

King Air E90 | Limitations

TRAINING REFERENCE ONLY — NOT A SUBSTITUTE FOR THE AFM

This document is a training summary compiled from the aircraft's POH/AFM. In any conflict, the FAA Approved Airplane Flight Manual for the specific airplane, including all applicable Supplements and Temporary Changes, is the governing authority. Verify limitations against the AFM for the serial number being flown.

Source: Beechcraft King Air E90 Pilot's Operating Manual and FAA Approved Airplane Flight Manual, P/N 90-590012-5 (issued March 17, 1972; revised through May 20, 1988) — Section I, LIMITATIONS (pages 1-1 through 1-10). Several airspeed, flap, and landing-gear limits are published as dual ("or") values reflecting different airplane configurations; both are shown here — confirm the value applicable to the specific serial number in its AFM.

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1. AIRSPEED

AIRSPEED LIMITATIONS (CAS)

POH 1-4

The limitations in this section have been approved by the Federal Aviation Administration and must be observed in the operation of the Beechcraft King Air E90. Values are Calibrated Airspeed (CAS) as published in the AFM.

SPEED	CAS	REMARKS
Maximum Operating Speed Vmo	226 kt	Do not deliberately exceed in any regime of flight (climb, cruise, or descent). Decreases 4 kt per 1,000 ft above 15,500 ft (per placard).
Maximum Operating Mach Mmo	.46 Mach	Do not deliberately exceed in any regime of flight.
Maximum Design Maneuvering Speed Va	175 kt	Do not make full or abrupt control movements above this speed.
Maximum Flap Extension — Approach (35%)	174 kt	Do not extend flaps or operate with flaps extended above this speed.
Maximum Flap Extension — Full Down (100%)	140 kt or 130 kt	Value depends on airplane configuration — verify against the specific AFM.
Maximum Gear Extended Speed Vle	156 kt	Do not exceed with the landing gear extended.
Maximum Gear Operating — Extension Vlo	156 kt	Do not extend the landing gear above this speed.
Maximum Gear Operating — Retraction Vlo	146 kt or 130 kt	Do not retract the landing gear above this speed. Value depends on configuration.
Air Minimum Control Speed Vmca	88 kt	Lowest speed at which the airplane is directionally controllable after sudden loss of an engine with the operating engine at takeoff power.

NOTE

Vmo / **Mmo** may not be deliberately exceeded in any regime of flight (climb, cruise, or descent). Do not use controls abruptly above 175 knots CAS.

MARKING	CAS VALUE / RANGE	SIGNIFICANCE
Red Radial	226 kt	Maximum Operating Speed (V_{mo}).
Green Arc	88 to 226 kt	Normal Operating Range.
White Arc	76 to 140 kt or 76 to 130 kt	Full-Flap Operating Range. Upper limit depends on airplane configuration.
White Triangle	174 kt	Maximum Approach-Flap Speed.
Blue Radial	111 kt	One-Engine-Inoperative Best Rate-of-Climb Speed (V_{yse}).
Red Radial	88 kt	Minimum Single-Engine Control Speed (V_{mca}).

2. POWER PLANT

POWER PLANT

Number of Engines	2
Engine Manufacturer	United Aircraft of Canada, Ltd. (Pratt & Whitney Canada)
Engine Model	PT6A-28

ENGINE OPERATING LIMITS

POH 1-1

Each column is a separate limitation. The limits presented do not necessarily occur simultaneously. Refer to the Pratt & Whitney Engine Maintenance Manual for specific actions required if limits are exceeded.

OPERATING CONDITION	SHp	TORQUE @2200 (ft-lb)	TORQUE @1900 (ft-lb)	MAX ITT °C	N1 %	PROP N2 RPM	OIL PRESS PSIG	OIL TEMP °C
Take-Off (5-min limit)	550	1315	1520	750	101.5	2200	80-100	10 to 99
Max Continuous (10)	550	1315	1520	750	101.5	2200	80-100	10 to 99
Cruise Climb	550	1315	1520	710	101.5	2200	80-100	0 to 99
Cruise (9)	550	1315	1520	750 (9)	101.5	2200	80-100	0 to 99
Hi-Idle (1)	—	—	—	—	—	—	—	-40 to 99
Lo-Idle (2)	—	—	—	660 (6)	—	—	40 min	-40 to 99
Starting	—	—	—	1090 (4)	—	—	—	-40 min
Acceleration (4)(8)	—	—	2100	850	102.6	2420	—	0 to 99
Max Reverse (7)	—	—	—	750	88	2100	80-100	0 to 99

NOTE

- (1) At approximately 70% N1.
- (2) At 50% N1 minimum.
- (3) Normal oil pressure is 80 to 100 psig at throttle settings above 27,000 RPM (72% N1). Oil pressure below 80 psig is undesirable and should be tolerated only to complete the flight, preferably at reduced throttle. Report below-normal oil pressure as an engine discrepancy and correct before the next take-off. Oil pressure below 40 psig is unsafe: shut the engine down or land as soon as possible using minimum power to sustain flight.
- (4) Value is time-limited to two seconds.
- (5) For every 10°C below -30°C ambient, reduce maximum allowable N1 by 2.2%.
- (6) High ITT at ground idle may be corrected by reducing accessory load and/or increasing N1.
- (7) Reverse operation is time-limited to 1 minute.
- (8) High generator loads at low N1 may cause the ITT acceleration limit to be exceeded (does not apply during engine start). Observe generator load limits.
- (9) ITT limit is 695°C below 10,000 ft. Cruise torque limit varies with altitude and temperature.
- (10) Maximum Continuous Power is intended for emergency use at the discretion of the pilot.

GENERATOR LOAD VS. MINIMUM N1

POH 1-2

GENERATOR LOAD	GROUND OP	5,000 FT	25,000 FT	30,000 FT
0 to .25	51%	51%	58%	60%
.25 to .5	51%	60%	67%	70%
.5 to .75	57%	65%	74%	78%
.75 to .9	60%	68%	78%	82%
.9 to 1.0	63%	69%	80%	85%

CONFIGURATION	SPECIFICATION
Non-Reversing Installation	Two full-feathering, constant-speed, three-blade propellers. Blades T10173B-8, hubs HC-B3TN-2(B). Blade angles at the 30-in. station: low pitch 19°, feathered 87°. Diameter 93 3/8 in. max, 90 3/8 in. min.
Reversing Installation	Two full-feathering, constant-speed, reversing, three-blade propellers. Blades T10173E-8 or T10173B-8, hubs HC-B3TN-3 or HC-B3TN-3B. Blade angles at the 30-in. station: feathered 87°, reverse -11°. Set flight-idle stop to obtain 600 ± 60 ft-lb torque at 2000 RPM (prop), sea level, standard day.

NOTE

Emergency Propeller RPM Limits — The maximum propeller overspeed limit is 2420 RPM. Propeller speeds above 2200 RPM indicate failure of the primary governor. Propeller speeds above 2288 RPM indicate failure of both the primary and secondary governors.

POWER PLANT INSTRUMENT MARKINGS

INSTRUMENT	RED (RADIAL) MIN	GREEN ARC (NORMAL)	RED (RADIAL) MAX
Interstage Turbine Temp (ITT)	—	400° to 750°C	750°C *
Gas Generator Tach (N1)	—	—	101.5%
Torquemeter	—	400 to 1315 ft-lb	1315 ft-lb (2200 RPM) **
Propeller Tachometer	—	1800 to 2200 RPM	2200 RPM
Oil Pressure	40 psi	80 to 100 psi	100 psi
Oil Temperature	—	10° to 99°C	99°C

NOTE

* Dashed Red Radial (starting limit): 1090°C.

** Dashed Red Radial: 1520 ft-lb at 1900 RPM.

3. FUEL

APPROVED ENGINE FUELS

POH 1-3

Jet A, Jet A-1, and Jet B fuels, and grades 80/87 through 115/145 Commercial Aviation fuels, which conform to PWA Specification No. 522 and later revisions. (Check the Consumable Materials Chart, Section X — Servicing.)

CAUTION

Operation with the fuel pressure light on is limited to 10 hours between main engine-driven fuel pump overhaul or replacement.

One standby pump may be inoperative for takeoff (crossfeed will not be available from the side of the inoperative standby pump).

Operation on aviation gasoline: (1) limited to 150 hours during any one overhaul period; (2) limited to 18,000 ft altitude with either standby fuel pump inoperative; (3) main tanks only — auxiliary tanks are not to be filled with aviation gasoline.

FUEL CAPACITY — USABLE FUEL

POH 1-3

Total System Capacity	474 gallons
Main Fuel System	392 gallons
Auxiliary Fuel System	82 gallons

FUEL MANAGEMENT

POH 1-3

1. Auxiliary tanks are not to be filled unless the main tanks are full.
2. If fuel is in the auxiliary tank, it must be depleted before using fuel from the main tanks.
3. Do not take off if the fuel quantity gages indicate in the yellow arc or less than 265 lbs of fuel in each main tank.
4. Crossfeed only during single-engine operation.

4. OIL

OIL SPECIFICATION

POH 1-3

Synthetic type conforming to the current CPW 202 and PWA 521 specifications. (Check the Consumable Materials Chart, Section X — Servicing.)

5. INSTRUMENT MARKINGS

MISCELLANEOUS INSTRUMENT MARKINGS

POH 1-4

Cabin Differential Pressure — Green Arc	0 to 4.7 psi
Cabin Differential Pressure — Red Arc	4.7 psi to end of scale
Vacuum (Suction) — Narrow Green Arc (30,000 to 15,000 ft)	3.0 to 4.3 in. Hg
Vacuum (Suction) — Wide Green Arc (15,000 ft to Sea Level)	4.3 to 5.9 in. Hg
Pneumatic Gage — Green Arc	12 to 20 psi
Pneumatic Gage — Red Radial	20 psi
Propeller Deice Ammeter — Green Arc	14 to 18 amperes
Fuel Quantity Gages — Yellow Arc (No-Takeoff Range)	0 to 265 lbs

6. WEIGHT AND BALANCE

WEIGHT LIMITS

POH 1-5

Maximum Ramp Weight	10,160 lbs
Maximum Take-off Weight	10,100 lbs
Maximum Landing Weight	9,700 lbs
Maximum Zero Fuel Weight	No limitation

CENTER OF GRAVITY LIMITS (LANDING GEAR EXTENDED)

POH 1-5

Aft Limit: 160.0 inches aft of datum at all weights.

FORWARD LIMIT	STATION (AFT OF DATUM)
At 10,100 lbs	152.0 inches
At 9,700 lbs	150.7 inches
At 7,850 lbs or less	144.7 inches

7. FLIGHT AND OPERATING LIMITS

MANEUVERS

POH 1-4

This is a normal category airplane. Acrobatic maneuvers, including spins, are prohibited.

Maximum Operating Altitude	31,000 feet
Maximum Take-off Ambient Temperature	ISA + 37°C
Flight Load Factors (at 10,100 lbs design gross weight)	Maneuver: +3.70 g / -1.68 g
Maximum Operating Cabin Pressure Differential	4.6 psi
Fuselage Pressure Vessel Structural Life Limit	20,000 hours
Starter Operating Time Limit	40 sec ON, 60 sec OFF, 40 sec ON, 60 sec OFF, 40 sec ON, then 30 min OFF.

NOTE

Do not use controls abruptly above 175 knots CAS.

AFT-FACING CHAIRS

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

8. ICE AND RAIN PROTECTION

MINIMUM OIL TEMPERATURE FOR FLIGHT (FUEL ICING)

POH 1-2

Engine oil is used to heat the fuel entering the fuel control. Because no fuel temperature measurement is available at that point, the fuel temperature is assumed equal to OAT. The AFM's Minimum Oil Temperature graph is used in preflight planning to identify conditions where fuel-control icing could occur. If oil temperature versus OAT indicates possible ice formation during take-off or in flight, anti-icing additive per MIL-I-27686 must be mixed with the fuel at refueling.

CAUTION

Anti-icing additive must be properly blended with the fuel to avoid deterioration of the fuel cell. The additive concentration by volume shall be a minimum of 0.060% and a maximum of 0.15%. Approved blending procedures are in Section II, Normal Procedures.

JP-4 fuel per MIL-T-5624 has MIL-I-27686 anti-icing additive blended at the refinery — no further treatment is necessary. Some suppliers blend additive in their storage tanks; before refueling, check whether the fuel has already been blended, and blend only enough additive for the unblended fuel.

9. PLACARDS

OVERHEAD PANEL — AIRSPEED LIMITATIONS

POH 1-5

Two variants of the overhead AIRSPEED LIMITATIONS placard are published, reflecting different airplane configurations — both value sets are shown; confirm the applicable placard for the specific serial number.

AIRSPEED LIMITATION	VARIANT A	VARIANT B
Max Operation (SL to 15,500 ft; -4 kt per 1,000 ft above)	226 kt	226 kt
Max Gear Extension	186 kt	156 kt
Max Gear Retract	146 kt	130 kt
Max Gear Extended	156 kt	156 kt
Max Approach Flap	174 kt	174 kt
Max Full Down Flap	140 kt	130 kt
Max Maneuvering	175 kt	175 kt
Min Single-Engine Control	88 kt	88 kt
Recommended Approach Speed	96 kt	96 kt
Recommended Twin-Engine Climb — Best Angle	103 kt	103 kt
Recommended Twin-Engine Climb — Best Rate	113 kt	113 kt

This airplane is approved for VFR, IFR day and night operation, and flight into icing conditions. This airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards, markings, and manuals. No acrobatic maneuvers, including spins, are approved.

CAUTION

Stall warning is inoperative when the master switch is off. The standby compass is erratic when windshield anti-ice and/or air conditioner and/or electric heat is on.

OTHER LIMITATION PLACARDS

POH 1-6 to 1-10

- On lower left corner of center subpanel (WARNING): Prop Sync switch must be in the OFF position for take-off and landing.
- Adjacent to copilot's airspeed indicator: See limitations placard for "Max. Operation" above 15,500 ft.
- On curved pedestal adjacent to power levers (CAUTION): Reverse only with engines running.
- On pedestal adjacent to cabin pressurization controller (WARNING): De-pressurize cabin before landing.
- On window-frame escutcheon adjacent to front seats: All aft-facing seats must have back upright and headrest fully raised during take-off and landing.
- On aft wall of baggage compartment / nose baggage compartment: Total compartment capacity, including baggage and/or passenger and/or equipment, not to exceed 350 lb (see Weight & Balance section for loading).
- On emergency exit hatch release cover (CAUTION): Do not open escape hatch when cabin is pressurized.
- Inside airstair door (CAUTION): Do not open door when cabin is pressurized; do not check security of the cabin door by moving the door handle unless the cabin is depressurized and the aircraft is on the ground.

10. KINDS OF OPERATION**APPROVED KINDS OF OPERATION**

POH 1-1

The Beechcraft King Air E90 is approved for the following kinds of operation, as defined in the AFM, when the required equipment is installed and operable:

#	KIND OF OPERATION
1	VFR — Day
2	VFR — Night
3	IFR — Day
4	IFR — Night
5	Icing Conditions

NOTE

This airplane is approved for flight into icing conditions when the following equipment is installed and operable: wing and empennage surface deice system, electrothermal propeller deice system, fuel vent heaters, heated stall warning, heated pitot, heated left windshield, engine air inlet electrothermal boots, inertial separator system, alternate static air source, and auto-ignition.

11. V-SPEED DEFINITIONS (GENERAL REFERENCE)

Takeoff and Initial Climb

V-Speed	Name	Meaning
V1	Takeoff decision speed	Maximum speed at which a reject may be initiated; at or above it the takeoff must be continued.
Vr	Rotation speed	Speed at which the pilot rotates to raise the nose.
Vlof	Lift-off speed	Speed at which the aircraft first becomes airborne.
V2	Takeoff safety speed	Target climb speed with the critical engine inoperative.
V2min	Minimum takeoff safety speed	Lowest allowable V2 .
Vef	Engine-failure speed	Speed at which the critical engine is assumed to fail (certification).
Vmu	Minimum unstick speed	Slowest speed at which the aircraft can safely lift off.
Vfto	Final takeoff speed	Speed in the final takeoff / climb segment.

Climb Performance

V-Speed	Name	Meaning
Vx	Best angle of climb	Most altitude gained per distance over the ground.
Vy	Best rate of climb	Most altitude gained per unit of time.
Vxse	Best angle, single-engine	Vx with one engine inoperative (multiengine).
Vyse	Best rate, single-engine	Vy with one engine inoperative — the blue line .

Stall Speeds

V-Speed	Name	Meaning
Vs	Stall speed	Minimum steady flight speed at which the aircraft is controllable.
Vs0	Stall speed, landing configuration	Stall with full flaps and gear down — bottom of the white arc.
Vs1	Stall speed, clean configuration	Stall in a specified (usually clean) configuration — bottom of the green arc.
Vsr	Reference stall speed	Certification reference stall speed.
Vsse	Safe single-engine speed	Minimum speed for intentionally cutting one engine.
Vsw	Stall warning speed	Speed at which the stall warning activates.

Airspeed Indicator Limit Speeds

V-Speed	Name	Meaning
Va	Design maneuvering speed	Maximum speed for full or abrupt control inputs without overstress.
Vno	Maximum structural cruising speed	Normal operating limit — top of the green arc, start of the yellow arc.
Vne	Never-exceed speed	The red line — never exceed.
Vfe	Maximum flap-extended speed	Top of the white arc.
Vle	Maximum landing-gear-extended speed	Maximum speed flying with the gear down.
Vlo	Maximum landing-gear-operating speed	Maximum speed to extend or retract the gear.
Vmo / Mmo	Maximum operating limit speed / Mach	Maximum operating airspeed and Mach number.

Approach and Landing

V-Speed	Name	Meaning
Vref	Landing reference speed	Threshold-crossing speed, typically 1.3 x Vs0 .
Vapp	Approach speed	Target speed on final approach.
Vbg	Best glide speed	Speed for maximum glide distance (best lift-to-drag ratio).

Multiengine Control

V-Speed	Name	Meaning
Vmc / Vmca	Minimum control speed (airborne)	Minimum speed to maintain control with the critical engine inoperative — red radial line.
Vmcg	Minimum control speed (ground)	Minimum control speed on the takeoff roll.
Vmcl	Minimum control speed (landing)	Minimum control speed in the landing configuration.
Vmbe	Maximum brake energy speed	Maximum speed from which the brakes can absorb a rejected takeoff.

Design and Certification Speeds

V-Speed	Name	Meaning
Vb	Design gust-intensity speed	Turbulence-penetration design speed.
Vc	Design cruising speed	Certification design cruising speed.
Vd / Vdf	Design / demonstrated diving speed	Certification dive speed.
Vf	Design flap speed	Certification design flap speed.
Vh	Maximum level-flight speed	Maximum speed in level flight at maximum continuous power.

NOTE

These are certification design speeds. They are rarely referenced in day-to-day operations.

Airspeed Indicator Colour Markings

V-Speed	Name	Meaning
White arc	Flap operating range	Vs0 to Vfe .
Green arc	Normal operating range	Vs1 to Vno .
Yellow arc	Caution range	Vno to Vne — smooth air only.
Red line	Never exceed	Vne .
Blue line	Best rate, single-engine	Vyse (multiengine).
Red radial	Minimum control speed	Vmc (multiengine).

NOTE

The colour markings are defined by the V-speeds above, so a change to a limitation speed changes the arc.