

APPENDIX H—COMAIR ICING GUIDANCE/PROCEDURES

COMAIR

INTER-OFFICE MEMO

TO: All EMB-120 / SAAB 340
Flight Crewmembers

DATE: December 8, 1995

FROM: Wayne A. Wolke
EMB-120/SAAB 340 Program Manager

FILE NO.: 95120001

SUBJECT: Winter Operating Tips - Freezing Rain / Drizzle

Normal Icing

Normal ice accumulation on an aircraft occurs at a relatively slow rate, and forms primarily on the leading edges of the aerodynamic surfaces which are protected with deicing boots. With routine vigilance for ice, and the proper use of the deicing boots, these icing encounters can easily be managed by our turbopropeller aircraft.

There have been incidents of EMB-120 aircraft flown by other carriers encountering such conditions, which resulted in controllability problems. The three major factors which result in controllability problems were lack of airspeed control (and operation of the autopilot in the wrong vertical mode causing airspeed deviations); failure to recognize the ice accumulation and utilize the installed deicing equipment; and, failure to recognize and control ice accumulation while holding.

The following guidelines have been developed for operations in icing conditions, and for Deicing operations at the CVG Hub:

CVG Deicing: (Reference Operations Bulletin 95-006)

1. Call Exceptions on 131.72 (Prior to Pushback) if deicing is required
2. On the first call to Ramp Control (122.82) tell them the runway planned and that deicing will be needed *if required*. (Frequency 131.02 next in line for the "pad")
3. After communications are completed with the deice truck (Deicing complete), contact Ramp Control on a frequency of 122.82 prior to aircraft movement.
4. There is NO longer a Snow Desk. The Coordinator has been trained specifically for this type of operation, and has decision making authority. (Type 1/or Type 2 fluid, how many trucks, and deice locations)
5. EMB-120 / SAAB 340 propellers must be Feathered before deicing starts

Autopilot Use

If icing conditions are experienced or residual ice is present, operate the autopilot in the IAS mode only (climb). The IAS mode will allow the aircraft to descend if airspeed cannot be maintained at the present power setting. Other autopilot modes will allow the aircraft to slow in order to hold the selected mode, or may not give the necessary stall margin required for residual ice on the aircraft. Monitor power settings and increase as necessary.

Airspeed

When flying in icing conditions, do not fly the EMB-120 at less than 160 KIAS, or 150 KIAS in the SAAB 340. This will add to the stall margin when maneuvering with airframe ice. If necessary, power settings up to maximum continuous may be used to maintain airspeed. This includes increasing N_p to 100% in the EMB-120, or 1396 RPM in the SAAB 340. Avoid prolonged holding in icing conditions. Request a change in altitude or location to exit icing conditions once these conditions are encountered. Use a holding speed of 170 KIAS when residual airframe icing is suspected. Monitor airspeed closely when in icing conditions, especially in turns.

Approach and Landing

Even with residual ice on the aircraft, 130 KIAS provides adequate margin for approach in the EMB-120 with flaps at 25°, and the SAAB 340 with flaps at 20°. Both aircraft should land with the approach flap setting (25° / 20°) when in icing conditions or with suspected residual airframe icing. The use of the lower landing flap setting improves controllability and eliminates the need to make a flap change on approach. Remember that airflow interruption on a horizontal stabilizer with residual ice may result in a tail stall, causing a nose-down pitching movement. Do not add flaps at low altitude (short final) as there will be insufficient time for recovery if a tail stall is created by the flap change. The aircraft should be slowed on short final to cross the runway threshold at 50 feet at V_{REF} (or $V_{REF} + 10$ KIAS if residual airframe icing is present or suspected).

Freezing Rain / Drizzle

Recent testing of turbopropeller aircraft in freezing drizzle and freezing rain icing conditions have shown that ice may form on the aerodynamic surfaces behind the pneumatic deicing boots. Freezing drizzle and freezing rain will exceed the capabilities of the deicing equipment. Freezing drizzle/rain can be expected when flying in areas with liquid precipitation at temperatures below 0°C. This is especially dangerous as the liquid is supercooled and will freeze upon impact with the aircraft. Supercooled droplets form in stratiform clouds with temperatures between 0 and -15°C when accompanied by some mechanism, usually wind shear, to generate turbulence. The turbulence caused by the wind shear can increase the collisions between droplets, and help keep larger, heavier drops aloft. Very fast accumulation can be expected, and a change in altitude or course should be made to get out of the freezing drizzle/rain conditions. Special attention must be given to airspeed control and autopilot use.

Recognition / Escape

Early recognition of ice accumulation due to freezing drizzle/rain is critical to safety of flight. Airframe icing will be noticed on the windshield wipers of the aircraft. Ice accumulations will also be observed on the unheated portions of the windshield (EMB-120) and the side windows (SAAB-340). Also check the propeller spinner for ice accumulation. A loss of airspeed will occur as the ice builds on the aircraft. When this occurs a alternate plan should be discussed between flight crewmembers on an escape procedure from moderate or severe icing conditions.

Pireps

Probably the most important thing flight crews can do for each other is to provide PIREPS in areas when freezing drizzle/rain, or any other critical flight conditions are encountered. Your report will enable other crews to avoid the conditions by changing altitude or flight routing. These reports should immediately be given to ATC so that other flights in the immediate area can take action, and to Flight Control so that they may plan succeeding flights accordingly.

Conclusion

The problems of encountering icing conditions can be lessened by incorporating the following suggestions:

- ✓ **Prepare for Icing Encounters.**
 - Preflight weather analysis.
 - Crew coordination.
 - A plan for avoidance and escape from severe icing conditions should be discussed by flight crewmembers as part of their crew briefing when icing conditions are expected.
- ✓ **Recognize Icing.**
 - Crew vigilance.
- ✓ **Autopilot Usage.**
 - Use only IAS Vertical Mode during climb.
- ✓ **Airspeed.**
 - Minimum 160 KIAS for EMB-120 / 150 KIAS for SAAB 340.

✓ **Approach and Landing.**

- Approach at 130 KIAS with flaps 25° for EMB-120 / 20° for SAAB 340.
- V_{REF} at runway threshold (or $V_{REF} + 10$ KIAS if residual airframe icing is present or suspected).

✓ **PIREPs.**

- Assist following flights with frequent reports of adverse conditions.

**EMB-120 FLIGHT STANDARDS BULLETIN****DATE:** 2 JUL 96**FILE NO.:** 96-02**SUBJECT:** Severe Icing Conditions [per AD 96-09-24]

Severe icing may result from environmental conditions outside of those for which the airplane is certificated. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the airplane.

During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

- Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.
- Accumulation of ice on the upper surface of the wing aft of the protected area.
- Accumulation of ice on the propeller spinner farther aft than normally observed.

Since the autopilot may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

In icing conditions, use of flaps is restricted to takeoff, approach, and landing only. When the flaps have been extended for approach or landing, they may not be retracted unless the upper surface of the wing aft of the protected area is clear of ice, or unless flap retraction is essential for go-around.

Icing detection lights must be operative prior to flight into icing conditions at night.
(NOTE: The MEL will be revised to reflect this change.)

COMAIR **EMB-120 FLIGHT STANDARDS BULLETIN*****The Following Weather Conditions May Be Conducive To Severe Inflight Icing -***

- Visible rain at temperatures below 0 degrees Celsius ambient temperature.
- Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

Procedures For Exiting The Severe Icing Environment -

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified above for identifying severe icing conditions are observed, accomplish the following:

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- Do not engage the autopilot.
- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
- Do not extend flaps during extended operation in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- If the flaps are extended, do not retract them until the airframe is clear of ice.
- Report these weather conditions to Air Traffic Control.

Any questions or comments, please call the EMB-120 Program Manager (606) 767-2458.



EMB-120 FLIGHT STANDARDS BULLETIN

DATE: 18 OCT 96

FILE NO.: 96-04

SUBJECT: Winter Flying Tips

1996-97 Deice Operations

The procedures for aircraft ground deicing for the 1996-97 winter are included in a new revision to the *COMAIR Operations Manual*. Please ensure that you have this revision and become familiar with the changes. The Operations Manual revision also includes new Holdover Timetables. The new tables are to be used immediately, the tables currently shown in the *EMB-120 Flight Standards Manual* should not be used, and will be deleted in Revision 9 when it becomes available.

Autopilot Use

The autopilot may only be used in the IAS mode when climbing in icing conditions. In any other mode the aircraft may be slowed to a stall if the autopilot is trying to maintain a climb or pitch attitude. When in the IAS mode the autopilot will descend if necessary to maintain the desired airspeed (below FL200 minimum desired airspeed is 170 KIAS), thereby not allowing the airspeed to drop to stalling speeds. Please refer to Bulletin No. 96-02 for autopilot restrictions when encountering severe icing conditions.

Aircraft Ground Deicing

Leave the flaps in the 0° position until completion of aircraft ground deicing. This will reduce contamination of the actuators, rollers, and tracks, and thereby reduce flap malfunctions. The taxi checklist should be performed after completion of deicing.

Be sure to close all bleed air sources (engines and APU) prior to the application of deicing fluid. The bleeds may be reopened no less than sixty seconds after deicing. This allows time for all residual fluid in the intakes to be ingested. Also ensure that the propellers are feathered prior to the start of deicing.

Other Precautions

Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

- If the autopilot is engaged, hold the control wheel firmly when disengaging the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.

COMAR EMB-120 FLIGHT STANDARDS BULLETIN

Do not extend flaps during extended operation in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.

If the flaps are extended, do not retract them until the airframe is clear of ice.

Refer to Bulletin No. 96-02 for precautions for severe icing conditions.

All icing detection lights must be operative prior to flight into terrain.
 (NOTE: The MEL will be revised to reflect this change.)

The APU is to be used after landing in extremely cold conditions (e.g., below 0°C). Start the APU prior to shutting down either engine, and maintain it running for starting.

Minimum airspeed for holding is now 170 KIAS (will be in FSM Rev. 9).

Minimum airspeed for holding is now 170 KIAS (will be in FSM Rev. 9).

We will attempt to hangar as many aircraft as possible. If an aircraft is not hangared, please start both engines to warm the engine oil prior to passenger boarding. This will also expose any starting / engine problems encountered prior to passenger boarding. Engines may need to be run for 10-15 minutes to sufficiently warm the oil on extremely cold mornings. Remember that the propellers may not be brought out of feather until the oil is above 0° C. Consider keeping the number two engine running, if ramp agents are available, and the airport does not restrict boarding with an engine running (e.g., STL).

Any questions or comments, please call the EMB-120 Program Manager at (606) 767-2458.

Cold Weather Operation**General Policy Regarding Use of Anti-Ice Equipment****NOTE**

Icing conditions exist when the OAT is +3 degrees C or below and visible moisture in any form is present (such as clouds, rain, snow, sleet, ice crystals or fog with visibility of one mile or less).

Icing conditions also exist when the OAT on the ground and for takeoff is +3 degrees C or below when operating on ramps, taxiways or runways where surface snow, ice, standing water or slush may be ingested by the engines, or freeze on engines, engine sensor probes, nacelles, wings, control surfaces or flaps.

Ignition

Continuous ignition must be used for takeoff and landings on contaminated runways (i.e., surface covered with standing water, slush or snow).

Continuous ignition must be used for flight through moderate or severe icing.

Wing/Engine Inlet De-Ice.

Allow ice accumulation to build approximately 1/2 inch prior to inflating the wing and engine inlet de-ice boots. When it is difficult to see the wing leading edge, or operating at night, an airspeed loss of 10 to 15 knots is a good indicator of ice accumulation.

CAUTION

Premature activation of the surface de-ice boots could result in ice forming the shape of an inflated de-ice boot, making further attempts to de-ice inflight impossible.

Windshield Heat

Select windshield heat ON prior to operating in icing conditions.

Cold Weather Operation**Descent and Landing**

Pre-heat the windshield prior to entering icing conditions. Turning the windshield ice protection on immediately before descending into an undercast may not give the windshield enough time to fully heat.

Anytime ice is suspected of adhering to any aircraft surfaces, beware of clear ice runback.

Land with flaps 25 if ice is suspected on any aircraft surface. Use flaps 25 Vref +5.

Minimum holding speed in icing conditions: 160 Kts.

Maximum speed for windshield wiper operation: 160 Kts.

Landing

Landing on runways having a *Nil Braking Action* report are not authorized.

A positive touchdown should be made to loosen possible frozen brakes.

Following initial touchdown on a slippery runway, aileron and rudder, supplemented by asymmetrical power, are the primary controls for steering the aircraft. As soon as possible after main gear touchdown, lower the nosewheel and utilize smooth, even reverse.

Use of moderate reverse will aid in decelerating the aircraft. After wheel spinup, the anti-skid system will become effective. Brakes should be used with caution. Apply brakes smoothly, do not pump the brakes, as this causes the anti-skid system to readjust brake pressure to reestablish optimum braking, thereby lengthening the stopping distance.

LIMITATIONS

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FLIGHT IN ICING CONDITION

Flight into known icing conditions is approved when the appropriate equipment and instrument required by the airworthiness and operating regulations are approved, installed and in an operative condition:

WARNING: SEVERE ICING MAY RESULT FROM ENVIRONMENTAL CONDITIONS OUTSIDE OF THOSE FOR WHICH THE AIRPLANE IS CERTIFICATED. FLIGHT IN FREEZING RAIN, FREEZING DRIZZLE, OR MIXED ICING CONDITIONS (SUPERCOOLED LIQUID WATER AND ICE CRYSTALS) MAY RESULT IN ICE BUILD-UP ON PROTECTED SURFACES EXCEEDING THE CAPABILITY OF THE ICE PROTECTION SYSTEM, OR MAY RESULT IN ICE FORMING AFT OF THE PROTECTED SURFACES. THIS ICE MAY NOT BE SHED USING THE ICE PROTECTION SYSTEMS, AND MAY SERIOUSLY DEGRADE THE PERFORMANCE AND CONTROLLABILITY OF THE AIRPLANE.

DURING FLIGHT, SEVERE ICING CONDITIONS THAT EXCEED THOSE FOR WHICH THE AIRPLANE IS CERTIFICATED SHALL BE DETERMINED BY THE FOLLOWING VISUAL CUES. IF ONE OR MORE OF THESE VISUAL CUES EXISTS, IMMEDIATELY REQUEST PRIORITY HANDLING FROM AIR TRAFFIC CONTROL TO FACILITATE A ROUTE OR AN ALTITUDE CHANGE TO EXIT THE ICING CONDITIONS.

- UNUSUALLY EXTENSIVE ICE ACCRETED ON THE AIRFRAME IN AREAS NOT NORMALLY OBSERVED TO COLLECT ICE.
 - ACCUMULATION OF ICE ON THE UPPER SURFACE OF THE WING AFT OF THE PROTECTED AREA.
 - ACCUMULATION OF ICE ON THE PROPELLER SPINNER FARTHER AFT THAN NORMALLY OBSERVED.
- Since the autopilot may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.
 - In icing conditions, use of flaps is restricted to takeoff, approach, and landing only. When the flaps have been extended for approach or landing, they may not be retracted unless the upper surface of the wing aft of the protected area is clear of ice, or unless flap retraction is essential for go-around.
 - All icing detection lights must be operative prior to flight into icing conditions at night.

NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL).

CTA APPROVED

AUGUST 20, 1986

REV. 48 - OCTOBER 14, 1986



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AIRPLANE FLIGHT MANUAL

NORMAL PROCED. YES

OPERATION IN ICING CONDITIONS

FLYING INTO ICING CONDITION

When flying into known or forecast icing conditions, proceed:

IGNITION Switches	ON
Ice Protection System	TURN ON AS REQUIRED

The ice protection system should be turned on as follows:

- AOA, TAT and SLIP: before flying into known icing conditions.
- Propeller: before flying into known icing conditions or at the first sign of ice formation.
- Wing and tail leading edges, engine air inlet and windshield: at the first sign of ice formation.

Holding configuration:

Landing Gear Lever	UP
Flap Selector Lever	UP
Airspeed	160 KIAS MINIMUM
Np	85% MINIMUM

To eliminate propeller vibrations, increase Np as required.

NOTE: For approach procedures in known or forecast icing conditions, increase the airspeed by 5 up to 10 KIAS until the short final.

THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCTIVE TO SEVERE IN-FLIGHT ICING

1. Visible rain at temperatures below 0 degrees Celsius ambient air temperature.
2. Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of this manual for identifying severe icing conditions are observed, accomplish the following:

1. Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
2. Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
3. Do not engage the autopilot.
4. If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.

CTA APPROVED

AUGUST 01, 1991

REV. 48 - OCTOBER 14, 1996

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**OPERATION IN ICING CONDITIONS (Continued)**

5. If an unusual roll response or uncommanded roll control movement is observed, reduce the angle of attack.
6. Do not extend flaps during extended operation in icing conditions. Operation with flaps extended can result in a reduced wing angle of attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
7. If the flaps are extended, do not retract them until the airframe is clear of ice.
8. Report these weather conditions to Air Traffic Control.

– OPERATION IN ICING CONDITIONS CHECKLIST COMPLETED –