

# Handling, Servicing, & Maintenance

## Section VIII

Servicing

### Table of Contents

INTRODUCTION TO SERVICING.....	3
"51% Rule".....	3
"51%" Documentation Requirements.....	3
AIRPLANE INSPECTION PERIODS.....	5
ALTERATIONS OR REPAIRS.....	6
Ground Handling.....	6
Main Wheel Jacking.....	7
Nose Wheel Jacking.....	7
OUT-OF-SERVICE CARE.....	7
Preparation for Service.....	9
FUEL SERVICING.....	9
OIL SYSTEM SERVICING.....	9
BATTERY.....	10
TIRES.....	11
LANDING GEAR SHOCK ABSORBERS.....	11
BRAKES.....	12
INDUCTION AIR FILTER.....	12
INSTRUMENT VACUUM SYSTEM.....	12
PROPELLER.....	12
ELECTRICAL POWER.....	13
CARE AND CLEANING.....	13
ENGINE.....	15
RECOMMENDED SERVICING.....	16 & 17
NOTES:.....	18 thru 20

Section VIII  
Table of Contents

INTRODUCTION TO SERVICING ..... 3

"5150 Rule" ..... 3

"5150 Documentation Requirements" ..... 3

AIRPLANE INSPECTION PERIODS ..... 2

ALTERATIONS OR REPAIRS ..... 6

Ground Handling ..... 6

Main Wheel Jacking ..... 7

Nose Wheel Jacking ..... 7

**Intentionally Blank** ..... 7

OUT-OF-SERVICE CARE ..... 7

Preparation for Service ..... 9

FUEL SERVICING ..... 9

OIL SYSTEM SERVICING ..... 9

BATTERY ..... 10

TIRES ..... 11

LANDING GEAR SHOCK ABSORBERS ..... 11

BRAKES ..... 12

INDUCTION AIR FILTER ..... 12

INSTRUMENT/VACUUM SYSTEM ..... 12

PROPELLER ..... 12

ELECTRICAL POWER ..... 13

CARE AND CLEANING ..... 13

ENGINE ..... 13

RECOMMENDED SERVICING ..... 16 & 17

NOTES ..... 17

## INTRODUCTION TO SERVICING

This section is designed to help you the owner and pilot of your *Express* to service and maintain it in a safe and efficient manner. The information herein is approved by Express Design Inc. The intended user of this handbook is the pilot, not the aircraft's mechanic. The information herein is intended as a guide to maintaining the aircraft and assumes any/all work accomplished is of such quality that structural or aerodynamic integrity is not compromised. Inspections, inspection periods and servicing information herein should be used as a guide.

### "51% Rule"

Your *Express* is in a growing group of aircraft called amateur built. This group of aircraft is unique in that, under the proper conditions, you the builder can become that aircraft's "Certified Repairman" under the Federal Aviation Agency "51% Rule". This has many far-reaching advantages which allow you the builder to service, alter, and maintain that aircraft throughout its "life". This obviously has many advantages and is probably part of the reason you purchased the aircraft.

### "51%" Documentation Requirements

As you build your aircraft we hope that you keep good track of bills showing that 1)-You bought the parts and they were shipped to you. 2)- Pictures of you in the process of building the machine are considered mandatory by some agency personnel, and the more the better. Be sure to date each picture, adding some ID as to which part of the builder's manual being worked. Finally 3)-A notebook (preferably bound) log of your building process is recommended. This log should contain your hand written day-by-day description of work performed. References to the builder's manual section should be included and the pictures posted in this log is ideal. Each day's entry should be initialed or signed just as a pilot's log book is endorsed by the pilot.

Given this documentation you should have no problem obtaining your "Repairman" certificate. With this certificate you then are in effect the A&P and the AI for your aircraft (plus engine and propeller) and can perform any and all maintenance it may require, modify, add or remove equipment, etc. with the resulting savings in both time and dollars.

## WARNING

It remains your responsibility as pilot to insure that the aircraft remains airworthy. For example your altimeter and transponder must be checked each 24 months by a certified repair station before the plane can be flown in the IFR system.

All limits, procedures, safety practices, servicing instructions and requirements contained in this handbook are considered by EDI to be mandatory. It is strongly recommended that you secure the services of an FBO familiar with the *Express* or at least this type of amateur built aircraft for support. This will benefit both you as the owner and the FBO by becoming your second pair of eyes on an as required basis. EDI or your local EAA chapter can supply you with helpful information in this regard.

### 4 Non-owner Built Aircraft

If you purchased your *Express* from the builder, it then falls under the rules of all other aircraft and owner/pilot maintenance is significantly restricted. It is then treated just as a commercially built aircraft except that an AI is not required for annuals, and A&P can perform annuals on an "amateur built" aircraft. (The original builder still may perform any and all work on your aircraft, the one he built, however.)

For aircraft registered in the United States, FAR Part 43 defines the types of servicing and maintenance that a certified pilot who owns or operates the aircraft may perform. For other countries the registry of that country should be consulted to define the work that may be performed by the pilot. All other maintenance required must be performed by appropriately licensed personnel.

In this case it is again recommended that you secure the services of an FBO for your maintenance so that it can become familiar with the aircraft. Such personnel will undoubtedly want to familiarize themselves with the aircraft and will need access to the builder's manuals, blueprints, etc. in order to best serve your needs.



## AIRPLANE INSPECTION PERIODS

### FAA Required Inspection Periods

An annual inspection is required on all aircraft. This inspection must include an inspection of the landing gear, all structure for cracks, evidence of delaminations, corrosion of parts, security of fittings and fasteners, a compression test of the engine's cylinders, and an inspection of the propeller. This "Annual Inspection" must be signed off in the aircraft log book by the inspector as well as must any repairs necessary due to items found during the inspection.

### Recommended Inspections

It is recommended that two additional levels of inspections beyond the preflight inspection found in Section IV of this handbook be made. These are at 25 hour and 100 hour intervals. Your new aircraft will undoubtedly be given several "100 hour" inspections at earlier intervals, a practice which is also recommended. In addition there are continuing care items, items which have a recommended overhaul or replacement schedule, and special inspections required due, such as gear or flap extensions at high speeds.

The 25 hour inspection is intended to cover rather routine items of wear such as tires, oil changes, cable end fittings, brake linings, hose and wire fretting and rubbing areas, etc.

The 100 hour inspection takes a more in-depth look at the aircraft for structural cracks, delaminations, etc. much as an annual inspection. It is recommended that the aircraft be thoroughly washed, the engine cleaned, compression checked and a complete review of the aircraft and engine log book be made to insure all FAA (or appropriate registering agency) requirements for such items as altimeter checks, item TBOs, etc. This inspection must be recorded in the aircraft and engine log books and signed by the inspector. Since your aircraft is registered as an EXPERIMENTAL aircraft it cannot be used for hire, however for aircraft flown regularly, accumulating many hours through the year this is a recommended inspection.

## ALTERATIONS OR REPAIRS

If you built your aircraft and have received your "Repairman" certification, you may make any modifications desired however in the interest of safety we strongly recommend that you seek experienced consultation before making any modifications to your aircraft. We take pride in your *Express* as well and have your best interest at heart.

If you purchased your aircraft, your local FAA inspector will be interested if you make any alterations. They may contact EDI or its dealers for advice. In any case, the work must be performed by properly licensed personnel.

### NOTE

Only EDI or its dealers approved parts should be used for any repairs to your *Express*. Salvage parts, or parts whose history cannot be fully traced and their care in storage and handling completely defined and determined acceptable by EDI or its dealers are not acceptable and are considered unsafe for use.

## 6

### GROUND HANDLING

The three view drawing shows the dimensions of your *Express* and its hangar requirements. See Section I.

### CAUTION

Proper inflation of the air/oleo style nose strut should be maintained to insure adequate propeller clearance. (No owner maintenance is permitted on the strut). While ground handling your *Express* the propeller should be placed in the horizontal position. Use care when turning the propeller-

**ASSUME THE MAGNETOS ARE HOT!**

### Towing

Your *Express* is an exceptionally light aircraft and should present no problems while ground handling. Mechanically attached towing is generally not recommended. If mechanical towing is necessary a tow bar fitting in the nose wheel axle should be used and extreme care taken. Hand towing is recommended as are wing walkers when towing in confined spaces.

## CAUTION

Do not exert force on the propeller or control surfaces during towing by hand. If the nose wheel must be raised, apply weight on the fuselage forward of the empennage, not on the horizontal stabilizer. With the nose wheel off the ground, the aircraft can be pivoted around the main gear as required.

## Tie-downs

Built in tie-downs should be used to secure your aircraft unless it is hangared. Tie-down ropes should be left with some slack to allow for any rope shrinkage. Manila or hemp ropes should not be used. Chains can be essentially snug. Chocks for the main gear wheels are also recommended.

## MAIN WHEEL JACKING

The aircraft can have one wheel raised by jacking. Care must be used to prevent damage to the landing gear doors. A scissors or "bottle" type hydraulic jack is recommended. An allowance must be made for the compression pads to extend the wheel to its limit. At this point the wheel may be removed for servicing of the wheel and/or brake.

## CAUTION

Anytime an aircraft is on jacks NO personnel should be allowed in or on the aircraft.

## NOSE WHEEL JACKING

The nose wheel may be raised easily by securing some weight about the fuselage forward of the empennage. A 4 inch wide strap is recommended or the use of the tail tie down point. Approximately 150 pounds is required. Again care must be observed and the caution note above applies.

## OUT-OF-SERVICE CARE

Should you be required to place your *Express* in storage precautions to protect it from deterioration are recommended. If long term storage is required protection from the elements is the primary concern. With the *Express* it may be easiest to remove the wings and store in your garage

where you have (or can provide) some control over temperature and humidity. In any case the most susceptible element of your aircraft is the engine's cylinder walls and bearing surfaces. The engine should be preserved according to the manufacturer's directions. These will essentially require it to be desiccated (have desiccant plugs installed), and replace the oil with a preservative oil such as "MIL-L-1010" as well as plugging the intake and exhaust ports with a desiccant.

The airframe will withstand the storage quite well under almost any circumstances since it is of high temperature materials, however, the upholstery, instruments and avionics will suffer from excessive heat and exposure to the sun so a cover is recommended. Elastomers such as tires also need to be protected from exposure to ultraviolet to limit their deterioration.

Fuel tanks should be filled or drained completely, the control surfaces locked, the aircraft electrically grounded, a pitot cover installed, the static port (or ports if installed on both sides) covered, the engine and cabin cooling air intake (NACA inlets) covered or plugged, and the

**8** battery removed.

### **Flyable Storage**

If the aircraft is to be put into flyable storage, the engine would not be preserved nor the desiccated plugs installed. Once a week the engine should be rotated by hand some 4 to 6 revolutions, and left in a different position.

### **WARNING**

**Before rotating the propeller make sure the mag switches are OFF, the throttle closed, and the mixture control in the CUT-OFF position. When turning the propeller assume it may start by standing clear.**

Each month, the aircraft should be started and run. It is preferable to fly the aircraft for thirty (30) minutes as the *Express* engine compartment is tight and inadequate cooling may result from a ground run.



## PREPARATION FOR SERVICE

Following storage, the aircraft preparations for flight should include the following. Remove all taped openings, plugs and control locks. Clean and thoroughly inspect the aircraft checking the gear, tires, controls pitot and static ports. Install a serviced battery. Install spark plugs and check the oil level. The "1010" oil used for storage should be removed and proper oil installed. The fuel tanks should be checked for water accumulation and purged as required. Following a short but thorough engine ground check the aircraft should be flown for 30 minutes maximum and given a very thorough post flight inspection.

## FUEL SERVICING

The *Express* fuel requirements are dependent on the engine installed. The engine manual should be checked for the recommended grade. In any case, the fuel should be clean and water free. The firewall gascolator drain should be checked on preflight inspections for evidence of water and the filter checked for solid foreign material. It is good practice to leave the tanks full to minimize the amount of combustible fuel/air vapor present in the tanks. This also helps minimize the amount of water vapor in the fuel system.

## OIL SYSTEM SERVICING

The oil used should conform to the engine manufacturer's recommendation. Since engine oil consumption is higher during break-in of a new or overhauled engine, very long flights should be avoided until it is certain that the sump quantity is sufficient for the flight duration. The oil level is checked thru the small door on the upper right top side of the engine cowling. A minimum of 6 quarts should be indicated before every flight.

### Oil Changes

During the initial break-in the engine should be operated with a straight mineral oil such as MIL-L-6082, or MIL-C-6529 Multiviscosity 20W50 Corrosion-Preventative Oil. The break-in is normally 20 to 25 hours during which time the oil consumption should stabilize. Following this 25 hours the oil and filter should be changed and an oil such as MIL-L-



22851 Ashless Dispersant Oil installed. If consumption has not stabilized at the 25 hour point, continue the use of mineral oil.

The engine oil should be changed at a minimum of each 100 hour of flight time. More often is recommended. The engine oil should be drained while the engine is thoroughly warm and with the aircraft in a level position. The filter should be changed at each oil change and the element examined for its contents. If a "spin-on" filter is installed it should be cut open and the element examined. Sand type material is indicative of inadequate air filtration and may warrant corrective action ranging from more frequent changes to the installation of an improved filter system. Metallic particles may vary from aluminum to steel to stainless steel. Following the initial break-in period during which some metallic particles are normal almost any amount thereafter becomes cause for concern. If subsequent changes show additional metallic particles, the source should be determined. The type can be somewhat determined by separating by category, i.e. magnetic or not, steel or aluminum, silicon (sand), etc.

Another method of determining the source is the use of spectral analysis of an oil sample. These services are readily available by mail, and can provide you with a running history of the contaminants from each of your oil changes.

## BATTERY

The battery should be checked for electrolyte level at each 25 hour inspection and serviced as necessary with distilled water. Do not overfill, nor should the battery be serviced in a low or discharged condition. If the battery is low on charge, service to cover the plates, charge to full, then service to full. Full is generally indicated by a "service ring" within each cell of the battery about an inch from the top.

Excessive water consumption may be an indication of an improperly set voltage regulator. The fully serviced and charged electrolyte should be checked for specific gravity.

## WARNING

The battery box must be vented overboard to dispose of the hydrogen gas produced during charging. Hydrogen is an explosive gas in widely varying concentrations so it is important to frequently check that the vent line is clear of obstructions.

## TIRES

The *Express* tires should be properly inflated at all times. The nose wheel tire should contain 35 to 40 psig and the main gear tires from 40 to 50 psig. Maintaining the proper inflation will minimize tread wear and aid in ground control of the aircraft. When inflating, visually check both sides of the tire for bulges, cracking of the sidewall, cuts. The tread should be greater than 1/16 ".

## WARNING

Tire size is important on your *Express*. Use only the specified tire. Other sizes may not fit into the wheel well and may damage the mechanism and the aircraft structure.

11

## LANDING GEAR SHOCK ABSORBERS

Your aircraft is fitted with a spring steel main gear. These require no servicing or inflation. As long as they are not physically cut or damaged and remain free of corrosion due to age or mechanical damage, they remain serviceable. [Early kits had "glass" "legs". These must be treated cautiously.]

The nose wheel strut contain a shimmy dampening system which must be checked periodically. The system consists of a "wave washer" which provides friction on the swiveling system. This check is made as follows:

- 1) Have someone hold the nose wheel off the ground by pressing down on the fuselage just forward of the empennage.
- 2) Twist the wheel left and right measuring the torque required (x pounds at x inches). Tightening the nut increases the squeeze on the washer, increasing the friction and thereby the anti-shimmy capability.

The shimmy damper system should provide between \_\_\_ and \_\_\_ ft-lbs of drag when the wheel/strut is moved (rotated left and right about the strut axis) at a moderate rate. Faster rotation rates should create higher torques. Verify this condition.

## **BRAKES**

The brakes are independent systems on each of the main gear wheels. The fluid reservoir for each is located behind the rudder pedals on the pilot's side. The toe brakes should depress approximately 1/2 inch before any pressure is generated on the brake when properly serviced. Lines should be checked for leaks and chaffing due to rubbing on the tire or the airframe while the gear is retracted. The brake pucks should be a minimum of 0.100 inches thick. The brake pucks should be replaced when less than this value.

## **INDUCTION AIR FILTER**

12 Operation of the aircraft in dusty areas requires that a filter be installed and changed periodically to preclude premature engine degradation. Removal of the filter requires removal of the cowling and should be accomplished at least on an annual basis. If operating in dusty areas, more often is desirable. Depending on the type of filter used, it may be cleaned, or may require replacement.

## **INSTRUMENT VACUUM SYSTEM**

The vacuum (or pressure) system for use by the gyro instruments contains very fine particle filters. These require changing on a regular basis. If operating the aircraft in a normal environment the filters should be changed every 500 hours or three years, more often in dusty areas.

## **PROPELLER**

Your propeller should be serviced according to the manufacturer's instructions. It is a highly stressed component and any failure has the potential of being catastrophic. Treat it with care. Nicks and dents (stress risers) in the leading edge due to rocks, hail or whatever need to be "dressed out" until smooth. Care should be used to maintain a similar contour to the blade after dressing and the area should then be polished resulting in a smooth, scratch free surface.



## WARNING

Use care when handling the propeller. Insure that the mags are OFF, the throttle CLOSED, and the mixture in the CUT-OFF position. Then remain as clear as possible during the dressing operation. Be prepared for a cylinder to fire when moving the propeller to a new position.

## ELECTRICAL POWER

### Alternator

The alternator is an alternating current device which is then converted by diodes to direct current for charging the battery. It has no brushes or other rubbing parts and may have the voltage regulator mounted on the unit or integral. The alternator units offered through Express Design Inc. use a remotely mounted voltage regulator. Its d.c. voltage output should be the same i.e. 14.2 to 14.8 volts. An alternator should never be operated open circuit, that is without a load, operated short circuited. Never attempt to polarize.

The *Express* uses a negative ground system. Filters in the system reduce noise in the avionics from the alternator and the magnetos.

Excessively high voltage regulation will cause overcharging of the battery and shorten its life, low settings will result in a low battery and probably poor starting especially in colder weather.

## CARE AND CLEANING

Your *Express* requires no special care and cleaning. Prior to washing, cover the wheels, pitot and static ports, and plug any cabin air intake ports. Care should be used to avoid removal of grease and oil from lubricated areas.

The windshield should be cleaned with generous amounts of water and a soft cloth. Prepared cleaners should be used with caution unless expressly made for acrylic material and even then with care. Oil and grease can be removed with small amounts of kerosene if necessary followed by soap and water.

Never use gasoline, benzene, alcohol, acetone, carbon tetrachloride, anti-ice fluids, lacquer thinners or glass cleaners.

They will either soften the material or cause it to craze. Rubbing of the surface with a dry cloth should be avoided as it causes static electricity build-up which subsequently attracts dirt and dust particles.

Upholstery materials and carpets can be cleaned in the normal manner. Rubber seals can be lubricated with Oakite 6, Armorall or equivalent materials. A vacuum is the primary means of cleaning the interior of loose dust and dirt. Blot up any liquid spills as soon as possible with cleansing tissues or clean rags. Hold the material securely against the spill for a few seconds allowing it to absorb the liquid. Repeat until all liquid is removed. Scrape off any gum materials. Test a spot remover on a test piece of material or an out of sight location if there is any question as to the compatibility of the cleaner and the upholstery or carpet materials. If acceptable, clean areas of spots as necessary. Detergent foams can be used to clean carpets if used per the manufacturer's instructions

- 14 Interior plastic parts should be cleaned with a water damp cloth. Oil and grease can be removed with cloth dampened slightly with kerosene. Volatile solvents such as those mentioned for the windshield are to be avoided.

## Exterior Painted Surfaces

### CAUTION

Polyester urethane finishes cure for 30 days or more following application. They should be washed only with a mild non-detergent soap until cured. Use only soft clean cloths and minimize rubbing to avoid damage to the paint film surface. Rinse thoroughly with clear water. Stubborn oil or grease deposits may be removed with automotive tar removers if required. (Mild detergents can be used on Urethane finishes.)

Wax or polish paint only after it has completely cured. Use power polishers with extreme care as they can build up excessive heat levels locally at the polishing surface and damage the paint surface.



## CAUTION

Avoid the use of high pressure cleaning systems and solvents. They can damage parts such as propeller hubs, fill pitot probes and static ports, enter cooling air ports with resultant damage to the interior and avionics, and remove areas of required lubricants. This type of equipment is great for DC-8s, not your *Express*.

## ENGINE

Clean the engine with a neutral solvent. While the engine is warm but not hot, spray with the solvent and allow to set a few minutes. Follow with a spray wash and allow to dry. Avoid excessively high pressures which can force entry of water and/or solvents under seals resulting in contamination of the sealed system or entry thru the firewall into the cabin. Use caution and protect any electrical relays or switches you may have installed in the engine compartment as well. Use only solvents which do not attack rubber or plastics. <sup>15</sup>

The following pages provide some general items to be checked on your *Express*. This listing is not necessarily complete, and you should add to as required depending on your specific installation and the manufacturers' recommendations of any particular equipment you may have.

**RECOMMENDED SERVICING**

**INTERVAL      ITEM**

**Preflight**

- Check & Service oil.
- Drain water trap.
- Service fuel tanks (previous flight) Check here.
- Check cowling latches secure.

**First**

**25 hrs**

**16**

- Service oil with Ashless Dispersant oil.
- Change oil filter.
- Change fuel filters.
- Check battery fluid.
- Check brake lines.
- Check all gear doors (nose & main gears).
- Check wing bolt torque, Lt & Rt, \_\_\_\_ (location)
- Control surface hinges.
- Recheck torque on all structural bolts.
- Recheck all safety wires fasteners, fittings etc.
- Check all moving parts for evidence of rubbing/fretting.

**First**

**50 Hrs**

- Change oil. \*
- Clean or change engine air filter.
- Lube landing gear mechanism.
- Check control surface hinges.

\* Begin Ashless dispersant if consumption is stabilized

## Each 100 Hrs

Change engine oil  
Change oil filter  
Clean fuel strainers  
Hoses & belts- wear, tightness, no cracks, secure  
Cowling attach fasteners- secure, attach points  
Clean/change engine air filter  
Engine mounts- Check  
Air induction & any valves- Security, no cracks  
Exhaust system- Cracks, secure, (esp. cabin heater)  
Propeller- Nicks, within overhaul, etc.  
Check all control cables for corrosion  
Check/Service gear retract mechanism (if RG)  
Jack aircraft and retract, gear-door fits (if RG)  
Wheel bearings (three) -repack  
Nose wheel and shimmy damper check  
Gear- Attach fittings, pants, wheel attachments - secure  
Sequence valves- Check operation  
Flex lines- Chafing, especially in gear wells  
Flap motor- Wiring secure, chafing, terminals, etc.  
Flap actuator- Check security, wear, running current  
Flap to aircraft fit- Excessive rubbing/wear  
Aileron to flaps and wing- Fit for rubbing/wear  
Battery- Electrolyte level **and** specific gravity  
Running lights and strobes - Operation  
Landing lights- Operation  
Cockpit lights- Operation, dim controls  
ELT- Battery life, operation check  
Static system- Leak tight, x-ponder functional  
Cabin door attach points & locking mechanism- Secure  
Shoulder harness- Attach points secure, fraying mat'l  
Seat belts- Attach points secure, fraying mat'l  
Airframe- Delaminations, cracks, lost paint, etc.







