Limitations

Section II

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GENERAL

The data approved by Express Design Inc. (EDI) and the Limitations presented herein are those established by EDI as applicable to the ~~Express~~ aircraft. Where there are differences between these models it will be so identified.

This section follows the format approved by the GAMA Specification #1, and is intended to provide operating guidelines and limitations specific to the ~~Express~~ aircraft only. All airspeeds quoted are given conventional nomenclature, are shown in knots, calibrated airspeed, and assume zero instrument error.

NOTE

It is imperative that you calibrate your airspeed system (static and pitot) to provide the corrections to the values shown below in KCAS or mph. If there is instrument (gauge) error that needs to be factored in also to reach KIAS (Indicated).

Engines

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These Express Design Inc. aircraft are powered by standard aircraft engines, the power varying from 200 to 280 HP. They are horizontally opposed, can be liquid or air cooled, four or six cylinder engines made by Textron Lycoming or Teledyne Continental. Four versions are shown in Section A thru D herein.

AIRCRAFT OPERATING SPEEDS

~~Express~~ Aircraft, General

SPEED	MARKING		KCAS	(mph)
Never Exceed Speed	Vne	Red Line	**204**	**(235)**
Caution,smooth air only		Yellow Arc	123-151	(142-174)
Maneuvering Speed	Va		123 ~~180~~	(142)
Normal Oper Range	Vno	Green Arc	104-~~151~~	(120-174)
Full Flap Oper Range	Vfe	White Arc	50-~~87~~ 123 104	(58-100)
Clean stall speed	Vs		55	(63)
Stall speed Ldg Config	Vso		50	(58)

POWERPLANT LIMITATIONS
OPERATING LIMITATIONS

Operating limitations for various engines used in Express models are shown below. If your engine differs, you must account for that. In addition, the data and limits shown are for new specification engines and does not reflect any degradation due to age, number or quality of overhauls.

IO-360 -ES (Continental Specification, 210 HP)

T.O. & Max Continuous RPM

Full throttle, red line,2800 rpm

Normal operation, 600 (idle) 2200 - 2500 rpm(cruise)

Cylinder Head Temperatures

Maximum,	460°F (238°C)
Normal Operating Range,	200 - 430 °F (90-221°C)
Recommended,	325 - 380°F (163-193°C)

Oil Temperatures

Maximum,	240°F (115°C)
Desired Operating,	160 - 180°F (71-820°C)

Oil Pressure

Minimum Operating (idle),	10 psig (0.68 atm)
Normal Operation,	30 - 60 psi (2-4.1 atm)
Maximum (starting & warm up),	100 psi (6.8 atm)

Fuel Flow

Cruise,	55%/48#/hr, 75%/60#/hr

Fuel Pump Inlet Pressure

Maximum,	+8.0 psig (0.54 atm)
Recommended,	-1.0 psig (-0.07 atm)
Minimum, -2.0 psig	(-0.14 atm)

Vacuum Pressure

Normal Operating Range,	4.3 - 5.9 In.Hg.

IO-550-G (Continental Specification, 280 HP)

Power Settings

Full Throttle & Max Cont, 280 HP, 127 #/hr, 2500 rpm

75% Pwr, 210 HP, 72 #/hr

65% Pwr, 182 HP, 62 #/hr

Normal Operation, 600(idle) 2200-2500 rpm (cruise)

Cylinder Heat Temperatures

Maximum, 460°F (238°C)

Normal Operating Range, 200-420 °F (90-215°C)

Recommended, 325-380°F (163-193°C)

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Oil Pressure

Minimum Operating (idle), 10 psig (0.68 atm)

Normal Operation, 30-60 psi (2-4.1 atm)

Maximum (starting & warm up), 100 psi (6.8 atm)

Fuel Pump Inlet Pressure

Maximum, +8.0 psig(0.54 atm)

Recommended, -1.0 psig (-0.07 atm)

Minimum, -2.0 psig (-0.14 atm)

Vacuum Pressure

Normal Operating Range, 4.3-5.9 in.Hg.

200 HP, IO-360 -A,C,D,J,K

(Lycoming Specification)

T.O. & Max Continuous RPM

Full throttle, red line,	2700 rpm
Normal operation,	600 (idle) 2350 - 2450 rpm (cruise)

Cylinder Head Temperatures

Maximum,	475°F (246°C)
Normal Operating Range,	325 - 380°F (163-193°C)
Recommended,	150 - 435 °F (65-223°C)

Oil Temperatures

Maximum,	240°F (115°C)
Desired Operating,	160 - 180°F (71-820°C)

Oil Pressure

Minimum Operating (idle),	10 psig
Normal Operation,	30 - 60 psi
Maximum (starting & warm up),	100 psi

Fuel Flow

Cruise,	65% = 61#/hr, 75% = 79#/hr

Fuel Pump Inlet Pressure

Maximum,	+8.0 psig (0.54 atm)
Recommended,	-1.0 psig (-0.07 atm)
Minimum,	-2.0 5 psig (-0.14 atm)

Vacuum Pressure

Normal Operating Range,	4.3 - 5.9 In.Hg

260 HP, IO-540-C4B5

(Lycoming Specification)

T.O. & Max Continuous RPM

Full throttle, red line,	2700 rpm
Normal operation,	600 (idle) 2350 - 2450 rpm (cruise)

Cylinder Head Temperatures

Maximum,	475°F (246°C)
Normal Operating Range,	325 - 380°F (163-193°C)
Recommended,	150 - 435 °F (65-223°C)

Oil Temperatures

Maximum,	240°F (115°C)
Desired Operating,	160 - 180°F (71-820°C)

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Oil Pressure

Minimum Operating (idle),	10 psig
Normal Operation,	30 - 60 psi
Maximum (starting & warm up),	100 psi

Fuel Flow

Cruise,	65% = 61#/hr, 75% = 79#/hr

Fuel Pump Inlet Pressure

Maximum,	+8.0 psig (0.54 atm)
Recommended,	-1.0 psig (-0.07 atm)
Minimum,	-2.0 5 psig (-0.14 atm)

Vacuum Pressure

Normal Operating Range,	4.3 - 5.9 In.Hg.

FUEL GRADES (Aviation Gasoline)
See your engine handbook for fuel requirements
100LL* or 100** minimum (Use of auto gas by STC only)

*Blue, **Green, Maximum lead content 2 cc/gal

OIL SPECIFICATION

Following initial break-in of the engine it should be operated with an ashless dispersant oil (MIL-L-22851) conforming to the applicable Contintntal or Lycoming engine handbook. Break-in (the first 50 hours or until oil consumption has stabilized) should be accomplished using a corrosion preventative oil or straight mineral oil. Low power settings (less than 65-75%) should be avoided during the break-in period and the oil level checked frequently.

PROPELLERS

is recommended that the Express be fitted with a constant speed propeller. Other propellers are available for installations. The McCauley 2A34C221-B/G-90DHC-16E was installed on the Continental IO-360ES, and the B2A34C225 is being installed on the Moriah. McCauley has approved the 415 propeller for their Lycoming 360 installation. All props must meet the minimum ground clearance requirements, for recommended operation out of grass airfields and extreme care must be exercised to avoid propeller strikes and foreign object damage.

Your propeller must match your airframe dynamically. Use only props approved for use with your engine, and then avoid operating at any rough rpm lest there be an airframe/engine/propeller

POWERPLANT INSTRUMENT MARKINGS

It is recommended that the following markings be made on the engine instrument gauges to conform to convention.

NOTE

General Continental and Lycoming engine values shown. The owner/operator should compare and correct (where different) for the particular model specifications for his installation.

OIL TEMPERATURE

Caution (Yellow Radial)	200 to 240°F
Normal Oper Range (Green arc)	160 (170) to 180 (220)°F
Maximum (Red radial)	240°F

OIL PRESSURE

Minimum (Idle, Red radial)	10 psi
Caution Range (Yellow arc)	10 to 30 psi
Operating Range(Green arc)	30 to 60 psi
Maximum - Cold oil (Red radial)	100 psi

TACHOMETER

Operating Range (Green arc) *	600 to 2750 (2450) rpm
Maximum (Red radial)	2800 (2500) rpm

* Your engine / propeller may have a limiting mid-range rpm. This must be marked with a short red band - **operation in this range must be avoided.**

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CYLINDER HEAD TEMPERATURE

Operating Range (Green arc)	240 to 380°F
Maximum (Red radial)	460°F
Recommended T.O. Minimum	240°F

MANIFOLD PRESSURE

Operating Range (Green arc)	15 to 29.6 in Hg.
Maximum (Red radial)	29.6 in. Hg.

FUEL FLOW ~ Lbs/hr

Operating Range(Green arc)	45%, (85%)
	41 to 77 (53 to 113)
Maximum Flow (Red radial)	110 (130)

INSTRUMENT MARKINGS

VACUUM PRESSURE

Operating Range (Green arc)	4.3 to 5.9 in. Hg.

WEIGHT LIMITS

Express FG- 200 HP:

Maximum Ramp, T.O. & Landing Weight	2895 lbs
Typical Empty Weight of Aircraft	1600 lbs
Maximum Baggage Weight	250 lbs

Express Loadmaster FG - 260 HP:

Maximum Ramp, T.O. & Landing Weight	2895 lbs
Typical Empty Weight of Aircraft	1700 lbs
Maximum Baggage Weight	250 lbs

CENTER OF GRAVITY LIMITS

FORWARD LIMITS

The allowable Center of Gravity (GC) range is from Fuselage Station (FS)_76.45 to FS 84.00. This is valid for both the FG and the RG models, and for all engine configurations.

AFT LIMIT

The aft CG limit is FS 84.00 inches, and must be considered a firm limit. Loadings which place the CG further aft are dangerous and must not be accepted. A "Weight and Balance" sheet must be completed and carried in the aircraft at all times. See Section VI.

REFERENCE DATUM

A Fuselage Station (FS) datum, must be used to establish your aircraft weight and balance. FS 34, the fwd face of the firewall, is generally a convenient location regardless of engine configuration.

MANEUVER LIMITS

The Express Models FG and RG aircraft are licensed as EXPERIMENTAL. Spins are not approved. Maneuvers which have been flown by Express Design approved test pilots are shown in the chart below. Care must be used and smooth control inputs used at all times when performing maneuvers which involve unusual aircraft attitudes, and instruction in such maneuvers is considered prudent.

DEMONSTRATED MANEUVERS

MANEUVER	ENTRY SPEED	MAX G'S
Chandelle	160 Kts	3.5
Lazy Eight	180 Kts	1.0 to 1.5
Stalls (not whip stalls)*	---	0.0 to 1.5

WARNING

Since these engines do not have an inverted oil system extreme care must be used during low or negative "g" maneuvers. Lack of oil pressure may cause the propeller to go to flat pitch and engine overspeed will result. Transient oil pressure conditions near zero must be limited to less than two (2) seconds. 1

NOTE

Speeds shown are calibrated. Corrections must be applied from a calibration of your aircraft to determine your proper entry indicated airspeeds.

All pilots are again reminded that instruction in unusual attitudes in the Express is highly desirable. Speed buildup during maneuvers can be rapid and proper control usage is essential throughout the maneuver to remain within limits. Express Design Inc. can help you find experienced instruction.

Minimum fuel in the wing tank under use is 20 gallons, auxiliary wing tanks should be empty. Sideslips should be limited to 30 seconds maximum and oil pressure should be monitored in accordance with the note above and fuel should be selected from the high wing during sideslips.

* *WARNING*. Aerobatics are not approved.

FLIGHT LOAD FACTOR LIMITS

Flaps up	+4.5, to -2.3 g's
Flaps down	+2.5 to -2.0 g's
Design Ultimate (Flaps up)	+8.8 to -4.4 g's

MINIMUM FLIGHT CREW

Minimum crew is one (1) pilot.

TYPES OF OPERATIONS AND LIMITS

The Express Models FG and RG are approved for the following types of flight when the required equipment is installed and operations are conducted as defined in this LIMITATIONS section.

1. VFR, day and night
2. IFR, day and night

WARNINGS

2 **1. Flight operations with passengers for hire and**
2. Flight into known icing is prohibited.

FUEL QUANTITIES

Standard Wing Tank (24 gal each wing)	48 gallons useable
Extended Wing Tank (18 gal each wing)	____ 36 gallons
With Dual Long Range wing tanks (Total)	____ 84 gallons

FUEL MANAGEMENT

Do not take-off with less than 8 gallons in the wing tanks. Since the engine is normally supplied fuel solely from the left or right main tank with injection return to one main, fuel must be used from that return tank initially. There is no interconnection between the wing tanks. A tank float operated warning light can be installed for alerting purposes. Fuel must be used from each wing by the pilot, maintaining left/right wing balance. Since other valving arrangements are possible, KNOW YOUR SYSTEM! Most accidents involve fuel, - lack of fuel or mishandling of onboard fuel.

WARNING

Failure to use from the return wing tank initially, could result in the pumping of the return fuel (from injected engines) overboard, out the vent line, and/or loss of the tank cap from excessive pressurization.

SEATING

This aircraft seats four adults, side by side,two front and two rear, and can be flown from either front seat (although dual rudder pedals and brakes are an option). The Loadmaster can also accomodate two children in two additional aft seats **providing the loading is such that the cg is maintained within limits**. The aft seats can be both forward or the left rear facing aft for improved rear passenger conversations.

WINTER OPERATIONS

Winter operations are acceptable with proper oil grades for the operating temperature.

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PLACARDS

All switches, lights, controls, adjustments and circuit breakers etc. should be marked with labels identifying what the switch, control, etc. is related to and what the position selects.

Safety related items such as door opening instructions, emergency shut-off, and seat belt/shoulder harness requirements should be placed where obvious and made clearly understandable. An example of this would be the door opening procedure. It should be placed appropriately near the door handle as well as being available in the EMERGENCY Section of this handbook (Red Tab).

An example of a switch marking is the strobe light switch. It should be labled as "Strobe" with "On" and "Off" positions identified. Convention is up is "on" and down is "off" for electrical switches. Circuit breakers should be labeled as to their rating, i.e. "5 Amp", "35 Amp", etc.

NOTE

There are two placards which must be installed.

1. The word "EXPERIMENTAL" must be placed where it can be prominently seen upon entry into the cabin. These letters must be at least 3 inches high, and contrast sufficiently to be seen on entry.

2. The baggage compartment must have a placard showing the maximum baggage allowed as shown on the weight and balance data sheet for the airplane.

In addition, the following are some recommended placards:

In front of the pilot;

Airspeed Limitations
Max Flap Extend Speed.....98 kts
Max Full Flaps....98 kts

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Near the main wing tank gauges;

Do Not Take-off With Less Than 12 Gallons in Main Tanks

Near the extended range tank fuel gauges;

26 Gallons Useable **26 Gallons Useable**

If anticollision light is NOT installed;

This Aircraft Not Fully Equipped for Night Flight

If strobe equipped;

Turn Strobe OFF when Taxiing in Vicinity of other Aircraft, or when Flying in Fog/Clouds. Standard Position Lights to be Used for All Night Flights.

Near canopy latch;

Latch Door Before Take-off
DO NOT OPEN IN FLIGHT

These placards can be photocopied, and laminated if desired and then pasted in a desirable location by the owner. It is recommended that all switches and circuit breakers also be labeled, and a dymo marker works well for that task. Further it is desirable to place all labels and placards such that all text is visible by the pilot when sitting in the cockpit seat. Seat belt must (and shoulder harness should) be installed and door and window opening placards should be visible by both occupants.

Special precautions should be used during flights in/around areas of atmospheric electrical activity as in thunderstorms. This aircraft, being of composite construction, conducts electricity most readily thru such as control cables, wiring etc., a condition to AVOID.

KINDS OF OPERATIONS

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EQUIPMENT LIST

This airplane may be operated in day or night VFR or day and night IFR in the United States if the appropriate equipment is installed and operable.

You as the builder and owner are responsible for the make-up of the Minimum Equipment List (MEL) for the airplane, and maintenance thereof prior to operation where the equipment is required. For example for a daytime flight, the position lights need not be operable however a strobe or anticollision light must be.

Minimum Equipment List (MEL)

System and/or Component	VFR, Day	VFR, Night	IFR, Day	IFR, Night	Remarks
ELECTRICAL PWR					
Alternator	0	1	1	1	Desirable
Battery	1	1	1	1	Desirable

System and/or Component	VFR, Day	VFR, Night	IFR, Day	IFR, Night	
Ammeter	1	1	1	1	
Voltmeter	0	0	0	0	
ENGINE					
Cyl Head Temp	0	0	0	0	Desirable
Exhaust Gas Temp	0	0	0	0	Desirable
Manifold Press	1	1	1	1	
Oil Pressure	1	1	1	1	
Oil Temperature	1	1	1	1	
FLT CONTROLS					
Elevator Trim System	1	1	1	1	
Flap Position Indicator	0	0	0	0	Desirable
FLT INSTRUMENTS					
Airspeed Indicator	1	1	1	1	
Altimeter	1	1	1	1	
Magnetic Compass	1	1	1	1	
Outside Air Temp	0	0	0	0	Desirable
FUEL SYSTEM					
Fuel Quantity Gauge/s	1	1	1	1	
Fuel Boost Pump	1	1	1	1	Desirable
Fuel Selector Valve(s)	1	1	1	1	
ICE/RAIN EQUIP					
Pitot Heat	0	0	0	0	Desirable
LANDING GEAR (If RG)					
Emergency Ext System	1	1	1	1	
Gear Warning Horn	0	0	0	0	Desirable

System and/or Component	VFR, Day	VFR, Night	IFR, Day	IFR, Night	Remarks
LIGHTS					
Cockpit Lights	0	1	0	1	Desirable
Landing Lights	0	0	0	0	Desirable
Navigation (Pos) Lights	0	3	0	3	
Rotating Beacon/Strobes	0	1	0	1	
PNEUMATIC SYSTEM					
Instrument Vacuum	0	1	1	1	
Pressure Gauge	0	1	1	1	
PUBLICATIONS					
Pilots Oper Handbook & Airplane Flight Manual	1	1	1	1	
Weight & Balance	1	1	1	1	
Pilots license/medical	1	1	1	1	
Maps, VFR flight	1	1	1	1	Desirable
Charts/Appr plates, IFR	1	1	1	1	
RESTRAINT SYSTEM					
Seat Belt/ Occupant	1	1	1	1	
Shoulder Harness	0	0	0	0	Desirable
Baggage Tiedown	0	0	0	0	Desirable

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