

SECTION 2 LIMITATIONS

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INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section and in Section 9 have been approved by the Federal Aviation Administration. Observance of these operating limitations is required by Federal Aviation Regulations.

NOTE

Refer to the Supplements, Section 9, of this Pilot's Operating Handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

NOTE

The airspeeds listed in the Airspeed Limitations chart (Figure 2-1) and the Airspeed Indicator Markings chart (Figure 2-2) are based on Airspeed Calibration data shown in Section 5 with the normal static source. If the alternate static source is being used, ample margins should be observed to allow for the airspeed calibration variations between the normal and alternate static sources as shown in Section 5.

The Cessna Model 172S is certificated under FAA Type Certificate No. 3A12.

AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in Figure 2-1. Maneuvering speeds shown apply to normal category operations. The utility category maneuvering speed is 98 KIAS at 2200 pounds.

SYMBOL	SPEED	KCAS	KIAS	REMARKS
V _{NE}	Never Exceed Speed	160	163	Do not exceed this speed in any operation.
V _{NO}	Maximum Structural Cruising Speed	126	129	Do not exceed this speed except in smooth air, and then only with caution.
V _A	Maneuvering Speed: 2550 Pounds 2200 Pounds 1900 Pounds	102 95 88	105 98 90	Do not make full or abrupt control movements above this speed.
V _{FE}	Maximum Flap Extended Speed: 10° Flaps 10° to 30° Flaps	107 85	110 85	Do not exceed this speed with flaps down.
—	Maximum Window Open Speed	160	163	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code significance are shown in Figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	40 - 85	Full Flap Operating Range. Lower limit is maximum weight V_{S0} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	48 - 129	Normal Operating Range. Lower limit is maximum weight V_{S1} at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	129-163	Operations must be conducted with caution and only in smooth air.
Red Line	163	Maximum speed for all operations.

POWERPLANT LIMITATIONS

Engine Manufacturer: Textron Lycoming.

Engine Model Number: IO-360-L2A.

Maximum Power: 180 BHP rating.

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum Engine Speed: 2700 RPM.

NOTE

The static RPM range at full throttle is 2300 - 2400 RPM.

Maximum Oil Temperature: 245°F (118°C).

Oil Pressure, Minimum: 20 PSI.

Maximum: 115 PSI.

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Fuel Grade: See Fuel Limitations.

Oil Grade (Specification):

MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil or MIL-L-22851 or SAE J1899 Ashless Dispersant Oil. Oil must comply with the latest revision and/or supplement for Textron Lycoming Service Instruction No. 1014.

Propeller Manufacturer: McCauley Propeller Systems.

Propeller Model Number: 1A170E/JHA7660.

Propeller Diameter : Maximum 76 inches.
: Minimum: 75 inch minimum.

POWERPLANT INSTRUMENT MARKINGS

Powerplant instrument markings and their color code significance are shown in Figure 2-3.

INSTRUMENT	RED LINE (MINIMUM)	GREEN ARC (NORMAL OPERATING)	RED LINE (MAX)
Tachometer: Sea Level 5000 Feet 10,000 Feet	----	2100 to 2500 RPM 2100 to 2600 RPM 2100 to 2700 RPM	2700
Oil Temperature	----	100 to 245°F	245°F
Oil Pressure	20 PSI	50 to 90 PSI	115 PSI
Fuel Quantity	0 (1.5 Gal. Unusable Each Tank)		
Fuel Flow	----	0 to 12 GPH	----
Vacuum Gage	----	4.5 - 5.5 in.Hg	----

Figure 2-3. Powerplant Instrument Markings

WEIGHT LIMITS

NORMAL CATEGORY

Maximum Ramp Weight: 2558 lbs.

Maximum Takeoff Weight: 2550 lbs.

Maximum Landing Weight: 2550 lbs.

Maximum Weight in Baggage Compartment:

Baggage Area 1 - Station 82 to 108: 120 lbs.

Baggage Area 2 - Station 108 to 142: 50 lbs.

NOTE

The maximum combined weight capacity for baggage areas 1 and 2 is 120 lbs.

UTILITY CATEGORY

Maximum Ramp Weight: 2208 lbs.

Maximum Takeoff Weight: 2200 lbs.

Maximum Landing Weight: 2200 lbs.

Maximum Weight in Baggage Compartment: In the utility category, the baggage compartment must be empty and rear seat must not be occupied.

CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Center of Gravity Range:

Forward: 35.0 inches aft of datum at 1950 lbs. or less, with straight line variation to 41.0 inches aft of datum at 2550 lbs.

Aft: 47.3 inches aft of datum at all weights.

Reference Datum: Lower portion of front face of firewall.

UTILITY CATEGORY

Center of Gravity Range:

Forward: 35.0 inches aft of datum at 1950 lbs. or less, with straight line variation to 37.5 inches aft of datum at 2200 lbs.

Aft: 40.5 inches aft of datum at all weights.

Reference Datum: Lower portion of front face of firewall.

MANEUVER LIMITS

NORMAL CATEGORY

This airplane is certificated in both the normal and utility category. The normal category is applicable to aircraft intended for non aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and turns in which the angle of bank is not more than 60°.

NORMAL CATEGORY MANEUVERS AND RECOMMENDED ENTRY SPEED*

Chandelles	105 Knots
Lazy Eights	105 Knots
Steep Turns	95 Knots
Stalls (Except Whip Stalls)	Slow Deceleration

* Abrupt use of the controls is prohibited above 105 KIAS.

UTILITY CATEGORY

This airplane is not designed for purely aerobatic flight. However, in the acquisition of various certificates such as commercial pilot and flight instructor, certain maneuvers are required by the FAA. All of these maneuvers are permitted in this airplane when operated in the utility category.

In the utility category, the rear seat must not be occupied and the baggage compartment must be empty .

UTILITY CATEGORY MANEUVERS AND RECOMMENDED ENTRY SPEED*

Chandelles	105 Knots
Lazy Eights	105 Knots
Steep Turns	95 Knots
Spins	Slow Deceleration
Stalls (Except Whip Stalls)	Slow Deceleration

*** Abrupt use of the controls is prohibited above 98 knots.**

Aerobatics that may impose high loads should not be attempted. The important thing to bear in mind in flight maneuvers is that the airplane is clean in aerodynamic design and will build up speed quickly with the nose down. Proper speed control is an essential requirement for execution of any maneuver, and care should always be exercised to avoid excessive speed which in turn can impose excessive loads. In the execution of all maneuvers, avoid abrupt use of controls.

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Flight Load Factors (Maximum Takeoff Weight - 2550 lbs.):

*Flaps Up	+3.8g, -1.52g
*Flaps Down	+3.0g

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

UTILITY CATEGORY

Flight Load Factors (Maximum Takeoff Weight - 2200 lbs.):

*Flaps Up	+4.4g, -1.76g
*Flaps Down	+3.0g

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

KINDS OF OPERATION LIMITS

The airplane as delivered is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

Total Fuel: 56 U.S. gallons (2 tanks at 28.0 gallons each).

Usable Fuel (all flight conditions): 53.0 U.S. gallons.

Unusable Fuel: 3.0 U.S. gallons (1.5 gallons each tank).

NOTE

To ensure maximum fuel capacity and minimize cross-feeding when refueling, always park the airplane in a wings-level, normal ground attitude and place the fuel selector in the Left or Right position. Refer to Figure 1-1 for normal ground attitude definition.

ADDITIONAL FUEL LIMITATIONS

Takeoff and land with the fuel selector valve handle in the BOTH position.

Maximum slip or skid duration with one tank dry: 30 seconds.

Operation on either LEFT or RIGHT tank limited to level flight only.

With 1/4 tank or less, prolonged uncoordinated flight is prohibited when operating on either left or right tank.

Fuel remaining in the tank after the fuel quantity indicator reads 0 (red line) cannot be safely used in flight.

Approved Fuel Grades (and Colors):

100LL Grade Aviation Fuel (Blue).

100 Grade Aviation Fuel (Green).

OTHER LIMITATIONS

FLAP LIMITATIONS

Approved Takeoff Range: 0° to 10°

Approved Landing Range: 0° to 30°

PLACARDS

The following information must be displayed in the form of composite or individual placards.

1. In full view of the pilot: (The "DAY-NIGHT-VFR-IFR" entry, shown on the example below, will vary as the airplane is equipped).

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category or in the Utility Category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

Normal Category	No acrobatic maneuvers, including spins, approved.
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Utility Category	No acrobatic maneuvers approved, except those listed in the Pilot's Operating Handbook.
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Baggage compartment and rear seat must not be occupied.

Spin Recovery	Opposite rudder - forward elevator - neutralize controls.
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Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY-NIGHT-VFR-IFR

2. On the fuel selector valve:

	TAKEOFF LANDING	BOTH 53.0 GAL.	ALL FLIGHT ATTITUDES
FUEL SELECTOR			
LEFT 26.5 GAL. LEVEL FLIGHT ONLY			RIGHT 26.5 GAL. LEVEL FLIGHT ONLY

3. Near fuel tank filler cap:

FUEL 100LL/100 MIN. GRADE AVIATION GASOLINE CAP. 26.5 U.S. GAL. USABLE CAP 17.5 U.S. GAL USABLE TO BOTTOM OF FILLER INDICATOR TAB

4. On flap control indicator:

0° to 10°	110 KIAS	(Partial flap range with blue color code; also, mechanical detent at 10°.)
10° to 30°	85 KIAS	(White color code; also, mechanical detent at 20°.)

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5. In baggage compartment:

120 POUNDS MAXIMUM BAGGAGE
FORWARD OF BAGGAGE DOOR LATCH

50 POUNDS MAXIMUM
BAGGAGE AFT OF BAGGAGE DOOR LATCH

MAXIMUM 120 POUNDS COMBINED

FOR ADDITIONAL LOADING INSTRUCTIONS
SEE WEIGHT AND BALANCE DATA

6. A calibration card must be provided to indicate the accuracy of the magnetic compass in 30° increments.

7. On the oil filler cap:

OIL
8 QTS

8. On control lock:

CAUTION!
CONTROL LOCK
REMOVE BEFORE STARTING ENGINE

9. Near airspeed indicator:

MANEUVERING SPEED - 105 KIAS

10. On the Upper Right Side of the Aft Cabin Partition:

EMERGENCY LOCATOR TRANSMITTER
INSTALLED AFT OF THIS PARTITION
MUST BE SERVICED IN ACCORDANCE
WITH FAR PART 91.207

11. On forward face of firewall adjacent to the battery:

CAUTION 24 VOLTS D.C.
THIS AIRCRAFT IS EQUIPPED WITH ALTERNATOR
AND A NEGATIVE GROUND SYSTEM.
OBSERVE PROPER POLARITY.
REVERSE POLARITY WILL DAMAGE ELECTRICAL
COMPONENTS.

12. On the upper right instrument panel:

SMOKING PROHIBITED

