MAXIMUM OPERATING PRESSURE-ALTITUDE LIMITS

Normal Operation . . . . . 31,000 feet

Operation with Aviation Gasoline:

- Both Standby Boost Pumps Operative . . . . . 31,000 feet
- Either Standby Boost Pump Inoperative . . . . . 17,000 feet
- Climbs without Crossfeed Capability . . . . . 17,000 feet

Operation with Yaw Damp System Inoperative. . . . . 17,000 feet

OUTSIDE AIR TEMPERATURE LIMIT

Do not operate the airplane when the outside air temperature exceeds ISA + 37°C.

CABIN PRESSURIZATION LIMIT

Maximum Cabin Pressure Differential. . . . . 5.1 psi

MAXIMUM OCCUPANCY LIMIT

Ten (10)

AFT-FACING SEATS

Only aft-facing seats (placarded as such on the leg crossmember) are authorized in the aft-facing position. The headrest and seat back of each occupied aft-facing seat must be in the fully raised position for takeoff and landing.

ICING LIMITATIONS

Minimum Ambient Temperature for Operation of Deicing Boots. . . . . -40°C

Minimum Airspeed for Sustained Icing Flight . . . . . 140 knots

Sustained flight in icing conditions with flaps extended is prohibited except for approach and landings.

The ice vanes shall be extended for operations in ambient temperatures of +5°C or below when flight free of visible moisture cannot be assured.

APPROVED AIRPLANE DEICING/ANTI-ICING FLUIDS

SAE AMS 1424 Type I

ISO 11075 Type I

SAE AMS 1428 Type II

ISO 11078 Type II

SAE AMS 1428 Type IV. Only the following type IV fluids are approved:

- Clariant Safewing MP IV 1957
- Clariant Safewing MP IV 2001
- UCAR ULTRA+ (Approved for use down to -15°C)
- Octagon Max Flight Type IV

STARTERS

Use of the starter is limited to 40 seconds ON, 60 seconds OFF, 40 seconds ON, 60 seconds OFF, 40 seconds ON, then 30 minutes OFF.

AUTOPILOT LIMITATIONS

Refer to the applicable FAA Approved Airplane Flight Manual Supplement in the SUPPLEMENTS Section.

STRUCTURAL LIMITATIONS

Refer to Chapter 4 of the *Beech King Air F90 Maintenance Manual.*

LIMITATIONS WHEN ENCOUNTERING SEVERE ICING CONDITIONS (Required By FAA AD 98-04-24)

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 protections systems, and may seriously degrade the performance and controllability of the airplane.

1. 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.
   a. Unusually extensive ice accumulation of the airframe and windshield in areas not normally observed to collect ice.
   b. Accumulation of ice on the upper surface of the wing, aft of the protected area.
   c. Accumulation of ice on the engine nacelles and propeller spinners farther aft than normally observed.
2. Since the autopilot, when installed and operating, 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.
3. All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL).]

SEVERE ICING CONDITIONS
(Alternate Method Of Compliance With FAA AD 98-04-24)

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

- Visible rain at temperatures below 0 degrees Celsius ambient air 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 in the Limitations Section 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.
5. If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
6. Do not extend flaps when holding 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.

ADDING BIOCIDE TO FUEL

See Beech King Air F90 Maintenance Manual for procedures to follow when adding BIOBOR JF biocide to the airplane fuel.

NICKEL-CADMIUM BATTERY CHECK (GROUND OPERATION ONLY)

Illumination of the BATTERY CHG annunciator indicates an above-normal charge current. Following an engine start, the battery recharge current is very high and causes the illumination of the BATTERY CHG annunciator. It should normally extinguish within five minutes. If it does not, or if it should reappear, the battery charge current should be monitored using the procedure shown below until it decreases to a level to extinguish the BATTERY CHG annunciator. Check the battery charge current every 90 seconds until the charge current decreases sufficiently to extinguish the annunciator. No decrease in charging current between checks indicates an unsatisfactory condition and the battery should be removed and checked by a qualified nickel-cadmium battery shop. Do not take off with the annunciator illuminated unless a decreasing battery charge current is confirmed.

1. Either Generator - OFF
2. Voltmeter - ENSURE INDICATION OF 28 VOLTS
3. Battery - OFF MOMENTARILY, NOTING DECREASE IN LOADMETER

If decrease in loadmeter exceeds 2.5%

4. Battery - CONTINUE TO CHARGE, REPEATING STEP 3 EVERY 90 SECONDS
5. BATTERY CHG Annunciator - EXTINGUISHED WHEN DECREASE IN LOADMETER IS LESS THAN 2.5%

COLD WEATHER PROCEDURES (SNOW, SLUSH, AND ICE)

PREFLIGHT INSPECTION

Verify that the tires are not frozen to the ramp, and that the brakes are free of ice contamination. Deicing or anti-icing solutions may be used on the tires and brakes if they are frozen. Solutions which contain a lubricant, such as oil, must not be used as they will decrease the effectiveness of the brakes.

In addition to the normal exterior preflight inspection, special attention should be given all vents, openings, static ports, control surfaces, hinge points, the stall warning vane and the wing, tail, and fuselage surfaces for accumulations of ice or snow. Removal of these accumulations is necessary prior to takeoff. Airfoil contours may be altered by the ice and snow to the extent that their lift qualities will be seriously impaired. Ice and snow on the fuselage can increase drag and weight. Frost that may form on the wing fuel tank bottom skins need not be removed prior to flight. Frost that may accumulate on other portions of the wing, the tail surfaces, or on any control surface, must be removed prior to flight.

Inspect the propeller blades and hubs for ice and snow. Unless engine inlet covers have been installed during snow or icing conditions, the propellers should be turned by hand in the direction of normal rotation to make sure they are free to rotate prior to starting engines.

The removal of frozen deposits by chipping or scraping is not recommended. A soft brush, squeegee, or mop may be used to clear snow that is not adhering to the surfaces. If use of deicing/anti-icing fluids are required to produce a clean airplane, special attention must be given to ensure that the pitot masts, static ports, fuel vents, the stall warning vane, cockpit windows and the area forward of the cockpit windows are free of the deicing/anti-icing solution. Both wings and both stabilizers must receive the same complete treatment. The type and concentration of deicing/anti-icing solution being applied and the rate of precipitation will affect the length of time the treatment will be effective. Refer to Chapter 12 of the *Beech King Air F90 Series Maintenance Manual* and Section VIII of this manual for additional information on deicing and anti-icing of airplanes on the ground. See Section II, LIMITATIONS, for a list of approved fluids.

Complete the normal preflight procedures, including a check of the flight controls for complete freedom of movement.

After engine start, exercise the propellers through low-and high-pitch and into reverse range to flush any congealed oil through the system.

If the optional brake deicing system is installed, turn it on prior to taxi if brakes require deicing.

TAXIING

Taxiing through deep snow or slush should be avoided when possible. Snow and slush can be forced into brake assemblies which may cause the brakes to freeze during a prolonged hold on the ground or during the subsequent flight. Keep flaps retracted during taxiing to avoid throwing snow or slush into flap mechanisms and to minimize damage to flap surfaces.

Glaze ice can be difficult to see. Therefore, taxi slowly and allow more clearance from objects when maneuvering the airplane.

BEFORE TAKEOFF

After completion of the normal Before Takeoff checklist, verify that the airplane is still free of frozen contaminants.

Ensure the runway is free from hazards such as snow drifts, glazed ice, and ruts.

WARNING

Ice, frost, or snow on top of deicing/anti-icing solutions must be considered as adhering to the airplane. Takeoff should not be attempted.

If the OAT is +5°C or below and visible moisture will be encountered during the takeoff, engine ice vanes must be extended to reduce the possibility of ice being ingested into the engine air inlet.

TAKEOFF

Allow additional take-off distance when snow or slush is on the runway. Extra cycling of the landing gear when above 500 feet AGL may help clear any contamination from the gear system.

When using FAA Approved SAE Type II or Type IV deicing/anti-icing fluids in the concentrated form, the control column force required to rotate for takeoff may temporarily increase approximately 20 pounds. The cruise, descent, approach and landing phases of flight are not affected by the use of these fluids.

LANDING

If it is possible that the brakes may be restricted by ice accumulations from previous ground or in-flight icing conditions, turn the brake deicing system (if installed) on during the descent.

Braking and steering are less effective on slick runways. Also, hydroplaning may occur under wet runway conditions at higher speeds. Use the rudder to maintain directional control until the tires make solid contact with the runway surface.

Selecting reverse thrust can effectively reduce stopping distances on slick runways; however, reverse thrust may cause snow or moisture to be thrown forward, temporarily reducing visibility.

SHUTDOWN AND SECURING

Avoid setting the parking brake, if possible. This will help reduce the possibility of freezing the brakes. Proper chocking can be used to prevent the airplane from rolling.

ICING FLIGHT

This airplane is approved for flight in icing conditions as defined in FAR 25, Appendix C. These conditions do not include, nor were tests conducted in, all conditions that may be encountered (e.g., freezing rain, freezing drizzle, mixed conditions, or conditions defined as severe). Some icing conditions not defined in FAR 25 have the potential of producing hazardous ice accumulations, which: 1) exceed the capabilities of the airplane's ice protection equipment; and/or 2) create unacceptable airplane performance. Flight into icing conditions which lie outside the FAR-defined conditions is not prohibited; however, pilots must be prepared to divert the flight promptly if hazardous ice accumulations occur.

Refer to Section I for limitations relating to icing flight, and Section III for emergency procedures associated with icing equipment malfunctions and procedures required for severe icing conditions.

WARNING

Due to distortion of the wing airfoil, ice accumulations on the leading edges can cause a significant loss in rate of climb and in speed performance, as well as increases in stall speed. Even after cycling deicing boots, the ice accumulation remaining on the boots and unprotected areas of the airplane can cause large performance losses. For the same reason, the aural stall warning system may not be accurate and should not be relied upon. Maintain a comfortable margin of airspeed above the normal stall airspeed. In order to minimize ice accumulation on unprotected surfaces of the wing, maintain a minimum of 140 knots during operations in sustained dicing conditions. In the event of windshield icing, reduce airspeed to 226 knots or below. Prior to a landing approach, cycle the deicing boots to shed any accumulated ice.

1. Surface Deice System
   a. Preflight: Check boots for damage and cleanliness
   b. Before takeoff: Deice Switch - CHECK BOTH POSITIONS (SINGLE - Up, MANUAL - Down)
      1) Check deice pressure gage
      2) Check boots visually for inflation and hold down. (Inflation is 6 seconds for wings, then 4 seconds for horizontal stabilizer.)
   c. In flight: (When ice accumulates to 1 inch) - Deice Switch - SINGLE (repeat as required)

NOTE

Either engine will supply sufficient air pressure for deice operation. In the event of failure of SINGLE cycle, use MANUAL cycle.

2. Engine Anti-Ice
   a. Before takeoff: 600 ft-lbs torque
      1) Engine Ice Vane Controls
         a) Extend - Check for torque drop, indicating vane extension.
         b) Retract - Check for torque increase to previous reading, indicating vane retraction.
      2) Power - REDUCE TO IDLE
   b. In Flight:
      1) Before visible moisture is encountered at +5°C and below or;
      2) At night when freedom from visible moisture is not assured at +5°C and below.
         a) Engine Ice Vanes - EXTEND
         b) Check proper operation by noting torque drop.
   c. Regain torque by increasing power levers if desired (observe ITT limits).

CAUTION

If in doubt, extend the vanes. Engine icing can occur even though no surface icing is present. If freedom from visible moisture can not be assured, engine ice protection should be activated. Visible moisture is moisture in any form; clouds, ice crystals, snow, rain, sleet, hail or any combination of these. Operation of strobe lights will sometimes show ice crystals not normally visible.

3. Engine Air Inlet:
   - In Flight
     - Engine Lip Boot Switches - ON (before ice forms)
4. Engine Auto Ignition:
   a. Before Takeoff
      1) Power Levers - IDLE
      2) Auto Ignition Switches - ARM
      3) Annunciator Panel - IGNITION ON
      4) Power Levers - ADVANCE TO ABOVE 425 FOOT-POUNDS TORQUE
      5) Auto/Ignition ARM Lights - CHECK ON - (IGNITION LIGHTS OFF)
   b. In Flight
      - Auto Ignition - ARM

NOTE

Engine Auto Ignition must be ARMED for icing flights and flights at night above 14,000 feet. To prevent prolonged operation of the igniters, during descent when Auto Ignition is armed, do not reduce power below 425 ft lbs torque.

5. Electrothermal Propeller Deice

CAUTION

Do not operate propeller deice when the propellers are static.

a. Before Takeoff:

1) Automatic Propeller Deice Switch - AUTO

2) Propeller Deice Ammeter - MONITOR for 2 minutes; normal operating range is 17 to 21 amperes. Indications above or below this range may indicate system malfunction, and should be thoroughly checked before beginning flight in icing conditions.

Airplanes LA-1 through LA-130:

3) Manual Propeller Deice Switch - MOMENTARILY HOLD IN INNER POSITION, THEN OUTER (Small loadmeter deflection on both meters in each position indicates manual system is operating.)

Airplanes LA-131 and after:

3) Manual Propeller Deice Switch - MOMENTARILY HOLD IN MANUAL POSITION (Small loadmeter deflection on both meters indicates manual system is operating.)

All Airplanes:

NOTE

Current for the manual (backup) system will not be indicated on the propeller deice ammeter; however, it will be indicated as part of the airplane's load on the loadmeter (small needle deflection) when the system is switched on.

4) Automatic Propeller Deice Switch - OFF

b. In Flight

1) Automatic Propeller Deice Switch - AUTO. The system may be operated continuously in flight, and will function automatically until the switch is turned off.

2) Relieve propeller imbalance due to ice by increasing rpm briefly and returning to the desired setting. Repeat as necessary.

CAUTION

If the deice ammeter does not indicate 17 to 21 amperes refer to the EMERGENCY PROCEDURES Section.

6. Fuel Vent Heat - ON
7. Pitot Heat - ON
8. Stall Warning Heat - ON

CAUTION

Prolonged use of pitot and stall warning heat on the ground will damage the heating elements.

9. Windshield Anti-Ice - AS REQUIRED (before ice forms)
10. Wing Ice Lights - AS REQUIRED
11. Alternate Static Air Source - REFER to EMERGENCY PROCEDURES Section.

PRACTICE DEMONSTRATION OF V_{MCA}

V_{MCA} demonstration may be required for multi-engine pilot certification. The following procedure shall be used at a safe altitude of at least 5000 feet above the ground in clear air only.

WARNING

IN-FLIGHT ENGINE CUTS BELOW V_{SSE} SPEED OF 102 KNOTS ARE PROHIBITED.

1. Landing Gear - UP
2. Flaps - UP
3. Airspeed - ABOVE 102 KNOTS (V_{SSE})
4. Propeller Levers - HIGH RPM
5. Power Lever (Simulated inoperative engine) - IDLE
6. Power Lever (Other engine) - MAXIMUM ALLOWABLE
7. Airspeed - Reduce approximately 1 knot per second until either V_{MCA} or stall warning is obtained.

CAUTION

Use rudder to maintain directional control (heading) and ailerons to maintain 5° bank towards the operative engine (lateral attitude). At the first sign of either V_{MCA} or stall warning (which may be evidenced by: inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn sound) immediately initiate recovery: reduce power to idle on the operative engine and immediately lower the nose to regain V_{SSE}.

NOISE CHARACTERISTICS

Approach to and departure from an airport should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.

For VFR operations over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas, pilots should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.

NOTE

The preceding recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgement, an altitude of less than 2000 feet is necessary to adequately exercise his duty to see and avoid other airplanes.

The flyover noise level established in compliance with FAR 36 is:

72.9 dB(A)

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of any airport.

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NOTE

After the autopilot is positively disengaged, it may be necessary to restore other electrical functions. Be sure when the master switches are turned on that the autopilot does not re-engage.

It is essential that you read your airplane's Pilot's Operating Handbook and FAA Approved Airplane Flight Manual and applicable supplements for your autopilot system and check the function and operation of your system.

The engagement of the autopilot must be done in accordance with the instructions and procedures contained in the AFM Supplement.

Particular attention must be paid to the autopilot settings prior to engagement. If you attempt to engage the autopilot when the airplane is out of trim, a large attitude change may occur.

IT IS ESSENTIAL THAT THE PROCEDURES SET FORTH IN THE APPROVED AFM SUPPLEMENTS FOR YOUR SPECIFIC INSTALLATION BE FOLLOWED BEFORE ENGAGING THE AUTOPILOT.

FLUTTER

Flutter is a phenomenon that can occur when an aerodynamic surface begins vibrating. The energy to sustain the vibration is derived from airflow over the surface. The amplitude of the vibration can (1) decrease, if airspeed is reduced; (2) remain constant, if airspeed is held constant and no failures occur; or (3) increase to the point of self-destruction, especially if airspeed is high and/or is allowed to increase. Flutter can lead to an in-flight break up of the airplane. Airplanes are designed so that flutter will not occur in the normal operating envelope of the airplane as long as the airplane is properly maintained. In the case of any airplane, decreasing the damping and stiffness of the structure or increasing the trailing edge weight of control surfaces will tend to cause flutter. If a combination of those factors is sufficient, flutter can occur within the normal operating envelope.

Owners and operators of airplanes have the primary responsibility for maintaining their airplanes. To fulfill that responsibility, it is imperative that all airplanes receive a thorough preflight inspection. Improper tension on the control cables or any other loose condition in the flight control system can also cause or contribute to flutter. Pilots should pay particular attention to control surface attachment hardware including tab pushrod attachment during preflight inspection. Looseness of fixed surfaces or movement of control surfaces other than in the normal direction of travel should be rectified before flight. Further, owners should take their airplanes to mechanics who have access to current technical publications and prior experience in properly maintaining that make and model of airplane. The owner should make certain that control cable tension inspections are performed as outlined in the applicable Beech Inspection Guide. Worn control surface attachment hardware must be replaced. Any repainting or repair of a moveable control surface will require a verification of the control surface balance before the airplane is returned to service. Control surface drain holes must be open to prevent freezing of accumulated moisture, which could create an increased trailing-edge-heavy control surface and flutter.

If an excessive vibration, particularly in the control column and rudder pedals, is encountered in flight, this may be the onset of flutter and the procedure to follow is:

1. IMMEDIATELLY REDUCE AIRSPEED (lower the landing gear, if necessary).
2. RESTRAIN THE CONTROLS OF THE AIRPLANE UNTIL THE VIBRATION CEASES.
3. FLY AT THE REDUCED AIRSPEED AND LAND AT THE NEAREST SUITABLE AIRPORT.
4. HAVE THE AIRPLANE INSPECTED FOR AIRFRAME DAMAGE, CONTROL SURFACE ATTACHING HARDWARE CONDITION/SECURITY, TRIM TAB FREE PLAY, PROPER CONTROL CABLE TENSION, AND CONTROL SURFACE BALANCE BY ANOTHER MECHANIC WHO IS FULLY QUALIFIED.

TURBULENT WEATHER

A complete and current weather briefing is a requirement for a safe trip.

Updating of weather information enroute is also essential. The wise pilot knows that weather conditions can change quickly, and treats weather forecasting as professional advice, rather than an absolute fact. He obtains all the advice he can, but stays alert to any sign or report of changing conditions.

Plan the flight to avoid areas of reported severe turbulence. It is not always possible to detect individual storm areas or find the in-between clear areas.

The National Weather Service classifies turbulence as follows:

Class of Turbulence	Effect
Extreme	Airplane is violently tossed about and is practically impossible to control. May cause structural damage.
Severe	Airplane may be momentarily out of control. Occupants are thrown violently against the belts and back into the seat. Unsecured objects are tossed about.
Moderate	Occupants require seat belts and occasionally are thrown against the belt. Unsecured objects move about.

Light	Occupants may be required to use seat belts, but objects in the airplane remain at rest.

Thunderstorms, squall lines and violent turbulence should be regarded as extremely dangerous and must be avoided. Hail and tornadic wind velocities can be encountered in thunderstorms that can destroy any airplane, just as tornadoes destroy nearly everything in their path on the ground.

Thunderstorms also pose the possibility of a lightning strike on an airplane. Any structure or equipment which shows evidence of a lightning strike, or being subjected to a high current flow due to a strike, or is a suspected part of a lightning strike path through the airplane, should be thoroughly inspected and any damage repaired prior to additional flight.

A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence; however, the absence of a roll cloud should not be interpreted as denoting that severe turbulence is not present.

Even though flight in severe turbulence must be avoided, flight in turbulent air may be encountered unexpectedly under certain conditions.

The following recommendations should be observed for airplane operation in turbulent air:

> Flying through turbulent air presents two basic problems, the answer to both is proper airspeed. On one hand, if you maintain an excessive airspeed, you run the risk of structural damage or failure; on the other hand, if your airspeed is too low, you may stall.
>
> If turbulence is encountered, reduce speed to the turbulent air penetration speed, if given, or to the maneuvering speed, which is listed in the Limitations Section of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. These speeds give the best assurance of avoiding excessive stress loads, and at the same time providing the proper margin against inadvertent stalls due to gusts.
>
> Beware of overcontrolling in an attempt to correct for changes in attitude; applying control pressure abruptly will build up G-forces rapidly and could cause structural damage or even failure. You should watch particularly your angle of bank, making turns as wide and shallow as possible. Be equally cautious in applying forward or back pressure to keep the airplane level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly out of trim as the vertical air columns change velocity and direction. If necessary to avoid excessive airspeeds, lower the landing gear.

WIND SHEAR

Wind shears are rapid, localized changes in wind direction, which can occur vertically as well as horizontally. Wind shear can be very dangerous to all airplanes, large and small, particularly on approach to landing when airspeeds are slow.

A horizontal wind shear is a sudden change in wind direction or speed that can, for example, transform a headwind into a tailwind, producing a sudden decrease in airspeed because of the inertia of the airplane. A vertical wind shear is a sudden updraft or downdraft. Microbursts are intense, highly localized severe downdrafts.

The prediction of wind shears is far from an exact science. Monitor your airspeed carefully when flying in storms, particularly on approach. Be mentally prepared to add power and go around at the first indication that a wind shear is being encountered.

FLIGHT IN ICING CONDITIONS

Every pilot should be intimately acquainted with the FAA Approved National Weather Service definitions for ice intensity and accumulation which we have reprinted below:

Intensity	Ice Accumulation
Trace	Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).
Light	The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment will prevent or remove accumulation. It does not present a problem if the deicing/anti-icing equipment is used.
Moderate	The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment, or diversion, is necessary.
Severe	The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.

It is no longer unusual to find deicing and anti-icing equipment on a wide range of airplane sizes and types. Since the capability of this equipment varies, it becomes the pilot's primary responsibility to understand limitations which restrict the use of the airplane in icing conditions and the conditions which may exceed the systems capacity.

Pilots and airplane owners must carefully review the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual in order to ascertain the required operable equipment needed for flight in icing conditions. In addition, they must ascertain from the same sources the limits of approval or certification of their airplane for flight in icing conditions, and plan the flight accordingly if icing conditions are known or forecast along the route.

Remember that regardless of its combination of deicing/anti-icing equipment, any airplane not fully equipped and functional for IFR flight is not properly equipped for flight in icing conditions. An airplane which does not have all critical areas protected in the required manner by fully operational equipment must not be exposed to icing encounters of any intensity. When icing is detected, the pilot of such an airplane must make immediate diversion by flying out of the area of visible moisture or going to an altitude where icing is not encountered.

Even airplanes fully equipped and certified for flight in the icing conditions described in Appendix C to FAR Part 25 must avoid flights into those conditions defined by the National Weather Service as "Severe". No airplane equipped with any combination of deicing/anti-icing equipment can be expected to cope with such conditions. As competent pilots know, there appears to be no predictable limits for the severest weather conditions. For essentially the same reasons that airplanes, however designed or equipped for IFR flight, cannot be flown safely into conditions such as thunderstorms, tornadoes, hurricanes or other phenomena likely to produce severe turbulence, airplanes equipped for flight in icing conditions cannot be expected to cope with "Severe" icing conditions as defined by the National Weather Service. The prudent pilot must remain alert to the possibility that icing conditions may become "Severe" and that his equipment will not cope with them. At the first indication that such condition may have been encountered or may lie ahead, he should immediately react by selecting the most expeditious and safe course for diversion.

Every pilot of a properly fully-equipped Beech airplane who ventures into icing conditions must maintain the minimum speed (KIAS) for operation in icing conditions, which is set forth in the Normal Procedures section, and in the Limitations section, of his Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. The pilot must remain aware of the fact that if he allows his airspeed to deteriorate below this minimum speed, he will increase the angle of attack of his airplane to the point where ice may build up on the under side of the wings aft of the area protected by the deice/anti-icing equipment.

Ice build-up, and its extent in unprotected areas may not be directly observable from the cockpit. Due to distortion of the wing airfoil, increased drag and reduced lift, stalling speeds will increase as ice accumulates on the airplane. For the same reasons, stall warning devices are not accurate and cannot be relied upon in icing conditions.

Even though the pilot maintains the prescribed minimum speeds for operating in icing conditions, ice is still likely to build up on the unprotected areas. Under some atmospheric conditions, it may even build up aft of the de-iced areas despite the maintenance of the prescribed minimum speed. The effect of ice accumulation on any unprotected surface is aggravated by length of exposure to the icing conditions. Ice buildup on unprotected surfaces will increase drag, add weight, reduce lift, and generally, adversely affect the aerodynamic characteristics and performance of the airplane. It can progress to the point where the airplane is no longer capable of flying. Therefore, the pilot operating even a fully-equipped airplane in sustained icing conditions must remain sensitive to any indication, such as observed ice accumulation, loss of airspeed, the need for increased power, reduced rate of climb, or sluggish response, that ice is accumulating on unprotected surfaces and that continued flight in these conditions is extremely hazardous, regardless of the performance of the deicing/anti-icing equipment.

Since flight in icing conditions is not an everyday occurrence, it is important that you maintain a proper proficiency and awareness of the operating procedures necessary for safe operation of the airplane and that the airplane is in a condition for safe operation.

Ensure moisture drains in the airplane structure are maintained open as specified in the Aircraft Maintenance Manual, so that moisture will not collect and cause freezing in the control cable area. Also, control surface tab hinges should be maintained and lubricated as specified in the Aircraft Maintenance Manual.

In icing conditions the autopilot should be disengaged at an altitude sufficient to permit the pilot to gain the feel of the airplane prior to landing. In no case should this be less than the minimum altitude specified in the Autopilot Airplane Flight Manual Supplement.

Observe the procedures set forth in your Pilot's Operating Handbook and FAA Approved Airplane Flight Manual during operation in icing conditions.

Activate your deice and anti-icing systems before entering an area of moisture where you are likely to go through a freezing level.

For any owner or pilot whose use pattern for an airplane exposes it to icing encounters, the following references are required reading for safe flying:

- The airplane's Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, especially the sections on Normal Procedures, Emergency Procedures, Abnormal Procedures, Systems, and Safety Information.
- FAA Advisory Circular 91-51 - Airplane Deice and Anti-ice Systems.
- Weather Flying by Robert N. Buck.

Finally, the most important ingredients to safe flight in icing conditions - regardless of the airplane or the combination of deicing/anti-icing equipment - are a complete and current weather briefing, sound pilot judgment, close attention to the rate and type of ice accumulations, and the knowledge that "severe icing" as defined by the National Weather Service is beyond the capability of modern airplanes and an immediate diversion must be made. It is the inexperienced or uneducated pilot who presses on "regardless" hoping that steadily worsening conditions will improve, only to find himself flying an airplane which has become so loaded with ice that he can no longer maintain altitude. At this point he has lost most, if not all, of his safety options, including perhaps a 180 degree turn to return along the course already traveled.

The responsible and well-informed pilot recognizes the limitations of weather conditions, his airplane and its systems, and reacts promptly.

WEATHER RADAR

Airborne weather avoidance radar is, as its name implies, for avoiding severe weather - not for penetrating it. Whether to fly into an area of radar echoes depends on echo intensity, spacing between the echoes, and the capabilities of you and your airplane. Remember that weather radar detects precipitation drops. Except for the most advanced radar units, it does not detect turbulence. Therefore, the radar scope provides no assurance of avoiding turbulence. The radar scope also does not provide assurance of avoiding instrument weather from clouds and fog. Your scope may be clear between intense echoes; this clear area does not necessarily mean you can fly between the storms and maintain visual sighting of them.

Thunderstorms build and dissipate rapidly. Therefore, do not attempt to plan a course between echoes. The best use of ground radar information is to isolate general areas and coverage of echoes. You must avoid individual storms by in-flight observations either by visual sighting or airborne radar. It is better to avoid the whole thunderstorm area than to detour around individual storms, unless they are scattered.

Remember that while hail always gives a radar echo, it may fall several miles from the nearest visible cloud and hazardous turbulence may extend to as much as 20 miles from the echo edge. Avoid intense or extreme level echoes by at least 20 miles; that is, such echoes should be separated by at least 40 miles before you fly between them. With weaker echos you can reduce the distance by which you avoid them.

Above all, remember this; never regard any thunderstorm lightly. Even when radar observers report the echoes are of light intensity, avoiding thunderstorms is the best policy. The following are some do's and don'ts of thunderstorm avoidance:

1. Don't land or take off in the face of an approaching thunderstorm. Sudden gust-front low level turbulence could cause loss of control.
2. Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.
3. Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.
4. Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.
5. Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.
6. Do circumnavigate the entire area if the area has 6/10 or more thunderstorm coverage.
7. Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.
8. Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

If you cannot avoid penetrating a thunderstorm, the following are some do's BEFORE entering the storm:

9. Tighten your safety belt, put on your shoulder harness, and secure all loose objects.
10. Plan and hold your course to take you through the storm in minimum time.
11. To avoid the most critical icing, establish a penetration altitude below the freezing level or an altitude where the OAT is -15°C or colder.
12. Verify that pitot heat is on, and activate anti-ice systems. Icing can be rapid at any altitude and can cause almost instantaneous power failure and/or loss of airspeed indication.

MOUNTAIN FLYING

Pilots flying in mountainous areas should inform themselves of all aspects of mountain flying, including the effects of topographic features on weather conditions. Many good articles have been published, and a synopsis of mountain flying operations is included in the FAA Airman's Information Manual, Part 1.

Avoid flight at low altitudes over mountainous terrain, particularly near the lee slopes. If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with extreme up and down drafts and severe turbulence. The worst turbulence will be encountered in and below the rotor zone, which is usually 8 to 10 miles downwind from the ridge. This zone is sometimes characterized by the presence of "roll clouds" if sufficient moisture is present. Altocumulus standing lenticular clouds are also visible signs that a mountain wave exists, but their presence is likewise dependent upon moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of such clouds should not be taken as assurance that mountain wave turbulence will not be encountered. A mountain