
Total in the last 24 hours	01:15
In this type of aircraft	30:00
In this type in the last 30 days	00:15
In this type in the last 24 hours	00:15

N.B.: The Data on flown hours were obtained through statements from the pilot's friends. The digital CIV was not up to date. It consisted of only 4 hours and 30 minutes of flight.

1.5.2 Personnel training.

The pilot took the Private Pilot course - Airplane (PPR) at the *Aeroclube de Luziânia* - GO, in 1998.

1.5.3 Category of licenses and validity of certificates.

The pilot had the Glider Pilot License - Airplane (PPL), Private Pilot – Airplane (PPR) and had valid Aircraft Technical Qualification for Single-Engine Land (MLTE) and Glider (PLAN).

1.5.4 Qualification and flight experience.

The pilot was qualified for this kind of flight.

1.5.5 Validity of medical certificate.

The pilot had valid Aeronautical Medical Certificate (CMA).

1.6 Aircraft information.

The aircraft, serial number 710001, was manufactured by Neiva Israel Aircraft in 1991, and was registered in the Private Air Service (TPP).

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engine and propeller logbook records were updated.

The aircraft was equipped with a Lycoming engine model O-540-B4B5, serial number L-17244-40, and a Marvel-Schebler carburetor, model MA-4-5, Part Number (PN) 10-5054, serial number BZ-12895.

The last inspection of the aircraft, the "IAM" type, was performed on 11APR2014 by the RPM shop (CHE # 1202-62 / ANAC) in Luziânia - GO, having flown 11 hours and 5 minutes after inspection.

According to the Component Control Information Map, the last engine revision was performed on 28NOV1999. Its Time Between Overhaul (TBO) was of 2,000 hours and it had flown 96 hours and 55 minutes since that intervention.

Also according to this Map, the carburetor was revised on 15SEPT2004. Its TBO was of 2,000 hours and it had flown 50 hours and 35 minutes since that intervention. However, by the date parameter, the review expired on 15SEPT2014.

1.7 Meteorological information.

The weather conditions were favorable for the visual flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The Aerodrome was public and operated VFR (visual flight) in daytime.

The runway was made of asphalt, with thresholds 11/29, dimensions of 1,200m x 20m, with elevation of 3,268 feet.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The first impact was against a satellite dish, 26,40 meters away from the site of the wreckage.

Figure 1 - View of the first impact site.

After this first impact, the aircraft crashed into a residential power pole, away from the satellite dish, broke a low voltage wire and crashed into a building at an angle of approximately 14°.

Figure 2 - Residential power pole and the aircraft wreckage.

As it collided with this building, the aircraft had a yaw to the left, of about 30°, and stopped in a pitch down attitude of approximately 44°.

The wreckage was concentrated at the coordinates 16°15’19"S / 047°57’28"W.

Figure 3 - View of the aircraft after the last impact.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Nil.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Because of his friendly relationship with the operator, the pilot had free access to the aircraft and authorization to perform flights with it.

Most of his flights on that plane had recreational purposes. His colleagues, also pilots, perceived him as a zealous commander and concerned to conduct the operation of the aircraft safely.

According to the operator, who had previously served as a flight instructor in previous years, the pilot, who also participated in glider competitions, demonstrated ability to operate the EMB 710-C model.

According to reports, the pilot's in-flight attitudes were adequate. The operator did not remember the pilot having experienced any real context of emergency, either in the model of the aircraft involved in the accident or in others that he used to fly.

On the day of the incident, the pilot participated with some friends, also pilots, of a barbecue. During the event, there were several local flights, recreational ones, in different aircraft models.

According to these friends, the pilot did not drink alcohol at any time during the meeting.

At about 6:00 pm (HBV), the pilot went to the hangar where the PT-NAB aircraft was and prepared it for the flight.

The first flight, which lasted approximately 15 minutes, ran normally. According to the passengers who were on board, no indication of abnormal aircraft operation or any inappropriate behavior on the part of the pilot was observed.

The second flight also started normally. According to the survivors, who were also pilots and were on board as passengers, after the engine was shut down, the pilot attempted to reignite it by performing some procedures but did not use the emergency checklist.

On these procedures, these witnesses stated that apparently he performed the actions appropriately to the abnormal condition presented, demonstrating, despite the context, to be emotionally balanced.

According to these surviving pilots, the use of the checklist and the performance of briefings were not a habit among the group of friends who flew that aircraft, especially since they were recreational flights.

According to them, due to the non-reignition of the engine, the pilot's decision was to go down in glide and ask passengers to tighten their seatbelts.

There was a soccer field close to the aircraft's position at that moment which would apparently be the most suitable place for an emergency landing.

However, according to the witnesses on board, there was not enough time to bring the aircraft in glide up to that point and it ended up colliding against the roof of a building.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

The Fuel and Lubricant Analysis Laboratory (LCL) of DCTA's Engineering Division (APA-E) conducted physico-chemical tests on four aircraft fuel samples for specific mass aspects at 20 ° C, corrosivity to copper and distillation.

The results showed that the samples were in compliance with Resolution 5/2009 of the National Agency of Petroleum, Natural Gas and Biofuels (ANP) and were clear and free from water and solid materials.

On 04MAR2015, the technicians of the Aeronautics Space Institute (IAE) followed the disassembly and analyzed the components of the engine Lycoming O-540-B4B5, n / s L17244-40, that equipped the aircraft PT-NAB.

According to the report drawn, the characteristics of the damages observed indicated that the engine did not develop power at the moment of the last impact.

The cylinders, pistons and rotating parts were in normal operating condition and had no evidence of failure.

The crankshaft bearings showed no signs of excessive wear.

No signs of failure in the lubrication system were identified.

The magnets were bench tested and there were no problems with their operation. Likewise, the spark plugs were in good condition and could provide normal operating conditions to the engine.

The selector valve of the fuel system was disassembled, which showed that there was residue, probably lead from the evaporation of the fuel. This element was found on both the transfer disk and the disk-positioning ball.

No compromise was observed on the fuel supply lines.

The Marvel-Schebler carburetor, model MA-4-5, PN 10-5054, serial number BZ-12895, installed in the engine, had float metal floats. As shown in Figure 4, they had scratching marks against the walls of the tub.

Figure 4 - Scratch marks observed in the carburetor float.

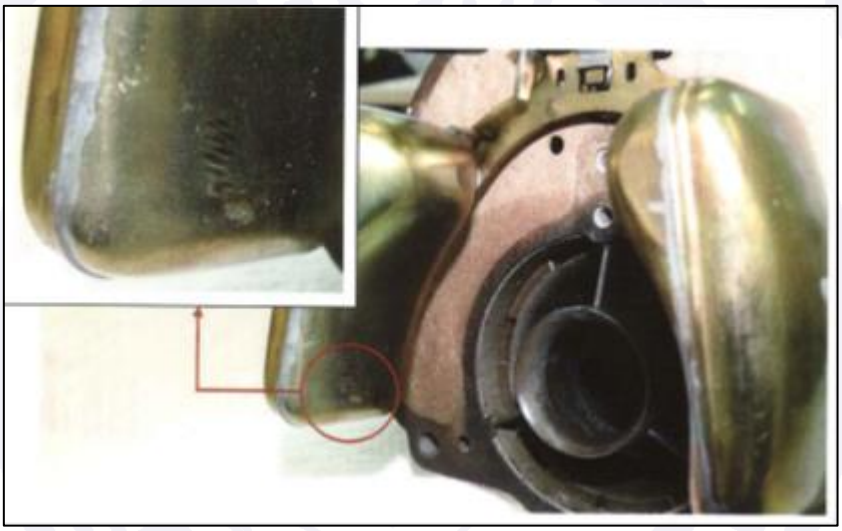


Figure 5 - Detail of the scratch marks observed in the carburetor float.

A special tool, called M-509 (Figure 6), was used to check the spacing between the flotation buoys and the walls of the carburetor tank. This calibration was performed according to the instructions in the Installation Instruction E-1002 manual, 03JAN2011, for the carburetor model.

As can be seen in Figure 7, the float buoys were not centered on the carburetor.

Figure 6 - View of the special mounting tool described in Installation Instruction E-1002.

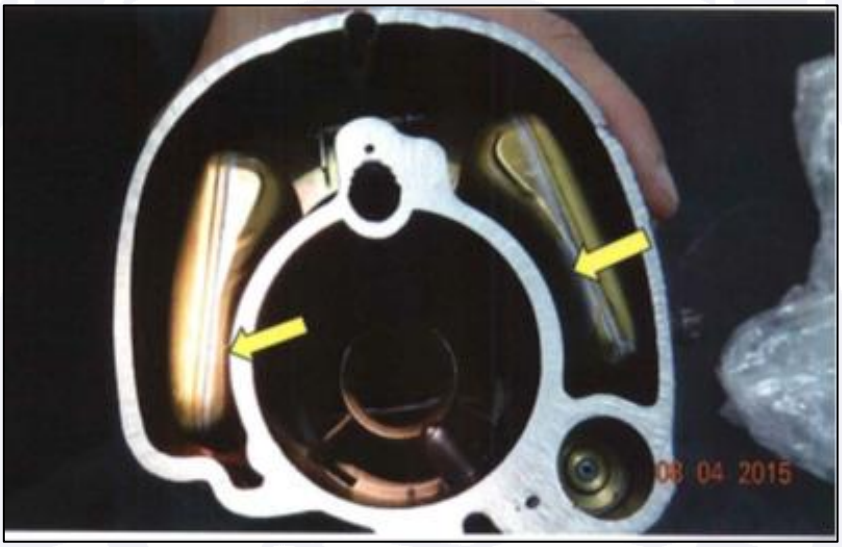


Figure 7 - View of the tool assembled on the carburetor cap, according to Installation Instruction E-1002, showing that the float was not centered inside the tank.

After the disassembly of the buoys, a deformation of its rod was observed, as shown in Figure 8.

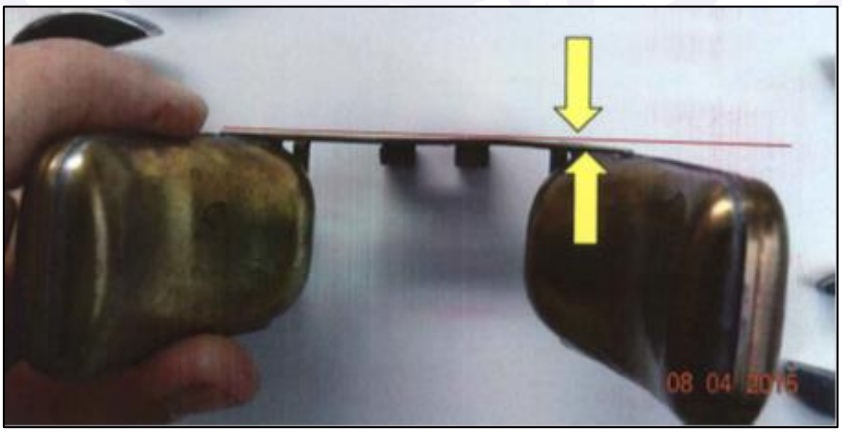


Figure 8 - View of the deformation observed on the float rod.

1.17 Organizational and management information.

The aircraft was acquired in 1997. Since then, the operator, his son and friends, who were also pilots, used the aircraft for personal and often recreational purposes.

According to information, the pilot did not perform regular trainings to maintain the proficiency in that airplane, since this practice was not common among the pilots who flew the aircraft recreationally. In addition, he was not interested in acquiring experience with a view to obtaining a Commercial Pilot qualification in the future.

Still according to the other pilots, emergency contexts were commonly simulated on the Luziânia Aerodrome region, in an informal way and without the presence of an instructor on board.

At the time of the incident, the injured pilot was responsible for the control and updating of the aircraft documentation. This control, however, was performed in a non-systematized way and did not count with the follow-up of the other friends who also operated the equipment.

1.18 Operational information.

The aircraft was within the weight and balance parameters.

According to reports, the pilot arrived at the *Aeroclube de Brasilia* at about 1400 (UTC) and took off to pick up his girlfriend in the city of Anápolis - GO, in an experimental CITABRIA aircraft of PP-ZIY brands. The return occurred at about 1600 (UTC).

During the day, he performed flights carrying friends on the CITABRIA aircraft and on another experimental aircraft, PT-ZED.

At about 2100 (UTC), the pilot collected the PT-ZED from the hangar and took the PT-NAB.

According to a passenger on the first flight, who possessed aeronautical knowledge, the fuel tanks and the power line were drained and the tanks were visually checked. According to this check, the left main fuel tank was the fullest.

The liquidometers indicated the presence of fuel in the four tanks; however, he could not tell what the volume was.

Also according to this passenger, the pilot performed the engine check and the parameters were within limits.

This first PT-NAB flight lasted approximately 15 minutes. After the landing, the passengers were exchanged for a new takeoff.

This change was made with the engine in low gear and, as in the previous flight, a take-off briefing was not held for passengers.

According to the report of a survivor, a pilot who was in a passenger condition and occupied the rear seat on the right side, the run took off normally.

During the climb after takeoff, at about 400 feet high, the aircraft lost power. The pilot started a left turn shortly after engine failure and performed procedures that appeared to be emergency ones, without success.

According to the survivor, the occupants of the rear of the aircraft were without their seat belts. Upon realizing the loss of engine power, he put his own and helped the other passenger to do the same.

Still according to him, the aircraft glided until the collision with the propeller spinning without producing power and the horn of stall did not ring at any moment. In his opinion,

the takeoff was performed with the flap deflected, because he remembers to have heard the activation of that device.

After the collision, this same survivor left the aircraft and could see fuel leaking from the wings.

It was recorded, during the initial action, that the flaps were retracted, that there was fuel in the engine feed line and in the cup-type filter. Approximately 15 liters of aviation gasoline (AvGas) were drained from the aircraft tanks 18 hours after the accident.

According to the aircraft operator, the last supply occurred on 02NOV2014. The records in the logbook indicated that were flown 3 hours and 30 minutes after this supply.

In Section 5 - Performance, of the Operation Manual and Approved Flight Manual (MO 710C / 529 REV 03, 16 / MAY / 2015), applicable to the aircraft of serial number 710001 to 710264, were the Velocity of Cruise charts Normal and Economy Cruising Speed, which referred to fuel consumption for the en-route flight.

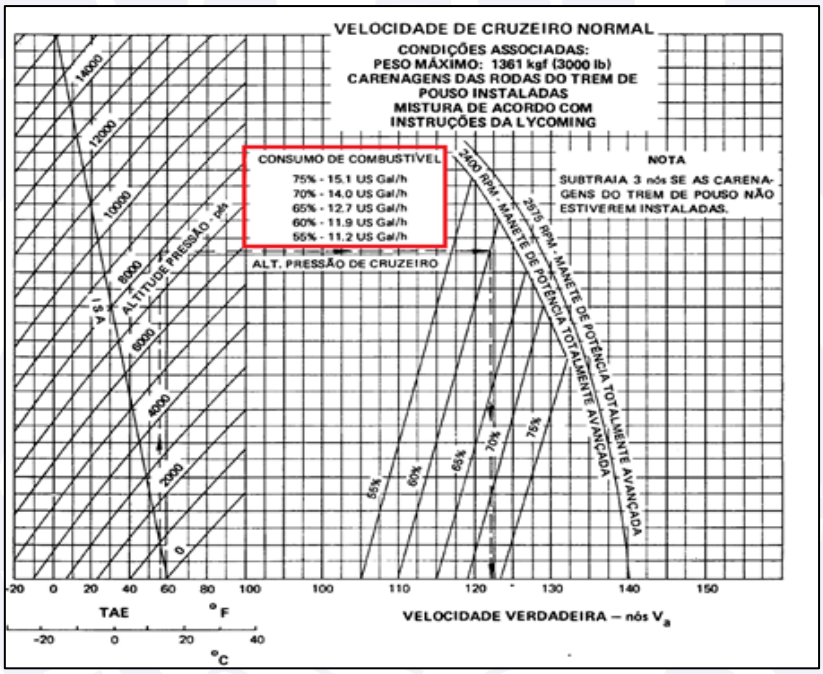


Figure 9 - Chart of fuel consumption in normal cruise regime.

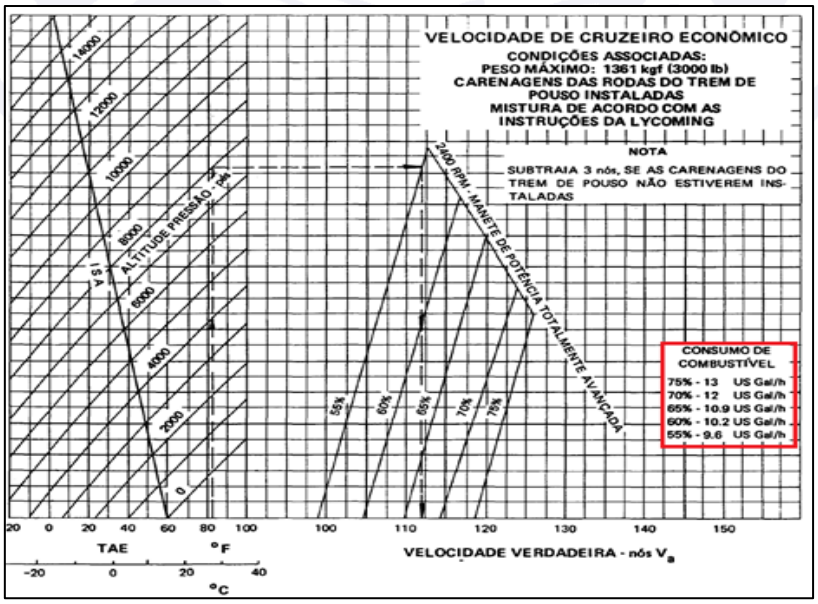


Figure 10 - Chart of fuel consumption in an economical cruise regime.

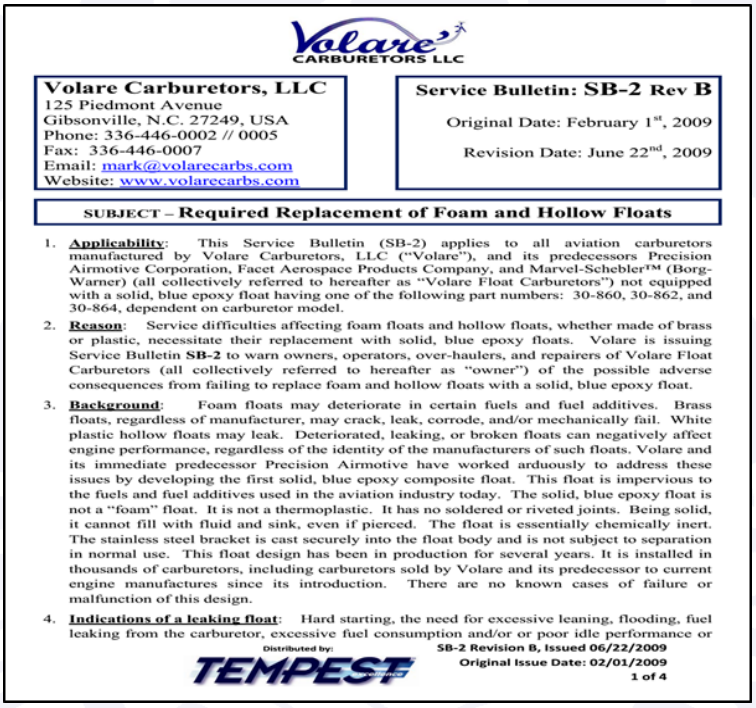
According to Section 2-21 - Fuel Limitations, the usable fuel volume was 82 US gallons.

Thus, the autonomy with normal cruising speed and 75% of the takeoff power would be approximately 5 hours and 20 minutes, disregarding the taxi's fuel consumption at the leveling of the aircraft.

The autonomy with an economical cruising speed and 75% of the takeoff power would be approximately 6 hours and 10 minutes, also disregarding the fuel consumption of the taxi to the leveling of the aircraft.

1.19 Additional information.

The Service Bulletin (SB) SB-2 Rev B, from 22JUN2009, Subject: Required Replacement of Foam and Hollow Floats, dealt with the need to replace the float of all carburetors that were not equipped with the "blue epoxy float".



Volare CARBURETORS LLC

Volare Carburetors, LLC
125 Piedmont Avenue
Gibsonville, N.C. 27249, USA
Phone: 336-446-0002 // 0005
Fax: 336-446-0007
Email: mark@volarecarbs.com
Website: www.volarecarbs.com

Service Bulletin: SB-2 Rev B
Original Date: February 1st, 2009
Revision Date: June 22nd, 2009

SUBJECT – Required Replacement of Foam and Hollow Floats

1. **Applicability**: This Service Bulletin (SB-2) applies to all aviation carburetors manufactured by Volare Carburetors, LLC ("Volare"), and its predecessors Precision Airmotive Corporation, Facet Aerospace Products Company, and Marvel-Schebler™ (Borg-Warner) (all collectively referred to hereafter as "Volare Float Carburetors") not equipped with a solid, blue epoxy float having one of the following part numbers: 30-860, 30-862, and 30-864, dependent on carburetor model.
2. **Reason**: Service difficulties affecting foam floats and hollow floats, whether made of brass or plastic, necessitate their replacement with solid, blue epoxy floats. Volare is issuing Service Bulletin **SB-2** to warn owners, operators, over-haulers, and repairers of Volare Float Carburetors (all collectively referred to hereafter as "owner") of the possible adverse consequences from failing to replace foam and hollow floats with a solid, blue epoxy float.
3. **Background**: Foam floats may deteriorate in certain fuels and fuel additives. Brass floats, regardless of manufacturer, may crack, leak, corrode, and/or mechanically fail. White plastic hollow floats may leak. Deteriorated, leaking, or broken floats can negatively affect engine performance, regardless of the identity of the manufacturers of such floats. Volare and its immediate predecessor Precision Airmotive have worked arduously to address these issues by developing the first solid, blue epoxy composite float. This float is impervious to the fuels and fuel additives used in the aviation industry today. The solid, blue epoxy float is not a "foam" float. It is not a thermoplastic. It has no soldered or riveted joints. Being solid, it cannot fill with fluid and sink, even if pierced. The float is essentially chemically inert. The stainless steel bracket is cast securely into the float body and is not subject to separation in normal use. This float design has been in production for several years. It is installed in thousands of carburetors, including carburetors sold by Volare and its predecessor to current engine manufactures since its introduction. There are no known cases of failure or malfunction of this design.
4. **Indications of a leaking float**: Hard starting, the need for excessive leaning, flooding, fuel leaking from the carburetor, excessive fuel consumption and/or or poor idle performance or

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Figure 11 - Service Bulletin SB-2 Rev B Page 1 of 4.

difficulty in stopping the engine with the mixture cut-off control may indicate a deteriorating or damaged float and/or flooding carburetor. However, the absence of these symptoms is not reason to ignore this Flight Safety Service Bulletin.

5. **Compliance**: In order to maintain flight safety, within 30 days of the date of issuance of this Flight Safety Service Bulletin, each owner of a Volare Float Carburetor not equipped with a solid, blue epoxy float is requested and strongly encouraged to inspect the carburetor and to re-inspect the carburetor at 30-day intervals thereafter until the float is replaced by a solid, blue epoxy float in accordance with the instructions in paragraph 6 of this bulletin. Failure to follow this advice may result in engine malfunction, damage, injury or death.

6. **Instructions**: Inspect the carburetor for any signs of flooding and other indicators of a possible deteriorating or damaged float including those mentioned in this bulletin. (*See* Marvel-Schebler™ bulletin SIL MS-12.) Remove from service prior to further flight any carburetors exhibiting signs of flooding or possible float deterioration or damage. In addition, take the following steps:

   a. Determine if a solid, blue epoxy float is installed in the carburetor:

      i. Every Volare manufactured or serviced carburetor is equipped with a solid, blue epoxy float unless the float was replaced with an unauthorized float subsequent to Volare's release of the carburetor. (*See* Volare SB-1 warning against the use of unauthorized parts in Volare Float Carburetors.)

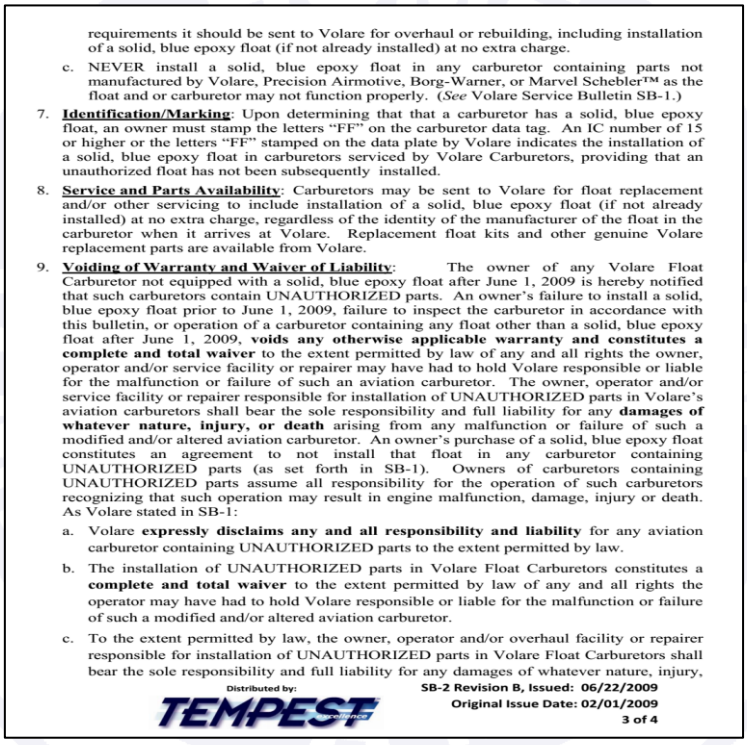
      ii. If Precision Airmotive manufactured, overhauled, or rebuilt the carburetor after November 2005, and the IC number on the carburetor's data tag is 15 or higher, the carburetor is equipped with a solid, blue epoxy float, unless the float was replaced with an unauthorized float subsequent to Precision's release of the carburetor.

      iii. If at any time Precision Airmotive performed more limited carburetor service (such as repair or testing without overhauling or rebuilding) and it cannot be conclusively determined from maintenance or other records that a solid, blue epoxy float is installed, there is no assurance that the carburetor contains a solid, blue epoxy float.

      iv. It is each owner's and operator's responsibility to make a positive determination regarding what type float is installed in his carburetor and take appropriate action based on that determination. While we believe the information in paragraphs ii and iii is correct and regardless of any error(s) that may be contained in those paragraph, it is the owner/operators responsibility to make a positive determination and confirm that a solid, blue epoxy float is installed. If a positive determination cannot be made or there is doubt as to whether the carburetor contains a solid, blue epoxy float, the carburetor must be partially disassembled to the extent necessary to make a positive determination. Refer to the appropriate carburetor Service Manual for disassembly and reassembly instructions and the aircraft maintenance manual for removal and installation instructions.

   b. Volare urges each owner to install a solid, blue epoxy float in any Volare Float Carburetor not so equipped prior to June 1, 2009. All carburetors must be overhauled or rebuilt every 10 calendar years after purchase or last overhaul or rebuild, or at engine overhaul, whichever comes first (*See* SB MSA-3). If the carburetor does not meet these

Figure 12 - Service Bulletin SB-2 Rev B Page 2 of 4.



requirements it should be sent to Volare for overhaul or rebuilding, including installation of a solid, blue epoxy float (if not already installed) at no extra charge.

   c. NEVER install a solid, blue epoxy float in any carburetor containing parts not manufactured by Volare, Precision Airmotive, Borg-Warner, or Marvel Schebler™ as the float and or carburetor may not function properly. (*See* Volare Service Bulletin SB-1.)

7. **Identification/Marking**: Upon determining that that a carburetor has a solid, blue epoxy float, an owner must stamp the letters "FF" on the carburetor data tag. An IC number of 15 or higher or the letters "FF" stamped on the data plate by Volare indicates the installation of a solid, blue epoxy float in carburetors serviced by Volare Carburetors, providing that an unauthorized float has not been subsequently installed.

8. **Service and Parts Availability**: Carburetors may be sent to Volare for float replacement and/or other servicing to include installation of a solid, blue epoxy float (if not already installed) at no extra charge, regardless of the identity of the manufacturer of the float in the carburetor when it arrives at Volare. Replacement float kits and other genuine Volare replacement parts are available from Volare.

9. **Voiding of Warranty and Waiver of Liability**: The owner of any Volare Float Carburetor not equipped with a solid, blue epoxy float after June 1, 2009 is hereby notified that such carburetors contain UNAUTHORIZED parts. An owner's failure to install a solid, blue epoxy float prior to June 1, 2009, failure to inspect the carburetor in accordance with this bulletin, or operation of a carburetor containing any float other than a solid, blue epoxy float after June 1, 2009, **voids any otherwise applicable warranty and constitutes a complete and total waiver** to the extent permitted by law of any and all rights the owner, operator and/or service facility or repairer may have had to hold Volare responsible or liable for the malfunction or failure of such an aviation carburetor. The owner, operator and/or service facility or repairer responsible for installation of UNAUTHORIZED parts in Volare's aviation carburetors shall bear the sole responsibility and full liability for any **damages of whatever nature, injury, or death** arising from any malfunction or failure of such a modified and/or altered aviation carburetor. An owner's purchase of a solid, blue epoxy float constitutes an agreement to not install that float in any carburetor containing UNAUTHORIZED parts (as set forth in SB-1). Owners of carburetors containing UNAUTHORIZED parts assume all responsibility for the operation of such carburetors recognizing that such operation may result in engine malfunction, damage, injury or death. As Volare stated in SB-1:

   a. Volare **expressly disclaims any and all responsibility and liability** for any aviation carburetor containing UNAUTHORIZED parts to the extent permitted by law.

   b. The installation of UNAUTHORIZED parts in Volare Float Carburetors constitutes a **complete and total waiver** to the extent permitted by law of any and all rights the operator may have had to hold Volare responsible or liable for the malfunction or failure of such a modified and/or altered aviation carburetor.

   c. To the extent permitted by law, the owner, operator and/or overhaul facility or repairer responsible for installation of UNAUTHORIZED parts in Volare Float Carburetors shall bear the sole responsibility and full liability for any damages of whatever nature, injury,

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or death arising from any malfunction or failure of such a modified and/or altered aviation carburetor.

10. **Safety First**: Volare is a customer-service oriented company committed to technical innovation in pursuit of aviation safety. While Volare has no authority to compel owners to act responsibly and take prudent action to insure their own safety and the safety of others, Volare believes compliance with this Flight Safety Service Bulletin is essential to protect against failures with unacceptable consequences. Volare strongly warns owners of the inherent risks involved in using any float other than a solid, blue epoxy float in any Volare Float Carburetor and strongly encourages owners to comply with this Flight Safety Service Bulletin.

Pictorial Examples of Carb floats REQUIRING REPLACEMENT

MA White Float (REPLACE)

HA White Float (REPLACE)

Brass Float (REPLACE)

MA Brown/Beige Foam (REPLACE)

MA Brown/Beige Foam (REPLACE)

MA Black Foam (REPLACE)

Pictorial Examples of GOOD (Blue Epoxy) Carb FLOATS

GOOD Small MA Float (BLUE)

GOOD HA Float (BLUE)

GOOD Large MA Float (BLUE)

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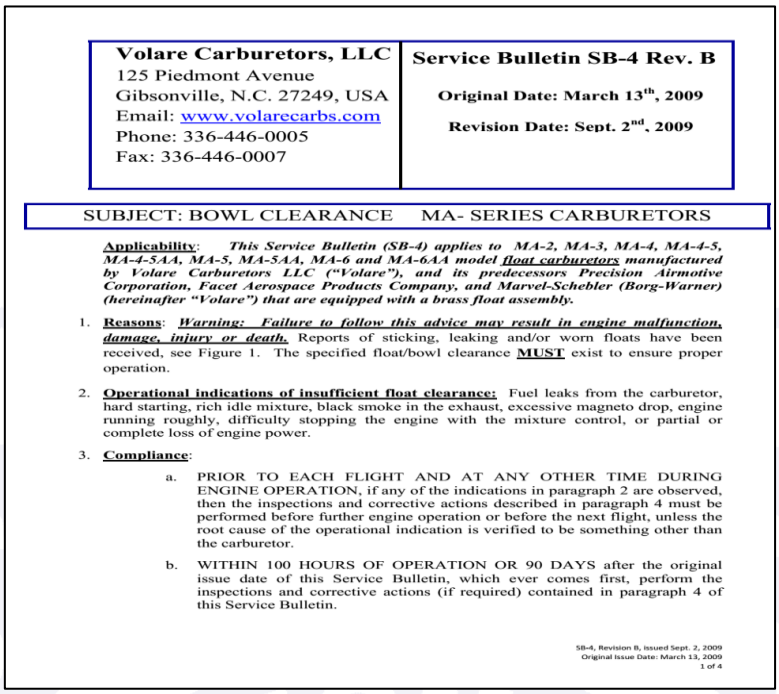
Figure 14 - Service Bulletin SB-2 Rev B Page 4 of 4.

No records of compliance with SB-2 Rev B were found in the aircraft documentation.

Service Bulletin SB-4 Rev B, 02SET2009, Subject: Bowl Clearance MA - Series Carburetors, addressed improper positioning of the float in the carburetor tub.

In item 1 (Figure 15), the manufacturer warned that the failure to comply with the parameters specified in this SB could result in engine malfunction, damage, injury or death.

Item 2 of this SB presented the operational indications related to non-observance of the minimum clearance recommended between the float and the wall of the carburetor tank. This could include carburetor fuel leaks, difficulty in starting the engine, very rich mixture, black smoke coming out, excessive dropping of the magnet, difficulty in shutting down the engine through the mixing lever, and even partial or total loss of engine power.



Volare Carburetors, LLC
125 Piedmont Avenue
Gibsonville, N.C. 27249, USA
Email: www.volarecarbs.com
Phone: 336-446-0005
Fax: 336-446-0007

Service Bulletin SB-4 Rev. B

Original Date: March 13th, 2009

Revision Date: Sept. 2nd, 2009

SUBJECT: BOWL CLEARANCE MA- SERIES CARBURETORS

Applicability: ***This Service Bulletin (SB-4) applies to MA-2, MA-3, MA-4, MA-4-5, MA-4-5AA, MA-5, MA-5AA, MA-6 and MA-6AA model float carburetors manufactured by Volare Carburetors LLC ("Volare"), and its predecessors Precision Airmotive Corporation, Facet Aerospace Products Company, and Marvel-Schebler (Borg-Warner) (hereinafter "Volare") that are equipped with a brass float assembly.***

1. **Reasons**: ***Warning: Failure to follow this advice may result in engine malfunction, damage, injury or death.*** Reports of sticking, leaking and/or worn floats have been received, see Figure 1. The specified float/bowl clearance **MUST** exist to ensure proper operation.

2. **Operational indications of insufficient float clearance:** Fuel leaks from the carburetor, hard starting, rich idle mixture, black smoke in the exhaust, excessive magneto drop, engine running roughly, difficulty stopping the engine with the mixture control, or partial or complete loss of engine power.

3. **Compliance**:

   a. PRIOR TO EACH FLIGHT AND AT ANY OTHER TIME DURING ENGINE OPERATION, if any of the indications in paragraph 2 are observed, then the inspections and corrective actions described in paragraph 4 must be performed before further engine operation or before the next flight, unless the root cause of the operational indication is verified to be something other than the carburetor.

   b. WITHIN 100 HOURS OF OPERATION OR 90 DAYS after the original issue date of this Service Bulletin, which ever comes first, perform the inspections and corrective actions (if required) contained in paragraph 4 of this Service Bulletin.

SB-4, Revision B, Issued Sept. 2, 2009
Original Issue Date: March 13, 2009
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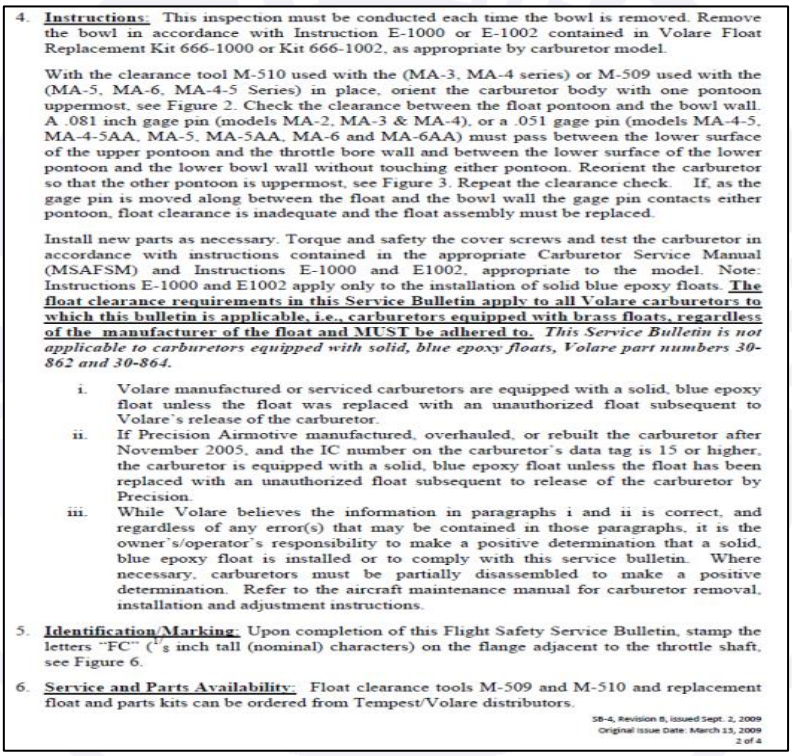
Figure 15 - Page 1 of 4 of the Service Bulletin SB-4 Rev B.



4. **Instructions:** This inspection must be conducted each time the bowl is removed. Remove the bowl in accordance with Instruction E-1000 or E-1002 contained in Volare Float Replacement Kit 666-1000 or Kit 666-1002, as appropriate by carburetor model.

   With the clearance tool M-510 used with the (MA-3, MA-4 series) or M-509 used with the (MA-5, MA-6, MA-4-5 Series) in place, orient the carburetor body with one pontoon uppermost, see Figure 2. Check the clearance between the float pontoon and the bowl wall. A .081 inch gage pin (models MA-2, MA-3 & MA-4), or a .051 gage pin (models MA-4-5, MA-4-5AA, MA-5, MA-5AA, MA-6 and MA-6AA) must pass between the lower surface of the upper pontoon and the throttle bore wall and between the lower surface of the lower pontoon and the lower bowl wall without touching either pontoon. Reorient the carburetor so that the other pontoon is uppermost, see Figure 3. Repeat the clearance check. If, as the gage pin is moved along between the float and the bowl wall the gage pin contacts either pontoon, float clearance is inadequate and the float assembly must be replaced.

   Install new parts as necessary. Torque and safety the cover screws and test the carburetor in accordance with instructions contained in the appropriate Carburetor Service Manual (MSAFSM) and Instructions E-1000 and E1002, appropriate to the model. Note: Instructions E-1000 and E1002 apply only to the installation of solid blue epoxy floats. **The float clearance requirements in this Service Bulletin apply to all Volare carburetors to which this bulletin is applicable, i.e., carburetors equipped with brass floats, regardless of the manufacturer of the float and MUST be adhered to.** ***This Service Bulletin is not applicable to carburetors equipped with solid, blue epoxy floats, Volare part numbers 30-862 and 30-864.***

   i. Volare manufactured or serviced carburetors are equipped with a solid, blue epoxy float unless the float was replaced with an unauthorized float subsequent to Volare's release of the carburetor.
   ii. If Precision Airmotive manufactured, overhauled, or rebuilt the carburetor after November 2005, and the IC number on the carburetor's data tag is 15 or higher, the carburetor is equipped with a solid, blue epoxy float unless the float has been replaced with an unauthorized float subsequent to release of the carburetor by Precision.
   iii. While Volare believes the information in paragraphs i and ii is correct, and regardless of any error(s) that may be contained in those paragraphs, it is the owner's/operator's responsibility to make a positive determination that a solid, blue epoxy float is installed or to comply with this service bulletin. Where necessary, carburetors must be partially disassembled to make a positive determination. Refer to the aircraft maintenance manual for carburetor removal, installation and adjustment instructions.

5. **Identification/Marking:** Upon completion of this Flight Safety Service Bulletin, stamp the letters "FC" ($\frac{1}{8}$ inch tall (nominal) characters) on the flange adjacent to the throttle shaft, see Figure 6.

6. **Service and Parts Availability:** Float clearance tools M-509 and M-510 and replacement float and parts kits can be ordered from Tempest/Volare distributors.

SB-4, Revision B, Issued Sept. 2, 2009
Original Issue Date: March 13, 2009
2 of 4

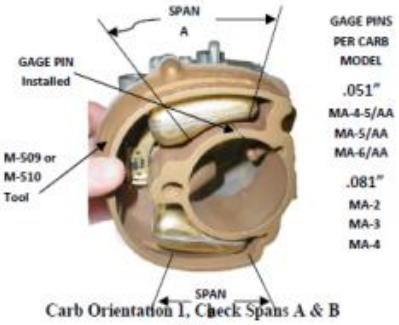
Figure 16 - Page 2 of 4 of the Service Bulletin SB-4 Rev B.

7. Voiding of Warranty and Waiver of Liability: An owner's/operator's failure to inspect and where necessary replace the float assembly in accordance with this bulletin, or operation of a carburetor which is non-compliant the clearance requirements set forth in this bulletin, or operation of a carburetor in which other than genuine Volare approved parts are installed, **voids any otherwise applicable warranty and constitutes a complete and total waiver** to the extent permitted by law of any and all rights the owner, operator and/or service facility or repairer may have had to hold Volare responsible or liable for the malfunction or failure of such an aviation carburetor. The owner/operator and/or service facility or repairer that returns a carburetor that is non-compliant with this service bulletin to service shall bear the sole responsibility and full liability for any **damages of whatever nature, injury, or death** arising from any malfunction or failure of such a non-compliant, modified and/or altered aviation carburetor.

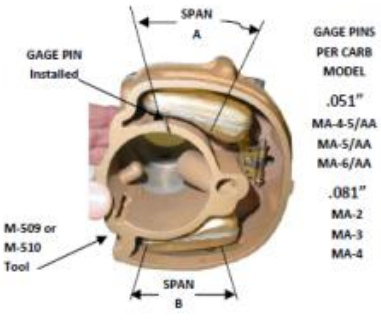
8. Safety First: Volare is a customer-service oriented company committed to technical innovation in pursuit of aviation safety. While Volare has no authority to compel owners to act responsibly and take prudent action to insure their own safety and the safety of others, Volare believes compliance with this Service Bulletin is essential to protect against failures with unacceptable consequences. Volare strongly warns owners of the inherent risks involved in operating an airplane with a float installation having non-conforming float to bowl clearance and strongly encourages owners to comply with this Service Bulletin.

Figure 17 - Page 3 of 4 of the Service Bulletin SB-4 Rev B.

Floats with Rubbing Wear – FEB 2009
Fig. 1



Carb Orientation 1, Check Spans A & B
Fig. 2



Carb Orientation 2, Check Spans A & B
Fig. 3

Example: Wear from Rubbing on Large MA Float
Fig. 4

Example: Wear from Rubbing on Small MA Float
Fig. 5

Conformance with this SB-4 'FC' Stamp Locations
Fig. 6

Figure 18 - Page 4 of 4 of the Service Bulletin SB-4 Rev B.

No records of compliance with this SB were found in the aircraft documentation.

The Brazilian Civil Aviation Regulation (RBAC) No. 39 - Airworthiness Guidelines, of 02MAR2011, foreseen, in section 39-5-I, that an Airworthiness Directive (AD) issued by the design State, was accepted as an Airworthiness Directive (AD) issued by the National Civil Aviation Agency (ANAC) itself.

The Airworthiness Directives (DA) and ADs, published respectively by the Brazilian National Civil Aviation Agency (ANAC), the Aircraft Registration State, and the North American Federal Aviation Administration (FAA), State of design of the engine and the carburetor, were legal documents, issued by these certifying bodies, which demanded actions to correct any unsafe conditions in the operation of an aircraft.

As a result, a survey was made of DA's and AD's issued by ANAC and FAA for the engine and carburetor installed in the crashed aircraft.

The search was restricted to DA's and AD's issued within the last 10 years, counting from the date of the accident. The terms "Lycoming Engines / O-540-B4B5" (manufacturer / model of the engine), "Marvel Schebler" (current name of the carburetor manufacturer) and "Volare" (former name of the carburetor manufacturer).

In the FAA database, AD No. 2012-03-07, issued on 01FEB2012, was found related to the Lycoming Engines / O-540-B4B5 engine, but it related to a model equipped with another carburetor and did not concern to the float installed in it.

Therefore, it has been considered that the FAA has issued no AD related to the carburetor buoys installed in the aircraft in the last 10 years.

In the ANAC database, the AD No. 2010-08-04, dated 04OCT2010, was related to the Marvel-Schebler carburetor, which canceled and replaced DA nº 88-08-03R2 (Figure 19), of 07NOV2005, issued by the DAC (Department of Civil Aviation), which preceded this agency in the regulation of civil aviation.

Basically, the two Airworthiness Directives addressed to the replacement of carburetor buoys.

SERVIÇO PÚBLICO FEDERAL
DEPARTAMENTO DE AVIAÇÃO CIVIL

DIRETRIZ DE AERONAVEGABILIDADE

DATA DE EFETIVIDADE:	DA Nº:
07 nov. 2005	88-08-03R2

Esta Diretriz de Aeronavegabilidade (DA), emitida pelo Departamento de Aviação Civil (DAC) com base no Capítulo IV do Título III do Código Brasileiro de Aeronáutica - Lei Nº 7.565 de 19 de dezembro de 1986 - e no Regulamento Brasileiro de Homologação Aeronáutica (RBHA) 39, aplica-se a todas as aeronaves registradas no País. Nenhuma aeronave à qual se aplica esta DA pode ser operada exceto após o cumprimento da mesma dentro dos prazos nela estabelecidos.

DA Nº 88-08-03R2 - MARVEL-SCHEBLER - Emenda 39-1100.

APLICABILIDADE:

Esta Diretriz de Aeronavegabilidade aplica-se a todos os carburadores Marvel-Schebler modelos MA-3, MA-4, MA-4-5, MA-5, MA-6 e HA-6 que possuam instaladas bóias não-metálicas.

CANCELAMENTO / REVISÃO:

Esta DA cancela e substitui a DA Nº 88-08-03R1 - Emd 1301/01-596, datada de 02 dez. 1988, e está sendo revisada para inserir um novo P/N de bóia dos carburadores feita de material polimérico avançado (não metálicas), porém não impedindo o uso das atuais bóias metálicas.

MOTIVO:

Foram reportados casos de apagamento de motor em vôo, devido à absorção de combustível pela bóia não-metálica de carburadores Marvel-Schebler, instalados em motores aspirados que equipam as aeronaves Neiva EMB-710C/710D "Carioca", EMB-712 "Tupi", 56( ) "Paulistinha", EMB-200/200A "Ipanema", entre outras, fato este que coloca em risco a segurança de vôo.

Como esta condição pode existir ou se desenvolver em aeronaves do mesmo tipo e afeta a segurança de vôo, é requerida a adoção de uma ação corretiva e, portanto, fica configurada a causa justa para impor o cumprimento desta emenda no prazo estabelecido.

AÇÃO REQUERIDA:

Substituição das bóias não-metálicas do carburador por bóias novas, metálicas ou de material polimérico avançado.

CUMPRIMENTO:

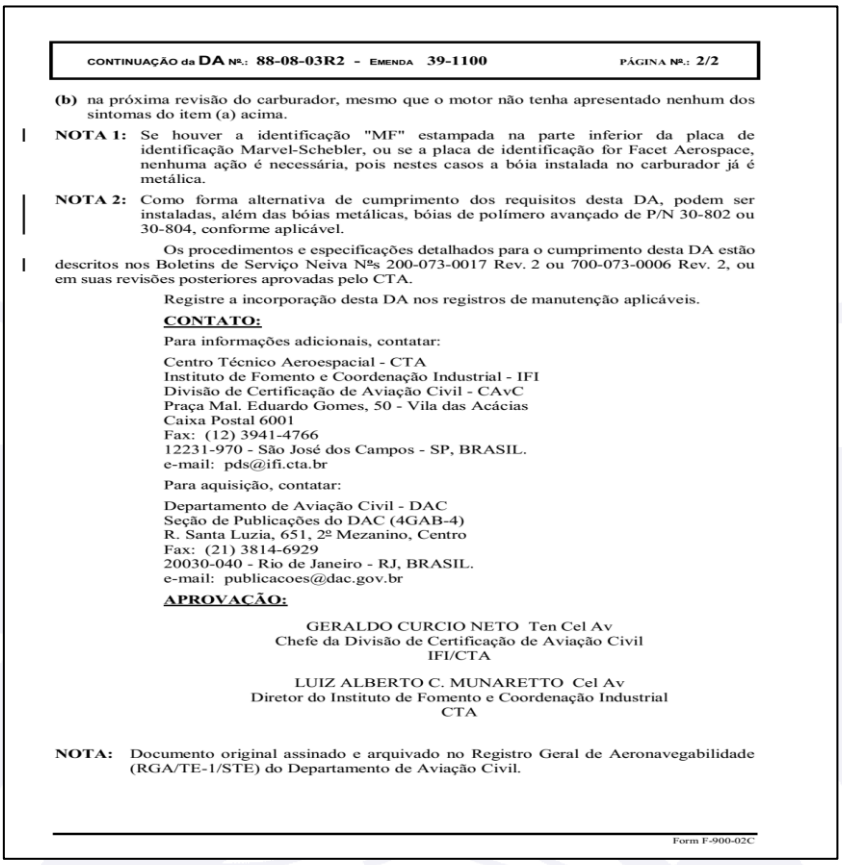
O cumprimento deve ser efetuado conforme abaixo, a menos que já tenha sido executado anteriormente.

Antes do próximo vôo, a partir de 02 dez. 1988, data de efetividade da Revisão 1 desta DA, substitua as bóias não-metálicas do carburador por bóias novas metálicas:

(a) caso o motor apresente um dos seguintes sintomas:
- **(1)** afogamento do carburador;
- **(2)** funcionamento irregular em baixos regimes de potência; ou,
- **(3)** tendência a continuar funcionando, mesmo após o corte.

Form F-900-02C

Figure 19 - Page 1 of 2 of DA nº 88-08-03R2, of 07NOV2005, issued by the DAC.



CONTINUAÇÃO da DA Nº.: 88-08-03R2 - EMENDA 39-1100 PÁGINA Nº.: 2/2

(b) na próxima revisão do carburador, mesmo que o motor não tenha apresentado nenhum dos sintomas do item (a) acima.

NOTA 1: Se houver a identificação "MF" estampada na parte inferior da placa de identificação Marvel-Schebler, ou se a placa de identificação for Facet Aerospace, nenhuma ação é necessária, pois nestes casos a bóia instalada no carburador já é metálica.

NOTA 2: Como forma alternativa de cumprimento dos requisitos desta DA, podem ser instaladas, além das bóias metálicas, bóias de polímero avançado de P/N 30-802 ou 30-804, conforme aplicável.

Os procedimentos e especificações detalhados para o cumprimento desta DA estão descritos nos Boletins de Serviço Neiva Nºs 200-073-0017 Rev. 2 ou 700-073-0006 Rev. 2, ou em suas revisões posteriores aprovadas pelo CTA.

Registre a incorporação desta DA nos registros de manutenção aplicáveis.

CONTATO:

Para informações adicionais, contatar:

Centro Técnico Aeroespacial - CTA
Instituto de Fomento e Coordenação Industrial - IFI
Divisão de Certificação de Aviação Civil - CAvC
Praça Mal. Eduardo Gomes, 50 - Vila das Acácias
Caixa Postal 6001
Fax: (12) 3941-4766
12231-970 - São José dos Campos - SP, BRASIL.
e-mail: pds@ifi.cta.br

Para aquisição, contatar:

Departamento de Aviação Civil - DAC
Seção de Publicações do DAC (4GAB-4)
R. Santa Luzia, 651, 2º Mezanino, Centro
Fax: (21) 3814-6929
20030-040 - Rio de Janeiro - RJ, BRASIL.
e-mail: publicacoes@dac.gov.br

APROVAÇÃO:

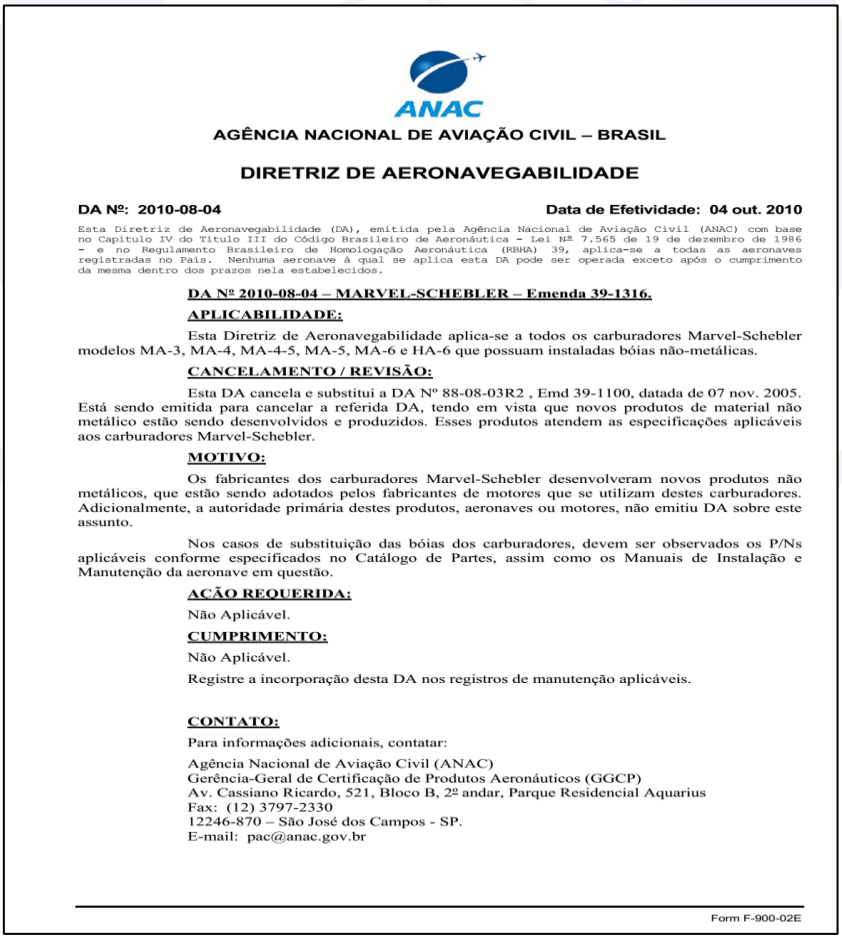
GERALDO CURCIO NETO Ten Cel Av
Chefe da Divisão de Certificação de Aviação Civil
IFI/CTA

LUIZ ALBERTO C. MUNARETTO Cel Av
Diretor do Instituto de Fomento e Coordenação Industrial
CTA

NOTA: Documento original assinado e arquivado no Registro Geral de Aeronavegabilidade (RGA/TE-1/STE) do Departamento de Aviação Civil.

Form F-900-02C

Figure 20 - Page 2 of 2 of DA nº 88-08-03R2, of 07NOV2005, issued by the DAC.



ANAC

AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL – BRASIL

DIRETRIZ DE AERONAVEGABILIDADE

DA Nº: 2010-08-04 **Data de Efetividade: 04 out. 2010**

Esta Diretriz de Aeronavegabilidade (DA), emitida pela Agência Nacional de Aviação Civil (ANAC) com base no Capítulo IV do Título III do Código Brasileiro de Aeronáutica - Lei Nº 7.565 de 19 de dezembro de 1986 - e no Regulamento Brasileiro de Homologação Aeronáutica (RBHA) 39, aplica-se a todas as aeronaves registradas no País. Nenhuma aeronave à qual se aplica esta DA pode ser operada exceto após o cumprimento da mesma dentro dos prazos nela estabelecidos.

DA Nº 2010-08-04 – MARVEL-SCHEBLER – Emenda 39-1316.

APLICABILIDADE:

Esta Diretriz de Aeronavegabilidade aplica-se a todos os carburadores Marvel-Schebler modelos MA-3, MA-4, MA-4-5, MA-5, MA-6 e HA-6 que possuam instaladas bóias não-metálicas.

CANCELAMENTO / REVISÃO:

Esta DA cancela e substitui a DA Nº 88-08-03R2 , Emd 39-1100, datada de 07 nov. 2005. Está sendo emitida para cancelar a referida DA, tendo em vista que novos produtos de material não metálico estão sendo desenvolvidos e produzidos. Esses produtos atendem as especificações aplicáveis aos carburadores Marvel-Schebler.

MOTIVO:

Os fabricantes dos carburadores Marvel-Schebler desenvolveram novos produtos não metálicos, que estão sendo adotados pelos fabricantes de motores que se utilizam destes carburadores. Adicionalmente, a autoridade primária destes produtos, aeronaves ou motores, não emitiu DA sobre este assunto.

Nos casos de substituição das bóias dos carburadores, devem ser observados os P/Ns aplicáveis conforme especificados no Catálogo de Partes, assim como os Manuais de Instalação e Manutenção da aeronave em questão.

AÇÃO REQUERIDA:

Não Aplicável.

CUMPRIMENTO:

Não Aplicável.

Registre a incorporação desta DA nos registros de manutenção aplicáveis.

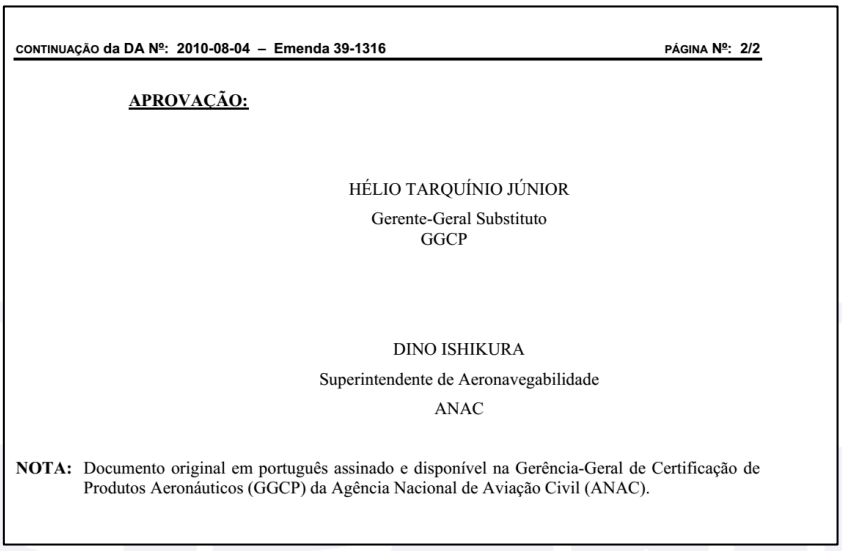
CONTATO:

Para informações adicionais, contatar:

Agência Nacional de Aviação Civil (ANAC)
Gerência-Geral de Certificação de Produtos Aeronáuticos (GGCP)
Av. Cassiano Ricardo, 521, Bloco B, 2º andar, Parque Residencial Aquarius
Fax: (12) 3797-2330
12246-870 – São José dos Campos - SP.
E-mail: pac@anac.gov.br

Form F-900-02E

Figure 21 - Page 1 of 2 of DA nº 2010-08-04, of 04OCT2010, issued by ANAC.



CONTINUAÇÃO da DA Nº: 2010-08-04 – Emenda 39-1316 PÁGINA Nº: 2/2

APROVAÇÃO:

HÉLIO TARQUÍNIO JÚNIOR
Gerente-Geral Substituto
GGCP

DINO ISHIKURA
Superintendente de Aeronavegabilidade
ANAC

NOTA: Documento original em português assinado e disponível na Gerência-Geral de Certificação de Produtos Aeronáuticos (GGCP) da Agência Nacional de Aviação Civil (ANAC).

Figure 22 - Page 2 of 2 of DA nº 2010-08-04, of 04OCT2010, issued by ANAC.

Until the date of the accident, 10JAN2015, Service Bulletin - SB-2 Rev B and Service Bulletin - SB-4 Rev B had not been converted to Airworthiness Directive (DA / AD).

The DA / AD Compliance Status Map of the aircraft only showed the record of service bulletins that had been converted into DA / AD by 15SEPT2004.

Supplementary Instruction (IS) No. 39-001, Revision A, approved by Administrative Rule No. 1628 / SAR, of 16AUG16, 2012, published in Official Gazette 160, Section 1, page 3, of 17AUG17, 2012, provided that:

> 4.4 Airworthiness Directive - AD: according to RBAC 39.3, ANAC Airworthiness Directives are legal prescriptions that apply to the following products: aircraft, aircraft engines, propellers, and equipment. They are documents issued by the ANAC of obligatory compliance and that establish, as appropriate, inspections, modifications, instructions, procedures and limitations applicable to aeronautical products, when there is an unsafe condition in that product and this condition is likely to exist or develop in others products of the same type design.
>
> 4.5 Continued Airworthiness Instructions: For the purposes of this IS, it is a service document issued by the manufacturer of the aeronautical product (aircraft, engine, propeller, equipment or component) for the purpose of correcting failure or malfunction of this product or of making modifications or even, aiming for improvements and / or limitations, or for the implementation of maintenance action or preventive maintenance to those provided in the manufacturer's basic maintenance program. A Service Bulletin is a service document considered as an example of continued airworthiness instruction.
>
> 4.6 Airworthiness Directive Compliance Form - FCDA: acceptable primary registration format, related to compliance with an Airworthiness Directive.
>
> 5.11 Compliance with a Service Bulletin
>
> 5.11.1 The AD makes the continued airworthiness instructions referenced in its mandatory text and may refer, in whole or in part, to an airworthiness statement provided by the manufacturer of the affected product. This instruction is now called as requirement.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a recreational flight, which departed from SWUZ at 2100 UTC, with one pilot and three passengers on board, and was expected to return to the same Aerodrome.

The interviews conducted and the preliminary tests carried out in the powertrain at the place of occurrence, indicated that the engine did not develop power at the moment of impact. In this way, we tried to identify what would have caused an engine failure in flight.

Examination of fuel samples at DCTA's Fuel and Lubricants Analysis Laboratory (LCL) did not find any non-compliance, prompting the investigators to rule out the possibility that it was contaminated.

Calculations, based on Section 5 - Performance, of the Operation Manual and Flight Manual (MO 710C / 529 REV 03, 16 / MAY / 2015), indicated that the aircraft had, at the time of the accident, a range of approximately 1 hour and 55 min.

This estimate was obtained considering that it had been operated at normal cruising speed and 75% of takeoff power during flights made after the last known supply.

The availability of fuel in the tanks at the time of the fall could also be verified by the volume collected for analysis after the occurrence and by the testimony of a passenger of the first flight performed on the day of the accident, which stated that the tanks were visually checked before takeoff.

Surveys also showed that there was no compromise in power lines or selector valve mechanism that could disrupt the supply of fuel to the engine.

Therefore, contamination, lack of fuel, or compromise of powertrain supply lines were not contributing factors to an engine failure in flight.

The dismantling of the engine and the analysis of its internal components made it possible to observe that they had no excessive wear or malfunction characteristics. Likewise, no evidence of failure of the lubrication and ignition systems was found.

In summary, the report prepared by IAE concluded that the engine was operational, but did not develop power at the moment of impact.

Tests conducted on the aircraft carburetor made it clear that Service Bulletin SB-2 Rev B had not been met since the float installed in it was of metallic material.

The markings on the float, which indicated friction against the wall of the tank, could be attributed to non-compliance with SB-4 Rev B, in addition to the possible non-use of the special tool M-509 during its installation.

As the carburetor manufacturer makes clear in SB-4 Rev B, item 1, failure to comply with this bulletin could result in engine malfunction, damage, injury, or death.

Therefore, the clearance described in SB-4 Rev B and Installation Instruction E-1002, when not observed, could lead to malfunction of the engine, including shutdown in more extreme situations.

In this way, it was concluded that there was a partial or total loss of engine power, due to the locking of the carburetor float, possibly related to non-compliance with the SB-4 Rev B requirements.

Regarding the warping of the float rod, it was not possible to determine whether it was the cause or effect of the float friction against the walls of the carburetor tub.

However, according to the Component Control Information Map, the carburetor had the inspection expired on the date of the occurrence.

Regarding the carburetor float buoys, DA no. 2010-08-04 it did not refer to any manufacturer's Service Bulletin and in its "Required Action" section was "Not Applicable", according to Figure 21.

Therefore, it was considered that it did not provide clear and objective information for its application and, consequently, for the re-establishment of a safe operating condition for that product.

According to the information collected, the pilot performed sporadic flights of a recreational nature in that aircraft. In this way, it can be said that he was not fully familiar with his behavior and particular characteristics of functioning.

According to the carburetor manufacturer, difficult starts, irregular low gear, black smoke coming out of the exhaust or rough operation would be the possible abnormalities resulting from failure to comply with SB-4 Rev B.

Thus, although it was not possible to prove that the engine had any of these characteristics prior to the flight in which the accident occurred, if so, this may not have been properly recognized.

Managing an in-flight engine failure, at the altitude the aircraft was at that time, would require the pilot to make quick decisions and attitudes by complying with emergency procedures according to memory items.

If, on the one hand, testimony collected indicates that he did not use the checklist during the flight, on the other hand, one of the survivors, who had some flight experience, stated that the procedures performed seemed appropriate to him.

Thus, it was not possible to determine whether the operational procedures applied to restore normal engine operation and subsequently to conduct the aircraft to a forced landing were in accordance with those described in the Operation Manual and Flight Manual of the aircraft.

According to statements, the use of the checklist was not a habit among pilots who recreationally flew the PT-NAB aircraft. Thus, it is probable that this collective behavior induced the pilot to act according to procedures, which, in memory, he believed were the right ones.

In the operational context of the pilot, there was no formal requirement for training or execution of maneuvers in simulated emergency situations to maintain proficiency.

Due to this scenario, it was not possible to guarantee that the pilot had sufficient conditioned reactions for the adequate management of the adverse situation experienced without the aid of the checklist.

This operational context may also have hampered the maintenance of situational awareness of the pilot in flight, making it slower to analyze the possibilities he had for restoring engine power and taking the aircraft to an emergency landing.

The briefings are widely used aviation risk management tools in a variety of situations, especially before take-offs. Through them, the crews anticipate emergency situations and prepare to react to them.

However, according to statements, this practice was not usual among the group of pilots who flew the crashed aircraft recreationally.

Failure to perform this procedure directly reflects the pilot's reactions and decisions in the context of an emergency and, in this case, may have affected his perception and analysis capacity, making it difficult to make a faster and more assertive decision during the management of the abnormal condition experienced.

Finally, IS No. 39-001, Revision A, approved by Administrative Rule No. 1628 / SAR, from 16AUG2012, allowed interpreting that a Service Bulletin would only be mandatory if converted into an Airworthiness Directive.

Thus, it was not clear what treatment should be given to bulletins which the manufacturer classified as mandatory and which had not been converted into AD.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had valid Aeronautical Medical Certificate (CMA);

b) the pilot had valid Technical Qualification for Airplane Single-Engine Land (MNTE);

c) the pilot was qualified for the flight;

d) the aircraft had valid Airworthiness Certificate (CA);

e) the aircraft was within the weight and balance parameters;

f) the airframe, engine and propeller logbooks records were updated;

g) g) during the initial action, it was verified fuel in the power line of the engine, in the cup-type filter and approximately 15 liters of AvGas were drained;

h) the aircraft fuel analysis showed that the samples were in accordance with Resolution 5/2009 of the National Agency for Petroleum, Natural Gas and Biofuels (ANP) and were clear and free of water and solid materials;

i) the internal components of the aircraft's engine showed no signs of excessive wear or malfunction, but it was not developing power at the time of impact;

j) no signs of failure of the lubrication and ignition systems were found;

k) The last revision of the Marvel-Schebler carburetor model MA-4-5, recorded on the Component Control Information Map, from 15SEPT2004, was valid until 15SEPT2014;

l) the MA-4-5 Marvel-Schebler carburetor used a metal float;

m) this float was not centralized in the carburetor tank and had scratching marks against its walls;

n) the carburetor float rod was warped;

o) there was no record of compliance with Service Bulletin SB-2 Rev B of 22JUN2009;

p) there was no record of compliance with Service Bulletin SB-4 Rev B of 02SEPT2009;

q) the aircraft had substantial damage;

r) the pilot and a passenger perished; and

s) two passengers suffered serious injuries.

3.2 Contributing factors.

- **Aircraft maintenance - a contributor**.

Failure to carry out the revision of the Marvel-Schebler carburetor model MA-4-5 and non-compliance with the Service Bulletins SB-2 Rev B of 22JUN2009 and SB-4 Rev B of 02SEPT2009 contributed to the non-identification of the warping of the carburetor rod and the insufficient spacing between the float and the walls of the component tank.

These discrepancies contributed to the partial or total loss of engine power due to an inadequate condition of the carburetor float.

In addition, the carburetor had its inspection deadline expired, setting up a failure to manage the aircraft maintenance.

- **Decision-making process - undetermined.**

It is possible that failure to conduct the take-off briefing, the non-use of the checklist, and the lack of formal training for reaction in emergency situations have interfered with the pilot's reactions and decisions in the face of an emergency.

- **Perception - undetermined**.

Failure to carry out the take-off briefing, failure to use the emergency checklist, and lack of formal emergency response training may have hampered the pilot's situational awareness, slowing the analysis of the possibilities he had to restore the engine power and to conduct the aircraft to an emergency landing.

- **Support systems - undetermined.**

Airworthiness Directive No. 2010-08-04, from 04OCT2010, did not refer to the manufacturer's service bulletin regarding the replacement of float buoys. In addition, in the "Required Action" field of the AD was the information "Not Applicable".

Therefore, it was considered that this document did not provide clear and objective information to restore a safe condition of Airworthiness for the carburetor.

Work-group culture - undetermined.

Failure to conduct take-off briefings and the non-use of checklists was a common practice among pilots who flew the aircraft recreationally.

It is possible that this behavior affected the pilot's ability to perceive and analyze, making it difficult to have a faster and more assertive decision-making during the management of the abnormal condition experienced.

4. SAFETY RECOMMENDATION.

A measure of preventative/corrective nature issued by a SIPAER Investigation Authority or by a SIPAER-Link within respective area of jurisdiction, aimed at eliminating or mitigating the risk brought about by either a latent condition or an active failure. It results from the investigation of an aeronautical occurrence or from a preventative action, and shall never be used for purposes of blame presumption or apportion of civil, criminal, or administrative liability.

In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of the air activity operational safety, and shall be treated as established in the NSCA 3-13 "Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State".

Recommendations issued at the publication of this report:

To the Brazil's National Civil Aviation Agency (ANAC):

A-005/CENIPA/2015 - 01 Issued on 05/04/2018

Revise Airworthiness Directive No. 2010-08-04 from 04OCT2010, to clarify in more detail the actions required to restore safe Airworthiness.

A-005/CENIPA/2015 - 02 Issued on 05/04/2018

Check the pertinence of issuing Airworthiness Directive for the Service Bulletin SB-4 Rev B, 02SEPT2009, Subject: Bowl Clearance MA - Series Carburetors, in order to make mandatory the actions contained there.

A-005/CENIPA/2015 - 03 Issued on 05/04/2018

Check the possibility of making clear in Supplementary Instruction No. 39-001 what should be the treatment given to bulletins that the manufacturer classifies as mandatory and that are not converted or incorporated by reference into an Airworthiness Directive.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

Nil.

On April 5th, 2018.