North Wing S-LSA Maintenance Manual
Model: Sport X2 582

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Preface

The documents listed below are required for a complete S-LSA package for the North Wing Apache 582 S-LSA. This document is the North Wing S-LSA Sport X2 582 Maintenance Manual for Types Navajo and Apache. It describes the maintenance requirements and procedures for the wing, carriage, engine, and propeller.

- **Pilot's Operating Handbook**
- **Rotax Owners Manual**
- **Rotax Maintenance (Compact Disk)**
- **Radio Manual – If Installed**
- **BRS Parachute Manual – If Installed**
- **Manuals for all installed instrumentation**

Manual Amendment Record Sheet

Amendment Date	Affected Sections	Affected Pages	Date Inserted	Signature
Feb 2,2009	Added Section 4.4.6 Fuel gage calibration		Feb 2, 2009	Kamron Blevins
July 10, 2009	Corrected Torque values for Warp propeller	Page 17	July 13, 2009	Kamron Blevins
June -2015	Maintenance task added	all	June 2015	Kamron Blevins

Table 1 Amendment Record Sheet

NOTE:
North Wing's manuals will be revised as necessary. Registered North Wing S-LSA owners will be notified of any changes and directed to the North Wing web site

(<http://www.northwing.com>) for the applicable pages. The amended pages should be printed and the prior page replaced in the folder as soon as possible. The amendment table should at that time be updated with the appropriate details and date.

Table of Contents

1.0 Introduction

This manual contains factory recommended procedures and instructions for ground handling, inspection, servicing and maintaining the North Wing S-LSA aircraft. The procedures described are to be used in conjunction with the appropriate Airworthiness Authority of the country of registration. Any airworthiness requirement published by the national authority takes precedence over this manual.

1.1 Skills

Maintenance of any aircraft requires a skill level commensurate with the specific maintenance task. This manual identifies the skill level for each maintenance task according to the following industry standard certification levels:

Owner:
Tasks that can be expected to be completed by a responsible and skilled owner who holds a pilot certificate but who has not received any specific authorized training. This includes all items in Part 43 appendix A – Preventative maintenance.

LSA Repairman – Inspection:
Items that can be expected to be completed on an E-LSA by a responsible owner who holds an FAA repairman certificate (light sport aircraft), with an inspection rating or equivalent. Abbreviation: LR-I

LSA Repairman - Maintenance :
Items that can be expected to be completed on a S-LSA by a responsible individual who holds a FAA repairman certificate (light sport aircraft) with a maintenance rating or equivalent from an FAA approved 104 hour course on Weight Shift Control. Abbreviation: LR-M

A&P:
Items that can be expected to be completed by a responsible individual who holds a mechanic certificate with airframe or power plant ratings, or both, or equivalent.

Task Specific:
Items that can be expected to be completed by a responsible individual who holds either a mechanic certificate or a repairman certificate and has received task specific training to perform the task. Abbreviation: TS

For those functions and tasks identified as suitable for an owner to perform, a sound understanding of mechanical systems, and good experience with the necessary tools and procedures is required. A lack of complete understanding of any task may render the aircraft un-airworthy and unsafe. Assessment and judgment of the condition of each individual component is required, which necessitates a sound understanding of the purpose of each component in the system. If there are any doubts regarding the required and appropriate maintenance, then the safety of the aircraft may be jeopardized in continuing with self

maintenance. In this situation a North Wing-approved repair station should be contacted for the correct procedures and or servicing.

All maintenance and repairs must be logged in the appropriate Airframe, Engine, Propeller, or Wing log book and signed by the person who performed the repair. Logbook pages are given in Appendix A of this manual. If additional pages are required, simply copy the required pages and insert in this manual. Although it is recommended, it is not required to maintain four separate log books as indicated above. However, any maintenance on any of the four systems must be logged in a maintenance log book and signed by the person performing the task.

1.2 Prohibited Maintenance and Alterations

This manual addresses only "Line" maintenance functions and tasks that can reasonably be performed by a responsible and skilled as described above. It does not address any "Heavy" maintenance tasks such as the removal of the engine cylinder heads, gear box, or electrical end of the engine block. For all required maintenance on the Rotax 582, refer to the Rotax engine manual provided with your North Wing S-LSA trike. For heavy repairs as mentioned above, consult a factory trained and certified Repairman Maintenance technician for Rotax engines. A list of Rotax repair stations can be found on-line, or contact your North Wing dealer.

Although "repairs" may be authorized for nearly all components, "alterations" to the following items beyond those specifically identified herein are strictly prohibited due to their critical safety role:

- airframe assembly
- backframe
- mast assembly
- seat frame
- root tube
- steering assembly
- pivot block assembly
- wing ribs, cables, struts, crossbar, or control frame
- bolt sizes or lengths

WARNING

THE INFORMATION IN THIS MANUAL NEEDS TO BE FOLLOWED, AND IT IS NOT ACCEPTABLE TO MAKE CHANGES TO THE MATERIALS AND OR PHYSICAL FEATURES OF THIS AIRCRAFT. IN PARTICULAR THE GRADES OF BOLTS THAT HAVE BEEN UTILIZED IN THE MANUFACTURE OF THIS AIRCRAFT ARE CRITICAL FOR ITS CONTINUING AIRWORTHINESS. NEVER REPLACE BOLTS WITH ANY OTHER SIZE OR GRADE. GRADE 8 BOLTS ARE NOT INTERCHANGEABLE WITH AIRCRAFT (AN) GRADE BOLTS. THE FATIGUE CHARACTERISTICS OF AIRCRAFT GRADE BOLTS ARE SUPERIOR TO OTHER BOLTS AND ALLOW LONGER SAFE SERVICE LIFE UNDER CYCLIC LOADS LIKE THOSE EXPERIENCED IN AIRCRAFT. THE LENGTH OF BOLT IS IMPORTANT. IF A SHORTER BOLT IS USED THE THREAD MAY ENCROACH ON THE LOAD BEARING AREA, WHICH INCREASES THE STRESSES EXPERIENCED BY IT.

1.3 Tooling and Materials

In general, all maintenance described herein is capable of being done with standard mechanics tools. However, since the Rotax engine is built in Austria, a set of metric open end, box, sockets, and hex wrenches may be needed. The only tools that might be considered somewhat special or unusual needed for the maintenance described in this manual are the following:

- Low range torque wrench capable of up to 230 inch pounds of torque with both metric and English size sockets
- High range torque wrench capable of up to 50 foot-pounds of torque with both metric and English size sockets
- Bettsometer for testing wing fabric strength
- Syringe with capacity of at least 4 ounces for bleeding the hydraulic brakes
- Propeller pitch gauge
- Safety wire twisting pliers and safety wire
- Air pump
- Lubricants and other liquid/paste materials required by Rotax
- Loctite 243, 567
- Anti-seize lubricant
- Plastic wire ties of various sizes
- Oil resistant thread sealer (tape of paste)

Other items may be required that are not on this list.

1.4 Service Difficulties and Errors

Any service difficulties, errors in this manual, or product defects should be reported to North Wing via the web site, fax, or telephone. Corrections will be made as appropriate and reported on the North Wing UUM Inc. web site.

1.5 Format

Chapter 2 provides general information useful for various maintenance activities. Chapters 3 and 4 of this manual address inspection and maintenance procedures for the major subsystems and equipment groups that comprise the North Wing aircraft. The Table of Contents provides a good guide to the sections needed for any line item repair, many or which can be performed by the owner. For heavy maintenance, such as rebuilding the engine, the owner is referred to the Rotax manual and to expert repair stations.

The information in this manual is based on the data that was available at the time of its publication. The latest amendments to this manual will be issued on the North Wing website in PDF format. This should be printed out and added to the manual. Therefore it is important that operators keep a regular check on the website for any amendments that have been made. If any errors or omissions are found in this manual please advise the factory.

1.6 Mandatory Service Bulletins

AS THE SERVICE HISTORY OF THE AIRFRAME EVOLVES NORTH WING WILL PERIODICALLY ISSUE MANDATORY SERVICE BULLETINS WHICH DETAIL ANY CHANGES TO THE MAINTENANCE MANUALS, PILOT'S OPERATING HANDBOOK, OR ANY OTHER IMPORTANT DETAILS.
THE WEB ADDRESS FOR SERVICE BULLETINS IS:
HTTP://WWW.NORTHWING.COM
IT IS THE RESPONSIBILITY OF THE OPERATOR TO KEEP UP TO DATE WITH ANY ROTAX DIRECTIVES THROUGH THE ROTAX WEBSITE.

2.0 General Information

2.1 Specifications

2.1.1 Wing (Mustang III- 15) For other Wings refer to the Wings owners manual

- Surface area: 161 sq.ft.
- Weight: 115 lbs
- Leading edge tube distance from the nose plate anchor hole to:
  1. Crossbar attachment hole 121”
  2. Rear most sail attachment point 213” +-.50”
- Leading edge outside diameter at:
  1. Nose 2.125”
  2. Crossbar 2.375”
  3. Rear sail attachment point 2.000”
- Crosstube: 6061-T6 Aluminum
  1. “Pin to Pin 109.375” +-.50”
  2. Outside diameter 2.375”
- Keel tube: 6061-T6 Aluminum
  - Nose 2 1/8”
  - Apex 2 ¼”

  Distance from leading edge bolts to:
  1. Crosstube hinge pin plates (must be resting on keel) 44.500” +- 2”
  2. Trike Hang Point 54” to 56.5”
- Ribs: 7075-T6 Aluminum 14
- Nose Plates: 1/8” Stainless steel
- Struts: Extruded 6061-T6 Aluminum
- Strut attachment brackets: Machined 6061-T6 Aluminum
- Down tubes: 6061-T6 Aluminum
- Base tube: 1 1/8” x 0.058” 4130 steel tubing
- Sail chord length
  1. 3’ from root 70.500”
  2. 3’ from tip 40.500”
- Total span 378”
- Flying weight range: (trike, wing, and pilot) 490-990 Lbs.
- Placard and test flight sticker location: Behind pull-back cable catch on the keel.
- Coated stainless steel front pitch wires: 3/32 - 7x7
- Coated stainless steel rear pitch wires: 3/32 - 7x7
- Coated stainless steel pull back wire: 5/32 – 7x7

For other Wings refer to the Wings owners manual

2.1.2 Carriage

Standard Configuration:

Material:

- Root tube: 2" x 3" rectangular 6061 aluminum tube
- Seat frame: 1¼ inch outside diameter 6061 aluminum tube
- Welded steel lower back frame
- Welded steel dual mast
- 1¼ inch diameter 6061-T6 aluminum nose tube with machined aluminum fittings at both ends for attachment
- 2" square aluminum tube vertical engine support
- 15" long adjustable engine sway bars for P-factor adjustments
- Powder coated or plated finish on all structural tubes
- Tires: Tubeless 15x6.00-6 (actual tire OD 13.5") 4 ply. Recommended pressure 20 psi
- Rear wheel hydraulic brakes

Dimensions:

- Length from fairing nose to propeller: 112 inches
- Length from carriage root tube to propeller: 108 inches
- Width (side to side outside of tires): 73 inches
- Width (side to side outside of wheel pants: 75 inches
- Total height with wing level 108 inches
- Wheel base (rear axle to front axle):
  - in short setting 66.5 inches
  - in long setting 69.0 inches

Optional Equipment:

- Body fairing (Apache): Fiberglass resin gel coat custom design (Red or Yellow)
- Optional Tires: 8.00-6 (actual tire OD is 17.5") Recommended pressure 15 psi
- Wheel pants: Fiberglass resin with matching color to body fairing
- Instructor Package: Dual steering, Instructor throttle, instructor mag switches

2.1.3 Engine and Related Systems

Standard Configuration:

- Rotax 582 Dual carburetor and dual ignition (DCDI)
- Dual Bing carburetors
- Remote choke (enrichener) operation
- Capacitor Discharge Dual ignition system
- Oil injection direct to carburetors

- Exhaust silencer
- E-box gear drive (3.47/1 ratio) with electric start
- North Wing custom dual radiator system
- 93.1 lbs with exhaust, carburetors, silencer. w/o fuel pump or radiator
- 64 hp @ 6500 rpm; 55ft.lbs max torque @ 6000 rpm
- 6800 max rpm
- Water cooled: Min Operating temperature: 140° Fahrenheit
  Max Operating temperature: 180° Fahrenheit
- Manual rewind starter
- Pneumatic fuel pump driven from crankcase pulse line
- Static cylinder compression 140 – 150 psi
- Spark plugs: 14mm, B8ES

Optional Equipment:

- Delete oil injection reservoir if injectors not used (50:1 if manually mixed)
- Intake silencer with associated carburetor jetting
- Ceramic powder coated exhaust system
- RK400 drive clutch and C-box instead of E-box (must use ignition end starter for electric start) (Clutch not available for E-box configuration)
- GPL ignition end starter for use with clutch

2.1.4 Fuel System

Standard Configuration:

- 16 gallon translucent polymer fuel tank
- Electric fuel gauge with panel display
- Engine driven pneumatic fuel pump
- See-through in-line fuel filter
- Primer bulb
- Cable driven dual throttle actuators (from front seat, right foot and hand throttle)
- Remote cable driven choke actuator from front seat

Optional Equipment:

- Optional third cable driven throttle actuator for instructor or rear seat operation. Includes rear seat ground steering bar.

2.1.5 Cooling System

Standard Configuration:

- Dual radiators shock mounted on rear left and right side
- Coolant reservoir with 8 psi pressure cap

- Coolant: 50/50 Ethylene Glycol/Water mix
- Coolant capacity: 1.2 gal US
- Single dual acting thermostat in engine opens at 135°F

2.1.6 Propeller

- Warp 3 blade 72" carbon fiber propeller
- Pitch set by gauge

2.1.7 Electrical System

Standard Configuration:

- Ignition system (see engine)
- 12 volt starter with key operation from the front seat
- Hot Box wiring center
- Regulated auxiliary lighting terminals (170Watts AC @ 6000rpm)
- Voltage regulator (Key West on 582, Ducati on 912)
- 12 volt 18 amp-hour battery
- Fusing integral to Hot Box
- Strobe light: mounted at rear below BRS mount
- Electronic Instrument System

Optional Equipment:

- Navigation position lights (red/green for after sunset flight mounted on wing tips)

2.1.8 Electronic Instrumentation System (EIS)

Standard Configuration:

- EIS console with following instrumentation:
  - Alarm and limit setting
  - Exhaust gas temperature each cylinder
  - Water temperature
  - Engine RPM
  - Total engine run time
  - Altitude
  - Rate of climb/decent
- Analog gauges for the following instruments:
  - Airspeed
  - Fuel tank level

2.1.9 Torque Specifications and Securing

Before any fastener is torqued to specifications, it is important to assure at least one full thread of the bolt will extend beyond the nut when tightened. If the nut does not extend at least that far, the bolt thread itself may fail if tightened to specifications.

Not all bolt connections have specific torque requirements. There are three basic types of bolt/nut connections that are addressed in the table below:

1. Normal bolt/nut fasteners
2. Nylock fasteners
3. Castle nut fasteners

Normal bolt/nut fasteners will have torque specifications listed in the table below.

Nylock nuts are used for many applications. Some of those applications do not require specific torque values while others do. For those applications where the bolt is exposed to only shear forces, the nut should be tightened until there is no free play in the connection, or all gap is eliminated between the nut and the fixtures being bolted together, then tightened another quarter to half turn. These applications are referred to as “Snug” connections in this manual. The limiting factor in the tightening of most Nylock applications on tubing is to avoid distorting the tubing circular shape. For those applications where significant torque should be used, a recommended torque is specified in the table below.

Castle nut fasteners are used for applications where the bolt is exposed only to shear stresses and does not experience any longitudinal tensile stresses. The purpose of the castle nut is to allow easy assembly and disassembly without the need for tools. Castle nuts must be secured in place with a safety pin or ring of any appropriate design. For these fasteners some gap between the bolt or nut under-side surface and the material being fastened is acceptable but should not be excessive. That is, the nut should be tightened to remove all visible gap and then adjusted to the nearest hole alignment for the safety pin. These types of attachments are referred to in this manual as simply “Secured” as opposed to “Torqued” or “Snug”.

Some fasteners must be secured from loosening using either safety wire, ring safeties, or pin safeties. The table below indicates which type of fastener should be used in each application, the type of safety recommended for each where applicable, and the associated torque where appropriate.

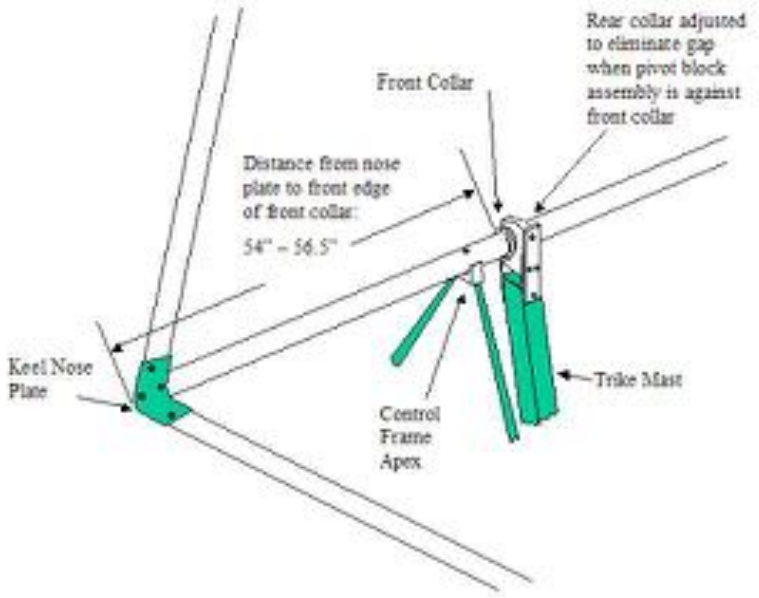
Location	Size	Securing Method	Torque Value (inch lbs)
Carriage:			
Rear wheel axle nut	5/8”	Nylock	Snug –1/4 turn
Front wheel axle nut	5/8”	Nylock	Snug –1/4 turn
Split wheel rim bolts	1/4”	Nylock	Snug
Axle to backframe bolts thru fiberglass rods	1/4”	Nylock	Snug
Seat frame upper/lower joint bolts	1/4”	Nylock	Snug
Lower lift cylinder bracket attachment	1/4”	Nylock	Snug
Seat frame to backbone attachment	1/4”	Nylock	Snug
Seat frame to main base tube	1/4”	Nylock	Snug
Mast connection bolts	5/16”	Nylock	Snug
Mast pivot bolts	5/16”	Nylock	Snug
Nose tube upper bolt/nut	1/4”	Castle/pin	Secured
Nose tube lower bolt/nut	1/4”	Castle/pin	Secured
Engine:			
Engine mount nuts	10mm	Lock washer Loctite 242	335
Head bolts	8mm	Loctite 242	60
Thermostat housing bolts	6mm	Loctite 222	25
Exhaust manifold bolts	8mm	Lock washer	195
Exhaust ball joint bolts	3/16”	Nylock	Snug
Exhaust muffler Lord mount nuts	5/16”	Lock washer	Snug
Carburetor boot hose clamps			Snug
Gear box lube oil drain screws	6mm	Safety wire	Snug
Gear box lube oil fill nut		Safety wire	Snug
Air intake silencer boot hose clamp			Snug
All others			See Rotax manual
Fuel System:			
Fuel pump attachment bolts	3/16”	Nylock	Snug
Electrical System:			
Spark plugs	14mm	Anti Seize	240
Battery hold down plate	3/16”	Castle	Secured
Cable clamp to battery post	3/16”	Lock washer	Snug
Hot Box connections	6-32		Snug + 1/2 turn

Location	Size	Securing Method	Torque Value (inch lbs)
Cooling System:			
Radiator mounting bolts	5/16”	Lock washer	Snug
Hose clamps			As required to prevent leaking
Wing:			
Base tube left side connections to corner bracket	1/4”	Castle	Pin
Base tube right side connections to corner bracket	1/4”	Nylock	Snug
Strut attachment bracket on downtube(both sides)	1/4”	Castle	Secured
Strut attachment fitting on ends of struts	1/4”	Nylock	Snug
Control frame apex bolt			
Front/rear wire tang attachment to downtube	1/4”	Nylock	Snug
Pivot block assemble top bolt	3/8”	Castle	Secured
Pivot block assemble middle two bolts	3/8”	Nylock	Snug
Pivot block assemble bottom bolt	3/8”	Nylock	Snug
Nose plate to leading edge bolts	¼”	Nylock	Snug
Crossbar plate to crossbar bolts	¼”	Nylock	Snug
Nose wire catch assemble to keel tube	¼”	Nylock	Snug
Crossbar to leading edge attachment bolts	3/8” eye bolt	Castle	Secured
Attachment bracket on leading edge for crossbar	¼”	Nylock	Snug
Sprog attachment to LE bracket	¼”	Nylock	Snug
Propeller:			
Mounting bolts to gear box plate	8mm	Safety wire or lock nut on back	175
Individual blade hold down bolts	6mm	Nylock	120

2.2 Weight and Loading

- Maximum Gross Weight: 1060 lbs
- Empty weight w/o options
  - Navajo 450 lbs
  - Apache 490 lbs
- Useful load: 500 lbs
- Maximum Fuel weight (17 gals): 105 lbs
- Pilot, Passenger, baggage @ full fuel: Apache 395 lbs

The trike center of gravity (CG) is adjusted by sliding the pivot block retaining collars forward and aft to the desired position. The range is measured by the distance from the front edge of the front retaining collar to the front tip of the keel tube (not nose bracket). See the sketch below.



In its forward most position, the front collar is up against the control frame apex. This is a distance of 50½" from the keel tube tip. The pivot block assembly may be moved rearward a maximum of 2" resulting in a measurement from the keel tube tip to the front collar of 52½".

The hang point is changed by loosening the split collar bolts evenly about 3 turns each with a ¼" Allen wrench. This should be enough to slide the collars to the desired position. **Note!** It is helpful to have the wing nose up when moving the hang point forward, and the wing nose down when moving the hang point rearward. This will allow the wing to slide in the pivot

block assembly with very little manual force. Retighten the collar bolts evenly. DO NOT tighten just one collar bolt completely and then the other. This will distort and possibly damage the keel tube.

Hang Point Moved Full Forward

Hang Point Moved Full Back

Collar Bolts
¼" Allen wrench

Caution:
For loads greater than 850 lbs. the cg must be no further back than 51 inches. i.e. the range for the cg for loads above 850 lbs is limited to 50½" – 51". For loads less than 850 lbs, the cg may be adjusted anywhere within the full range specified above.

2.3 Ground Handling

Care must be taken in maneuvering the trike on the ground for maintenance for several reasons:

1. Avoid overstressing the pivot block assembly that connects the trike to the wing
2. Avoid causing the trike to flip onto the propeller by lifting the nose too high
3. Avoid wear of the base tube due to rubbing against the nose tube
4. Avoid wing tip damage by scraping the ground or hitting objects

2.3.1 Moving

To safely move the trike with the wing attached, use the following procedure:

1. Anchor base tube securely to carriage either with a bungee holding the base tube against the nose tube, or by using the seat belts to hold the base tube against the seat. Be sure the wing is tilted at least 20° into the wind if trike is to be moved outside.
2. Release the parking brake
3. Confirm that the ignition magneto switches are off.

4. Push on the propeller near the hub, steering left and right by pushing on one side of the propeller harder than the other side. It is quite easy to steer the trike in the desired direction using this method.

2.3.2 Parking and Tie Down

Never leave the trike outside without securing both the wing and the trike. Be sure the wing is tilted into the wind, and secure the parking brake. For wind conditions greater than 5mph, the wing should be secured using the tie down straps located inside the wing at the crosstube-to-leading edge connection zipper. Position the wing at 90° to the wind direction so that the wind tends to press the lowered wing down further. Anchor owner supplied straps to the tie down straps inside the wing so as to hold this angle into the wind.

2.3.3 Lifting

The nose of the trike can be lifted using the hand hold underneath the nose of the wind fairing. **BE CAREFUL** not to lift the nose too quickly or too high. Any trike will easily go beyond the balance point, and can flip over onto the propeller causing substantial damage to the trike, wing, and engine.

2.4 Lubrication

The points requiring lubrication and the recommended lubricant is given in the following table. Most bearings on North Wing S-LSA aircraft are permanently sealed and do not require lubrication.

LOCATION	FREQUENCY	RECOMMENDED LUBRICANT
Engine lubrication	Continuous mix with fuel	Pennzoil with TC-W3
Throttle and choke cable	6 months	
Throttle and brake pedal arms	6 months	
Engine: Rotary valve	As level dictates	Same oil used in fuel mix
Gear box	See Rotax manual	See Rotax manual

2.5 Replacement Parts

All original equipment replacement parts for the carriage, propeller, and wing are available direct from North Wing through your Regional North Wing dealer. In most cases, all parts are in stock for immediate delivery. Rotax engine parts are available only through authorized Rotax parts dealers or repair stations.

There are very few disposable replacement parts on the North Wing S-LSA trike, however, wear and consequential replacement is expected on some parts. The following table indicates those parts expected to be replaced on a regular schedule or as a result of regularly scheduled inspections.

DISPOSABLE REPLACEMENT PARTS			
PART	FREQUENCY	RECOMMENDED PART	SOURCE
Spark plugs (4)	25 hours or sooner based on 10 hour inspection	NKG: BR8ES NOTE!! Use plugs with solid caps only. Do not use screw on caps	Local automotive parts dealer
Brake linings (2 sets)	Based on inspections	BP401	North Wing
Air filter: Without silencer/ With silencer	Clean or replace based on inspections	 K&N RC-2820 or Rotax 825-723 K&N CM-0300	North Wing or Any K&N filter dealer
Fuel filter	Replace after the first 30 hours. Thereafter, replace every 100 hours or sooner if required by inspection		North Wing or aircraft parts dealer
Carburetor sockets (2)	Based on inspections Look for deep cracks	Rotax part no. 867 696	Rotax parts center or repair station
Fuel lines	300 hours or sooner based on inspections	¼" Gates automotive fuel line.	North Wing or aircraft parts dealer
Tires: Standard Optional oversize	Based on inspections	6.00 x 6 4-ply 8.00 x 6 4-ply	North Wing or local tire dealer
Coolant	3 years, or 200 hours, or whenever drained for repairs	Any quality coolant suitable for aluminum engines. **Note!** Be sure coolant specifies it will mix with any other type coolant.	Local automotive parts dealer or retail stores

3.0 Inspections

All S-LSA aircraft must undergo an annual condition inspection by a qualified Repairman with at least a Maintenance rating (LSR-M). This requires satisfactory completion of an FAA approved 104-hour Repairman-Maintenance class for Weight Shift Control. In addition, anyone with an A&P certificate may perform the inspections.

For S-LSA aircraft used for non-commercial operation, an inspection is required every 12 months. For S-LSA aircraft used for commercial training or towing, an inspection is required every 100 hours of operating time. The checklist for these inspections is the same and is given below. This list incorporates all the applicable items required by FAR 43, Appendix D.

The Annual or 100-Hour Inspection supplements the pre-flight inspection that should be done prior to each flight. Since this inspection may be done by another person other than the owner or pilot, the inspection list includes checks from the pre-flight list as well. If problems are identified by the inspection that should have been identified by the pilot during pre-flight checks, the pre-flight procedure should be modified to assure all points are being checked.

If the annual or 100-hour inspection is performed properly, there is no need for additional, more in-depth inspections at longer intervals. All degradation mechanisms are covered in the standard annual/100hour inspections.

3.1 Inspection Procedure

The following steps must be followed prior to performing the actual inspection to achieve an effective inspection:

1. Walk around aircraft and note any visible damage or problems such as leaks and skin and sail damage. Examine any questionable areas closely and identify problems before proceeding.
2. After noting where leaks are visible, clean those areas with an appropriate solvent
3. Start engine and do magneto check for each magneto. Note any problems for further investigation.
4. Run engine for at least five minutes after minimum operating temperature is achieved (140F) and at a moderate load point (about 3500 rpm). On hot days, this may require fast taxiing or flying to keep temperature from exceeding its limit of 180F.
5. Note effectiveness of brake at holding trike during the 3500 rpm run-up. Also note amount of pedal travel required to hold trike. If excessive, brake pads may need replacement or hydraulic lines may need bleeding.
6. Find maximum exhaust gas temperature by stepping the engine RPM from 4500 to 5300 RPM in 200 RPM increments and hold at each speed for 10 seconds. The maximum EGT reading should occur in this range. Confirm that the maximum is below 1200F and the two EGT's are within 200F of each other. If not, note for more detailed inspection.
7. Note any excessive vibrations in this speed range.

8. Run engine at maximum RPM to check for proper propeller pitch. Acceleration should be smooth and achieve maximum RPM in 3 seconds or less. Failure to reach an indicated maximum speed between 6300 – 6500 RPM could be caused by excessive propeller pitch, fuel supply problem, carburetor adjustment, faulty tach, or an ignition problem, in order of their probability.
9. Note any excessive vibrations at maximum speed.
10. Note EGT reading at maximum RPM. It should be lower than the peak value observed in the 4500 – 5300 RPM range and again within 200F of each other.
11. Shut down engine and re-examine engine and other moving parts for new leaks that have become visible as a result of the short engine run. These areas will require more detailed inspection.
12. Allow all heated components to cool enough to touch.
13. Wash aircraft engine, wing, and outer surface according to instructions provided in subsequent maintenance sections of this manual so that other non-obvious problems can be seen.
14. Print out and perform detailed inspection per the following inspection checklist.
15. Perform the applicable inspection and maintenance in the Rotax 2 stroke maintenance manual based on time.
16. If any maintenance is performed as a result of findings during the inspection, repeat the pre-inspection run-up procedure given in steps 1 – 8 above.
17. Upon completion of the inspection, document any findings and corrections in the aircraft log book.

3.2 Inspection Checklists

North Wing Annual and 100-hour Inspection Check List

Page 1

Pre- and Post-Inspection Run-up

Date_____

Make_____ Model_____ Serial Number_____

Owner_____

Type Inspection_____

Tach Time_____ Total time_____

Completed		
Pass	Fail	**Step**
		1. Check logbook and operating limitations.
		2. Research Manufacturers safety directives, bulletins and letters.
		3. Clean aircraft.
		4. Prepare discrepancy list by walking around aircraft looking for leaks and physical surface damage.
		5. Clear discrepancy list.
		6. Perform inspection
		1. Magneto check at approx 3500 rpm: <u>Pre-Inspection</u> RPM drop #1: _____ RPM drop #2: _____ Differential_____
		2. Brake check at 4500 rpm for holding capability and pedal travel. Comments:
		3. After engine is at operating temperature, anchor trike securely and slowly ramp up to maximum RPM and check EGT's. and CHT's <u>Pre-Inspection</u> Max RPM _____ Max EGT #1: _____ Max CHT #1_____ Max EGT #2: _____ Max CHT #2_____
		4. Note excessive vibrations at maximum RPM
		5. Wash exterior of engine, carriage and wing as necessary

North Wing Annual and 100-hour Inspection Check List

M-Pulse 15 Wing		
Pass	Fail	Perform the following checks on the wing
		For wing inspection it will be necessary to remove the wing from the trike and perform checks 1 – 15 with the sail on the frame. Then the sail should be removed from the frame to complete the wing inspection, items 16 & 17.
		1. Wing fabric for tears greater than 1" long (25mm), are within 1" of a seam, run off the edge of the material, and abrasions that have weakened the fabric. These require professional repair. See Wing Repair section.
		2. Fabric for tears smaller than 1" that are not within 1" of a seam and do not run off the edge of the material. These can be repaired with sail repair tape.
		3. Tip webbing or any breaks or tears in webbing
		4. All zippers for smooth operation, full range operation, secure inter-locking at start end, and sound stitching
		5. Test fabric (top side of wing) for strength (UV damage) using a UV test panel from the Mustang III top surface or a Bettsometer. Annual testing with a Bettsometer is recommended for wings exposed to UV on a frequent basis or typically long exposure periods. Use a 1.2 mm diameter needle. Check tensioned sail for 1360 grams pulling upward.
		6. Remove all ribs and check for damage and symmetry against the template provided by North Wing
		7. Rib tensioning cords for wear and proper tension
		8. Wing strut attachment bolts tightened to "snug fit" (See torque table Section 2) and no visible wear on attachment pins
		9. Front and rear pitch control wires for stretch of 1/8" or more (See Specifications for factory length), kinks, broken strands, corrosion, slipped position at nico press, elongation or kinks in thimbles, and hardware attachments
		10. Pull back tensioning cable and pulley assembly for broken strands, kinked thimbles, worn attachment hardware and bolts.
		11. Cross bar connection plate bolts not worn and safety wired
		12. Sprogs for firm attachment and any bends. Check for bent ball joint.
		13. Nose plate bolts and swan hook tightened to "snug fit" (See torque table)
		14. Nose cone Velcro grip is not weak
		15. Position lights (if applicable) firmly attached
		16. Leading edges, keel tube, cross bars, down tubes, and base tube for dents, bends, corrosion, or wear at bolt holes
		17. All stitching for breaks and separation of sewn material

North Wing Annual and 100-hour Inspection Check List
(continued)

Carriage		
Pass	Fail	Perform the following checks on the trike carriage
		1. Confirm the required placards are in the proper places and readable: - Passenger Warning - "EXPERIMENTAL" is visible upon passenger entry - Switch positions and instrument limits - Identification plate - N-number
		2. Remove wheel fairings and check for cracks and worn bolts
		3. All tires for tread wear and proper inflation
		4. Brake pads for wear and rotors for abrasion and damage
		5. Brake pedal for excessive travel (add brake fluid and bleed lines)
		6. Remove rear wheels and check steel axles and bearings for wear and binding
		7. Fiberglass axle rods for any sign of cracking, elongation of bolt holes, broken attachment points
		8. Back bone for any sign of cracking or broken welds
		9. Engine mounting plates are secure attachment
		10. Lord engine mounts are not cracked or broken
		11. Fuel tank is secure and no sign of cracks or leaks
		12. Fuel tank sump drain works properly and no water in tank
		13. Fuel tank vent is not blocked
		14. Fuel tank cap fits secure
		15. Fuel lines are flexible and are not leaking
		16. Fuel filter is not contaminated, cracked, or obscured
		17. All fuel lines are secured from rubbing against other parts during flight that could cause wear
		18. Side bags are secure and attachment lines are not frayed or broken
		19. Body fairing bolts are torqued and bolt holes are not worn
		20. Body fairing is not cracked
		21. Trike base tube for cracks or bends
		22. Trike mast for cracks or bends
		23. Pivot block bolts for wear and thread integrity
		24. Pivot block assembly plates for straightness and worn bolt holes.
		25. Heart bolt for wear and cracking
		26. BRS lines for proper routing, anchoring, and wear points
		27. BRS mounting and covers are secure
		28. BRS rocket is secure and aimed clear of all obstructions
		29. BRS firing cable has adequate slack for trike handling and maneuvering
		30. BRS pull handle is mounted securely and in an appropriate position

		31. Front wheel forks are not bent and properly secured. Check alignment of steering pegs with trike base tube (should be perpendicular to base tube)
		32. Instructor steering linkage is secure and adjusted to align with front steering pegs
		33. Brake master cylinder is secure and not leaking
		34. Brake hydraulic line is secure, not worn, and not kinked
		35. Front wheel axle is secure

North Wing Annual and 100-hour Inspection Check List (continued)		
Engine (Rotax 582 DCDI)		
Pass	Fail	Perform the following checks on the engine and associated equipment
		Note! The engine checks listed here are provided for convenience in performing the annual and 100-hour inspections. The Repairman performing the inspection shall refer to the details in the Rotax Maintenance Manual provided with the North Wing trike for any questionable items.
		1. Spark plugs for wear and indication of improper fuel mixture
		2. All engine head bolts for torque to those given in the Rotax Maintenance Manual provided by North Wing with the aircraft
		3. Check rubber engine mounts for damage, cracks, and security
		4. Carburetor boots for cracks
		5. Throttle, oil injection and choke cables are properly routed and not kinked.
		6. Oil injection control arm adjusted properly
		7. Throttle and choke cable boots at carburetor are not cracked or missing
		8. Air intake silencer boots for cracks
		9. Oil lines and reservoir for rotary valve lubrication are not leaking or cracked
		10. Oil reservoir for engine lubrication is secure and not leaking
		11. Cap for oil reservoir fits snug and vent is working properly
		12. Oil lines from reservoir to injection pump, and from injection pump to carburetor base are not leaking, cracked, or hardened
		13. Oil leakage from gear case at side cooling ports is not excessive (Some leakage is expected at this point. If excessive, gear box seal must be replaced)
		14. Gear case gasket at front/rear half split for oil leakage
		15. Gear case output shaft (propeller shaft) bearing for leakage
		16. Replace gearbox lube oil. Use 85W-140
		17. Cooling system hoses, reservoir, water pump housing and gasket, thermostat housing gasket, and water temperature probe for leaks
		18. Cooling water reservoir cap for signs of leakage and pliable condition of rubber gasket on under side of cap. Replace if any signs of embrittlement.

		19. Radiator mounts for security and integrity of rubber shock mounts
		20. Radiator fins are not blocked or damaged
		21. Radiator hoses are not brittle or leaking
		22. All hose clamps are tight and not rusted
		23. All hoses are secured from rubbing against other parts that could cause wear
		24. Exhaust manifold mounts are properly torqued and no signs of exhaust leaks at manifold connection to cylinder heads
		25. Lord mounts holding muffler to backframe are not aged, cracked, or damaged.
		26. Exhaust pipe ball joint connections are secure
		27. Muffler and silencer for cracks (look for signs of exhaust leaks, i.e. dark spots)
		28. Exhaust silencer is secure and elbow clamps are tight and properly installed with "security bolt" under clamp bolt
		29. Exhaust gas temperature probes are not physically damaged
		30. Manual starter rope in good condition and recoil mechanism works properly

North Wing Annual and 100-hour Inspection Check List (continued)		
Propeller (Warp 3-Blade)		
Pass	Fail	Perform the following checks on the propeller
		1. Mounting bolts for proper torque
		2. Inspect for nicks, cracks, and abrasion
		3. Check for tracking in full circle
		4. Leading edge tape if used for tears or missing pieces (replace if any)

North Wing Annual and 100-hour Inspection Check List (continued)		
Electrical System and Instrumentation		
Pass	Fail	Perform the following checks on the electrical system and instrumentation
		1. Ignition coils on engine are clean and securely mounted
		2. Ignition wires to spark plugs are secure and firmly snap on spark plug caps
		3. Wiring harness coming out of engine ignition end for cleanliness, abrasions, cracks, or exposed conductor wires
		4. Relay/fuse box electrical connections for proper torque and integrity of insulation
		5. Ignition switch for secure mounting. Check that water gauge needle moves when ignition switch is turned from off to on.
		6. Magneto switches for secure mounting. Mag check during initial runup for inspection should have indicated any grounding problem.
		7. Battery for damage, clean tight connections, and adequate charge

		8. EIS panel for secure mounting
		9. Cycle EIS through all options and note limits and any problems
		10. EGT leads from probes to gauge for secure attachment and breaks. If initial run-up inspection showed unbalanced EGT readings, this could be caused by loose EGT connections, bad probe, faulty gauge, or carburetor adjustment or malfunction.

North Wing Annual and 100-hour Inspection Check List (continued)		
Operational Inspection		
Pass	Fail	Perform the following operational checks
		1. Fuel pump
		2. Fuel quantity, pressure and flow gauge
		3. Alternator output
		4. Electronic equipment
		5. Parking brake
		6. Oil pressure and temperature
		7. Propeller smoothness
		8. Mag drop # 1 #2
		9. Mag switch operation
		10. Idle RPM
		11. Static RPM note EGT and CHT in limits
		12. Throttle operation
		13. Engine instruments operational and within limit

North Wing Annual and 100-hour Inspection Check List (continued)		
General		
Pass	Fail	Check the following
		1. Aircraft conforms to operating limitations
		2. All Safety Directives, bulletins and letters complied with.
		3. Aircraft documents in order
		a. Registration
		b. Airworthiness certificate
		c. Operating Limitations
		d. Flight manual
		e. Weight and Loading
		f. Equipment list

Name of inspector_____

Certificate Number_____

Signature_____

4.0 Maintenance and Repairs

4.1 Maintenance Tasks

This manual describes the maintenance tasks listed in the following table that can be performed on the North Wing S-LSA trike Model: Sport X2. Some tasks can be performed by the owner with conventional tools, while others require special certifications as described in Section 1.1 above or special tools which are identified in the task description. A description of each maintenance task is given in the following section in the order listed in the tables below. In addition to the items listed below the owner may perform all items listed in Part 43 appendix A - Preventative Maintenance. The partial list of applicable items from Part 43 appendix are:

1. Removal, installation and repair of landing gear tires.
2. Servicing landing gear wheel bearings.
3. Replacing defective safety wire and cotter pins.
4. Lubrication not requiring disassembly other than removal of nonstructural items.
5. Making simple fabric repair not requiring stitching.
6. Replenishing brake fluid
7. Refinishing decorative coatings when disassembly is not required
8. Repairing upholstery when disassembly is not required
9. Making small repairs to fairings not changing the contour of the fairing.
10. Replacing safety belts.
11. Replacing seat parts where disassembly isn't required.
12. Replacing spark plugs.
13. Replacing any hose connection not including hydraulic lines
14. Replacing pre-fabricated fuel lines.
15. Replacing gearbox oil and fuel filters
16. Replacing and servicing batteries.

All maintenance shall be performed in accordance with Part 43, AC 43-13B, the Rotax 2 stroke maintenance manual, and the applicable North Wing UUM Inc maintenance manual.

For all Rotax engine maintenance, Warp propeller maintenance, BRS, and EIS instrument system maintenance, refer to the respective manuals provided by North Wing with your aircraft.

Maintenance/Repair/Replacement	Skill Level
Wing: Section 4.2	
1. Wing cleaning	Owner, LSR-M, A&P
2. Wing tuning: twist, LE tension (shims), rib tension, rib reflex, crossbar pull back position	Owner, LSR-M, A&P
3. Sail tear less than 1" long	Owner, LSR-M, A&P

4. Sail tear greater than 1" long	Factory repair or NW approved professional sail repair shop
5. Sail removal from frame	LSR-M, A&P
6. Leading edge replacement	LSR-M, A&P
7. Keel tube replacement	LSR-M, A&P
8. Crossbar replacement	LSR-M, A&P
9. Front and rear pitch cable (lower rigging) replacement	LSR-M, A&P
10. Wing fittings and hardware replacement	LSR-M, A&P

Carriage: Section 4.3	
1. Cleaning exterior	Owner, LSR-M, A&P
2. Remove rear wheel pants	Owner, LSR-M, A&P
3. Repair or replace rear tire	Owner, LSR-M, A&P
4. Replace wheel bearings	LSR-M, A&P
5. Replace rear brake pads/bleed brake lines	LSR-M, A&P
6. Replace rear Landing gear legs and/or spindle	LSR-M, A&P
7. Repair or replace front tire	Owner, LSR-M, , A&P
8. Reposition front fork assembly	LSR-M, A&P
9. Repair/replace front fork assembly	LSR-M, A&P
10. Replace Seat frame	LSR-M, A&P
11. Replace main dual mast	LSR-M, A&P
12. Replace seat belts	Owner, LSR-M, A&P
13. Replace mast lift cylinder	Owner, LSR-M, A&P
14. Replace engine mount tubes	LSR-M, A&P
15. Repair radiator leak in radiator and/or hoses	LSR-M, A&P
16. Remove and repair Apache Fairing	Owner, LSR-M, TA&P

Fuel System: **Section 4.4**	
1. Replacing fuel filter	Owner, LSR-M, A&P
2. Replacing fuel pump	LSR-M, A&P
3. Replacing fuel and pulse lines	LSR-M, A&P
4. Replacing fuel tank	LSR-M, A&P
5. Replacing fuel tank drain valve	LSR-M, A&P

Electrical System: **Section 4.5**	
1. Replacing battery	Owner, LSR-M, A&P
2. Checking and replacing voltage regulator	LSR-M, A&P
3. Checking and replacing magneto switches	LSR-M, A&P
4. Checking and replacing master key switch	LSR-M, A&P
5. Replace starter	LSR-M, A&P
6. Replace Hot Box	LSR-M, A&P

7. Replace starter solenoid – Out or Inside hot box	LSR-M, A&P
8. Connecting 12 Volt Power to Auxiliary Equipment	LSR-M, A&P

Engine: Section 4.6	
1. Changing Spark Plugs	Owner, LSR-M, A&P
2. Changing Gearbox oil	Owner, LSR-M, A&P
3. Remove and Replace prop. Per prop Mfg. instruction	Owner, LSR-M, A&P
4. Change Prop Pitch	Owner, LSR-M, A&P

4.2 Wing Maintenance: M-Pulse 15 Meter Wing

4.2.1 Wing Cleaning

Skill Level: Owner and higher

Tools: Damp cloth, pail, soft brush

Materials: Water and possibly mild detergent, aluminum polish/cleaner, WD40

Task Description:
The sail fabric should be cleaned regularly with a soft damp cloth. If the wing is exceptionally dirty, it can be washed with a mild detergent only. Keep detergent washing to a minimum. Acetone or alcohol can be used to remove stubborn stains without harming the sail. However, rinse thoroughly with water after cleaning with these chemicals. Because of the acid in their system, bug grime should be removed immediately to prevent long term deterioration of the sail.

All cables can be cleaned with a soft damp cloth. The plastic coating on the wing cables can be cleaned with WD40 or household cleaner if necessary.

Wing struts are anodized and can be cleaned with a soft damp cloth, or with a mild detergent. If placards, such as the "EXPERIMENTAL" placard is attached to the strut, be careful not to scrub the strut to avoid removing or damaging the placards.

Other exposed aluminum tubes, keel tube, cross bars, down tubes, base tube, leading edges, and ribs can be cleaned with a soft damp cloth or a mild detergent. In some cases it may be desirable to polish these tubes with a mild aluminum polishing cloth and compound.

4.2.2 Wing Tuning

Skill level: Owner and higher

Tools: Philips screw driver

Parts: Leading Edge Shims if necessary

Task Description:
This task can be complicated. If you do not feel comfortable in your understanding of the following instructions, do not attempt to adjust the wing. The performance of the wing can be significantly affected if excessive adjustments, or improper adjustments are made.

Prior to starting any wing adjustments, check the following items which may cause any number of problems.

1. Check for proper wing assembly. i.e. no cable routing problems, nose cable is not twisted at swan hook, nose cone is secure in place, sprogs are in place
2. Assure the crossbar setup cable in not caught or riding on the pivot block
3. Assure that all ribs are secured and have reasonable tension in the trailing edge rib strings. If a rib string is loose for no apparent reason, check to see if the rib has punctured and pushed through the rib pocket at the leading edge. This will cause a loose rib and a turning problem.
4. Match all ribs to the rib blueprint provided with your wing. Correct any deviations unless they were changed as a result of prior successful tuning.
5. Check the leading edges to assure they are not bent. If so, they must be replaced.

Once these checks are completed, and wing handling or performance problems persist, then proceed with the following diagnostics.

A few basic rules of wing tuning are listed here:

1. Make only small adjustments until the effect of those changes is determined by test flying.
2. Never change more than one adjustment at a time without testing the result of that adjustment.
3. Upon completion of making any adjustments, test fly the trike about a foot off the ground for the length of the runway at least three times before climbing to altitude to assure no adverse characteristics have been introduced.
4. Record all changes in your wing maintenance log

There are six basic types of adjustments that an owner is authorized to make to tune his wing handling:

1. Sail tension from front to rear at selective locations (rib positions)
2. Sail tension along the leading edge
3. Selective rib re-shaping
4. Twist (or washout) along the span of the wing
5. Cross bar pull back adjustment
6. Hang block location (CG adjustment)

Each of these adjustments has a different affect on the performance and handling of the wing. Table 4.2-1: Wing Tuning Diagnostics, provides a diagnostic procedure if your wing performance needs corrections. The "1st Adjustment" column is the recommended first corrective action. If the problem persists, the "2nd Adjustment" can be made. The code letters in the columns refer to the list of Corrective Adjustments in the following Table 4.2-2: Wing Corrective Adjustments. If neither of these two adjustments correct the problem, contact a North Wing dealer.

Symptom	1st Adjustment	2nd Adjustment
Tail heaviness (flies too slow)	B	
Nose heaviness (flies too fast)	A	
Wing pulls to the right with hands off straight and level flight	Q,F	L,D
Wing pulls to the left with hands off straight and level flight	R,E	K,C
Yaw unstable (roll response lag)	G	I
Roll is unstable (difficult to keep from rolling)	M	O,J
Roll too stable (heavy force required to enter into roll)	G	P,I
Wing Breaks to left in a stall		E,K
Wing breaks to the right in a stall		F,L
Trailing edge flutter	N	J

Table 4.2-1: Wing Tuning Diagnostics

Code	Description of Corrective Adjustments
A	Move hang block back (1/2" at a time)
B	Move hang block forward (1/2" at a time)
C	Increase camber on the last 2 cambered left tip ribs by ¼", or decrease the same on right tip by ¼"
D	Increase camber on the last 2 cambered right tip ribs by ¼", or decrease the same on left by ¼"
E	For a strong turn, increase the tension of the right leading edge pocket, or loosen the tension of the left leading edge pocket by inserting or removing shims respectively. See description below for inserting shims.
F	For a strong turn, increase the tension of the left leading edge pocket, or loosen the tension of the right leading edge pocket by inserting or removing shims respectively. See description below for inserting shims.
G	Loosen leading edge pocket on both sides by removing shims respectively. See description below for inserting shims.
H	Tighten leading edge pocket on both sides by inserting shims. See description below for inserting shims.
I	Loosen rib tension on both sides symmetrically except for #1 and the last 2 ribs
J	Tighten rib tension on both sides symmetrically starting at the tips
K	Tighten rib tension on the left side ribs #1 – 4
L	Tighten rib tension on the right side ribs #1 – 4
M	Loosen tension on ribs #2-4 on both sides to remove excess reflex from these ribs
N	Tighten rib tension in the locality of each problem area
O	Tighten the rigging tension of the cross bar restraining cable using the adjustable tangs on the rear shackle
P	Loosen the rigging tension of the cross bar restraining cable using the adjustable tangs on the rear shackle
Q	To correct a mild turn to the right, twist both left and right wing tips "counter" clockwise looking at the wing tip. Notice that even though you are twisting both wing tips "counter clockwise", the wing tip on each end moves in opposite directions because you are looking at it from opposite ends.
R	To correct a mild turn to the left, twist both left and right wing tips clockwise.

Table 4.2-2: Wing Corrective Adjustments

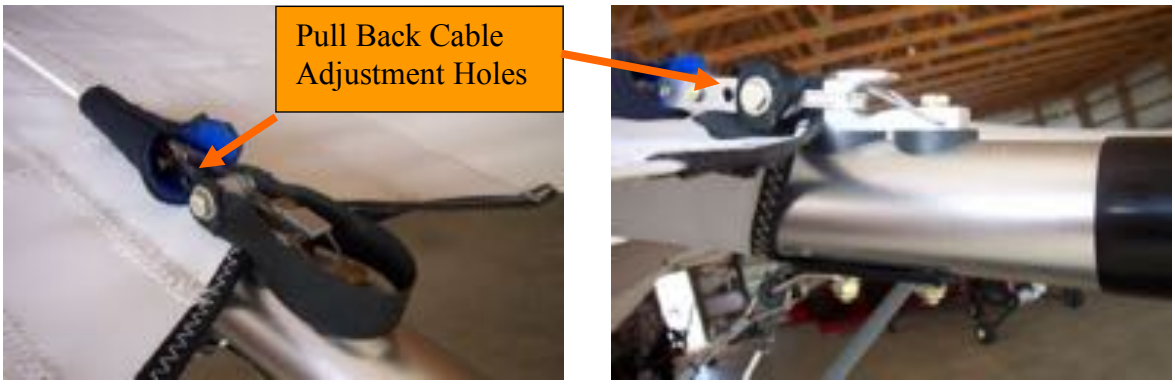
Descriptions of how to perform these adjustments is given in the following paragraphs. However, the amount of adjustment required is dependent upon the specific problem and varies from wing to wing. Therefore, it is important to make only one change at a time. Make a small change and then test the effect of those changes by flying the wing. It is best if these adjustments are made by someone with wing tuning experience since it takes practice and patience to tune a wing properly.

Moving the Hang Point (Adjustments A and B):
The hang point is easily adjusted to any location within the acceptable range. See description in **Section 2.2 Weight and Loading**.

Changing Wing Camber (Adjustments C and D):
Changing wing camber is done by reshaping the ribs selectively. It is seldom if ever needed except in the case of wing damage due to impact. Since this is a very delicate task, this must be done by a North Wing dealer. Contact North Wing to find the nearest location to you where this can be done.

Rib Tension (Adjustments I, J, K, L, M, N):
Rib tension is easily adjusted in one of two ways. For slight adjustments, the leech lines holding the ribs in the pockets can be crossed and then re-attached. This will essentially make the loop distance shorter and put more tension on that rib. If more tension is required, the knot in the leech line must be untied and re-tied at a short loop length.

Crossbar Rigging Tension (Adjustments O and P):
Rigging tension is adjusted using the pull back cable adjustment shackle as shown in the picture below. Wing must be removed from the trike and de-tensioned to do this adjustment.



Leading Edge Tension (Adjustment E,F,G, and H):
Adjusting the leading edge pocket tension on the MP wing requires inserting or removing shims in the leading edge under the trim tip using the following procedure.

1. Remove the last three ribs and de-tension the sail so it can be closed about 25 to 35%. This allows enough slack in the sail to remove it from the trim tip as described below. Note that a leading edge cannot be “loosened” if there are no shims in the side needing to be loosened.

Leading Edge Tension Adjustment cont'd:

Step 2: Loosen both trim tip screws 4-5 full turns. Using the Philips screwdriver, "pop" the screws in with the heel of your hand to loosen the trip tip. (For more detail on how the trim tip works, see next section on **Wing Twist**.)

Step 3: Using the black strap attached to the sail, pull the yellow strap out of the groove in the trim tip. This may require removing the sail screw at the nose going into the leading edge so the sail can slide back to allow slack in the yellow strap.

Step 4: Slide the trip tip out of the end of the leading edge.

Step 5: Slip shim over the trip tip, and reinsert trim tip into leading edge. Shims range from ¼" to ¾" .

Step 6: Realign screws with marks on leading edge as it was when disassembled. Otherwise, wing twist will be changed as well as LE tension. Note! Tighten the screws 1 –2 turns per side. Not all at once.

Step 7: Re-attach yellow strap into trim tip groove making sure strap is fully in groove.

Wing Twist (Adjustments Q and R):

Twisting the wing is done by loosening the wing trim tip and then simply twisting the sail at the tip by hand to a new position. The operation of the wing trim tip is described below. It is also helpful to review the description of "Inserting Shims" above since it shows how to release the trip tip so it can be turned.

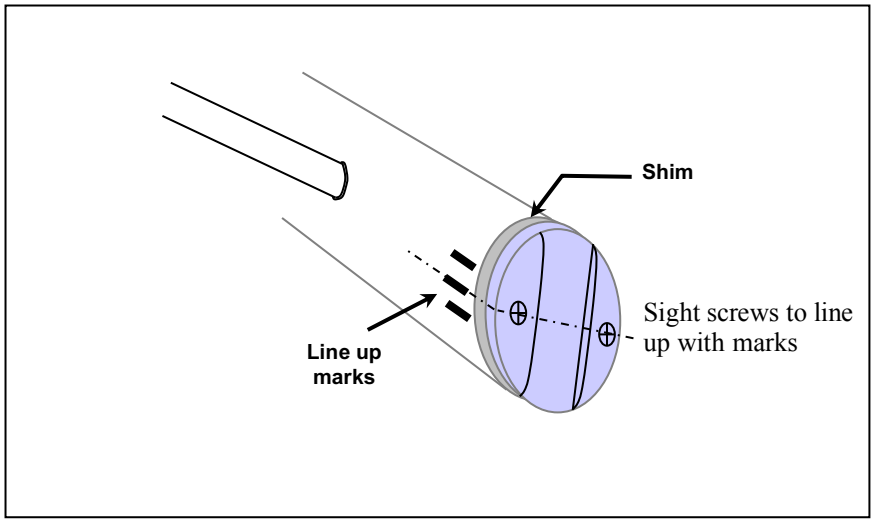


Figure 4.2-1: Wing Trim Tip End Cap Adjustment

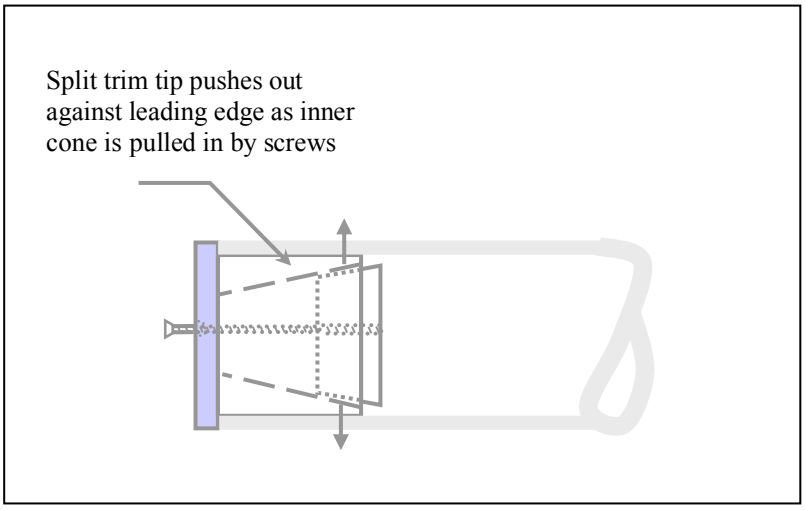


Figure 4.2-2: Wing Trim Tip Securing Mechanism

4.2.3 Sail Tears Less than 1" Long

Skill Level: Owner or higher

Tools: Scissors

Parts: Adhesive sail repair cloth from sail repair shop or aviation materials supplier

Task Description:
Sail tears up to 1" in length can be repaired using an adhesive sail repair cloth provided the tear in NOT within 1" of a seam or an edge of sail. Most sail color can be reasonable matched or coordinated. The patch should extend at least 1" in all directions from the tear.

Follow these steps:

1. Prepare the surface where the patch will be applied by washing it with a damp cloth and letting it dry thoroughly If the patch area feels contaminated with any substance, try a mild detergent followed by thorough rinsing with clean water and drying. You can also use alcohol or acetone to clean the area.
2. Cut the patch material to the required size. Since this task is only approved for tears up to 1" long, the maximum patch size should be 2" wide by 3" long. Rounding the corners of the patch will reduce the tendency of the patch to peel off or snag on something.
3. Remove the backing from the patch and apply patch to torn area.
4. Using a smooth hard material as a backer board under the patch area, roll the patch with a small roller such as a wall paper seam roller.

The wing can be flown immediately after applying an adhesive patch.

4.2.4 Sail Tears Greater Than 1" Long

Skill Level: Factory Repair or North Wing Approved Sail Repair Shop

Tools: Not applicable

Materials: Dacron sail material in several colors

Task Description:
Sail tears longer than 1", or tears that are within 1" of an edge or seam must be repaired by a certified sail repair shop or returned to North Wing for repair. In most cases, the sail must be removed from the frame and shipped to the sail repair shop. For instruction on sail removal, see Section 4.2.5.

4.2.5 Sail Removal from Frame

Skill Level: LSR-M, or A&P

Tools: Two 7/16" wrenches, one 9/16" wrench, Phillips screw driver, preferably a second person

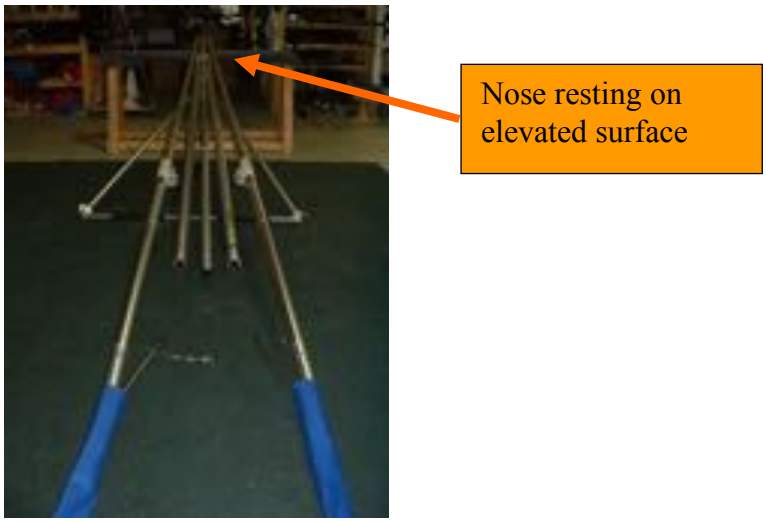
Materials: None

Task Description:

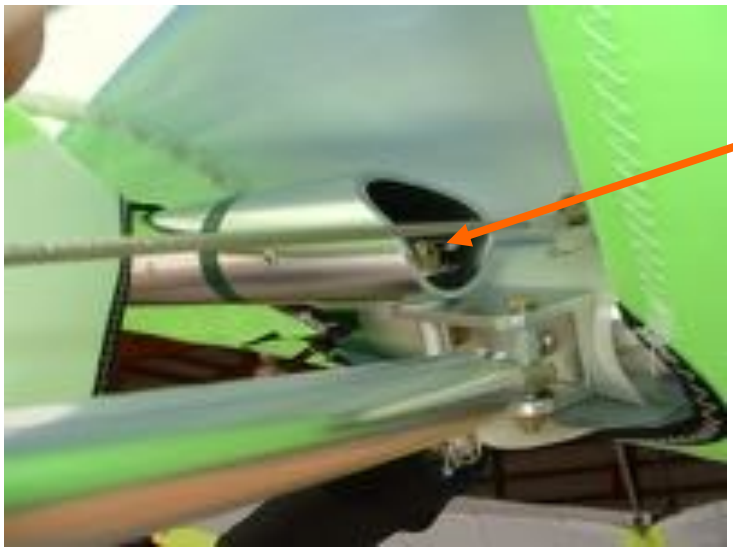
The sail should be removed for inspection of the frame every 3 years or 200 hours, OR if the wing has experiences any type of hard impact e.g. hard landing or striking an object.

Prepare a clean area about 40' x 40' to remove the sail, preferably shielded from the wind. The wing should be protected from coming into direct contact with the ground using either cardboard, a large paint cloth, or a clean floor surface. Clean dry grass can be used, but be careful when moving the wing on the grass to avoid permanent stains. If it is not possible to avoid the wind, face the nose of the wing into the wind.

1. Remove the wing from the trike using the procedure described in the Owner's Manual.
2. Remove wing struts and ribs following the procedure shown in the Owner's manual as if you were going to put wing in bag for transporting.
3. Disconnect the nose wires from the swan hook and lay the wing flat on the ground with top of wing up. Pull the washout tubes out of their sockets and fold back toward the tips. Fold the sprogs back toward wing tips.
4. Bring wing tips together simultaneously (requires 2 people) or in 3-4 small stages (if only one person) being careful not to force them together. The tensioner cable must slide clear of the wing penetration hole when bringing the wing tips together. If the tensioner hardware catches on the sail, it can easily tear the sail causing significant damage.
5. Lift the nose and rest it on a raised surface, e.g. a saw horse as shown below.

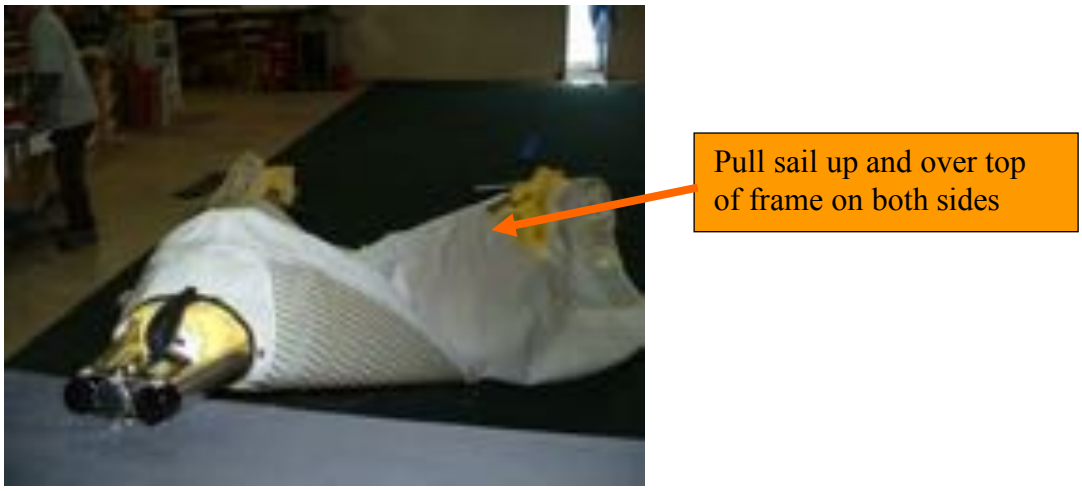


6. Remove Philips screw holding sail in place at nose on each side located up near nose on leading edge.
7. Remove rear wires from keel tube noting order of washers and saddles.
8. Unzip crossbar/leading edge inspection zipper and remove crossbar attachment bolts on both sides. This requires using a box wrench or socket on the nut inside the crossbar end and a screw driver inserted in the strut attachment hole to keep the eye bolt from turning. (Note! There is no need to remove the sprog or the sprog-to-leading edge attachment bracket.)



9. Un-velcro the sail-to-keel tube restraint webbing.
10. Slide sail toward rear slightly on both sides and open velcro straps that are holding yellow sail straps in place a couple inches from the wing tips. Lift yellow sail strap from groove in trim tip cap.

11. Pull the sail out and over the top of the leading edge and the outside of the entire frame as shown below.



12. Bring wing tips together again being careful not to force them. If any resistance is encountered, stop and check that the sail is clear of all parts, especially the tensioner cable attachments.
13. Slowly slide the frame out the nose of the sail guiding the crossbars and sprogs as required to clear the sail openings.

If the sail is to be shipped to a repair site, it is recommended that the mylar inside the leading edge be removed. If this is the case, continue with the following steps.

14. Remove the mylar from the leading edge by laying the sail flat on the ground with the leading edges laying straight and slowly and carefully pull the mylar out. If any resistance is encountered, stop and pull the leading edge of the sail flat and straight again. Having a second person slightly "fluff" the wing at the tip end as you pull the mylar out will help. Note the orientation of the mylar as it is removed so you will re-install it the same way.
15. Fold the sail first in half along the center line (keel tube pocket) with the top side out keeping the sail as flat as possible.

Replacing Sail on Frame

When replacing the sail on the frame, allow the same 40 foot clean working space preferably shielded from the wind.

1. If the mylar were removed for shipping, re-install it in leading edges first. Lay the wing on a clean surface with the top side up. Re-installing the mylar is reasonably easy to do if the leading edge pocket is laid "very" flat from nose to tip. This means the edges of the LE pockets cannot be folded over slightly or even bent a little, otherwise

the mylar will buckle and bind as it is pushed in. Be sure the mylar is oriented properly with the relief cuts on the bottom side. Lay the mylar out straight on the ground aligned with the LE pocket that it will be going into. Slide the mylar into the LE "MYLAR POCKET" by grasping it on both edges and pushing it gently into the pocket. Note there is a separate pocket that runs parallel to the LE pocket for the mylar. It will go very easily for about three quarter of the way. To get it fully in place, it may require a second person pulling and working the tip end of the sail pocket to relieve and resistance the mylar encounters. The slightest curve or bend will create a significant amount of resistance and prohibit the mylar from easily sliding into place.

If it becomes impossible to replace the mylar using the above method, it will be necessary to use an 18ft light weight pole with a small peg on the end. Insert the peg in the hole at the tip end of the mylar and carefully push the mylar into the sail pocket.

2. Turn the sail over so the top side is now down and stretch it out fully from nose to tip but with the tips about 4 – 5 feet apart.
3. Lay the frame on the ground near the nose and oriented with the control frame up. Using a small cord or velcro strap to hold the tubes together on each side is helpful. The control frame and crossbars must be kept separate from the leading edges. The sprogs should be tied back so they are pointing toward the tips of the frame, not the nose.
4. With help from a second person, carefully slide the tips of the leading edges into their respective LE pockets until the sprogs reach their access zipper. Untie the sprogs and guide them out of the sail while continuing to push the frame on to the sail.

4.2.6 Leading Edge Replacement

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" and one 9//16" box or open end wrenches
Philips head screw driver

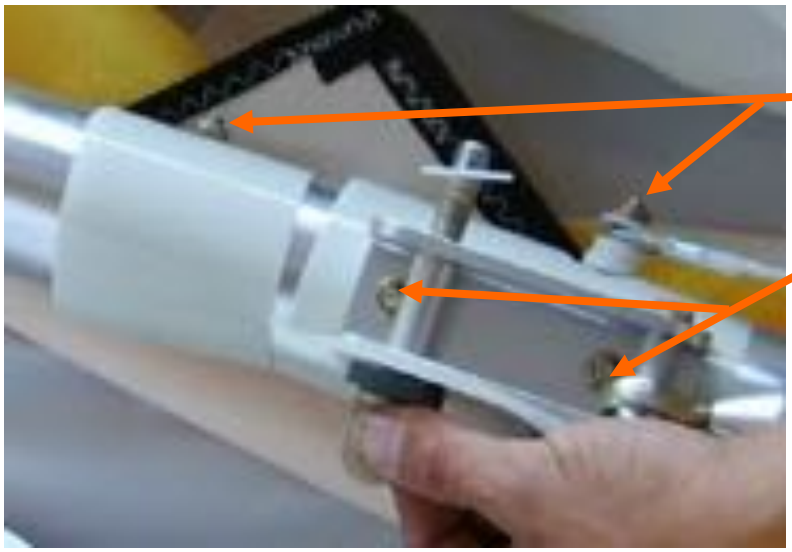
Materials: Replacement leading edges
AN4 Nylock nuts

Task Description:

Each leading edge has a rear section and nose section. Consequently, if damage to the leading edge occurs, it is important to determine if the damage is on the rear section or nose section, and on the right side or left side. The leading edges are color coded with green on the right and red on the left. Anytime the leading edge suffers a hit, both sections should be removed and inspected for any signs of dents, bends, or cracking including any signs of overstress or elongation around the bolt holes at the nose and the crossbar attachment points. The leading edge can be removed and replaced without removing the sail completely from the frame.

1. Perform Steps 1 – 5 described in Section 4.2.5, Sail Removal From Frame.

2. Remove the Philips screw from the damaged leading edge near the nose and save to re-install.
3. Pull the white velcro straps at the wing tips apart that hold the sail leading edge tight against the leading edge tube.
4. Pull the yellow sail retaining strap at the wing tip out of the trim cap groove using the loose black finger strap running parallel to the yellow strap but slight longer. Be sure the strap is pulled off the trim cap toward the front edge of the sail so the leading edge tube can be slid out without having to slide "through" the yellow strap.
5. Remove the trim cap following the instructions given in Section 4.2.2 on wing tuning. Be careful to note any shims that have been installed for proper re-assembly.
6. Unbolt the crossbar from the leading edge bracket noting the sequence of washers and saddle.
7. Unzip the mid-point sprog (long sprog) inspection zippers and fold the sprog back toward the wing tip to remove the tension from its support cable. Remove the front and rear LE attachment bolts (rear one attaches the sprog cable to the leading edge). This will require sliding a 7/16" open end wrench under the protective mylar wrapped around the leading edge to hold the head of the bolt. Note the sequence of washers on the cable attachment bolt. These are necessary to achieve the correct support of the sprog under load.



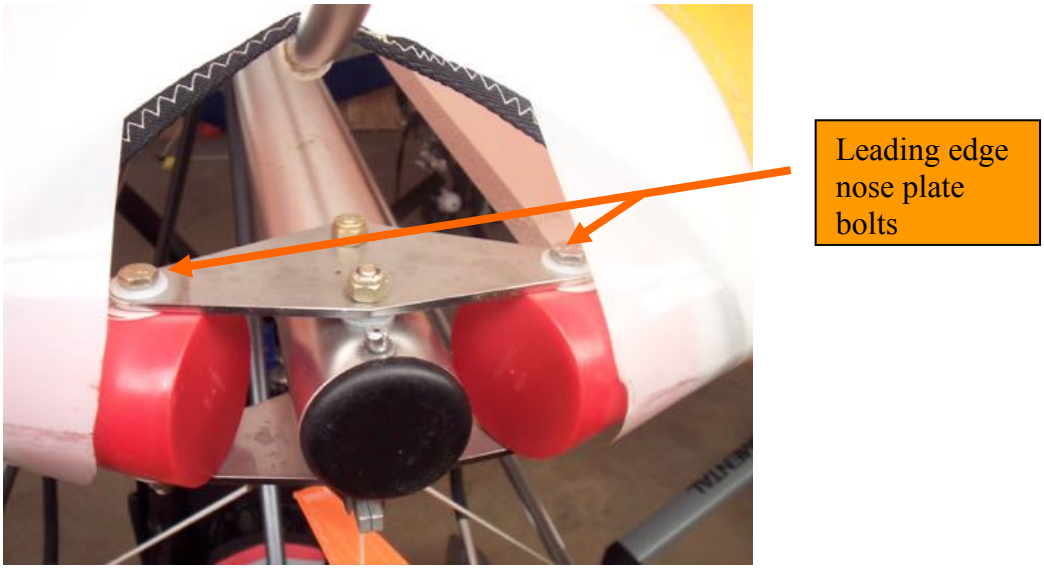
8. Remove the two ¼" bolts holding the attachment bracket for the sprog and crossbar to the leading edge. Note how the mylar is wrapped so it can be properly re-installed. Leave the sprog attached to the mounting bracket, and move the mounting bracket clear of the leading edge.

9. The rear leading edge section can now be removed by simply pulling it out through the wing tip being careful to fold the small sprog inward as the leading edge is extracted.

10. Once the rear LE section is removed, the rear sprog assembly can be removed by pulling the sprog out of its socket a sufficient distance to cut the bungee cord that pulls it in and then pushing the socket out of its hole in the leading edge.
11. Attach a new bungee cord 24" long to the sprog socket and install the socket in its hole in the LE. Remove the tip cover from the sprog and feed the long bungee cord through the sprog. While pulling the bungee with significant tension through the sprog, tie a knot in the bungee at a point that holds the sprog against its socket when in place.

If it is certain that this is the only section that is damaged, the new rear section leading edge can be installed and the leading edge reassembled. If the nose section of the LE must be removed or inspected, continue as indicated below.

12. Remove the LE bolt from the nose plate.



13. Slide the nose section out through the crossbar zipped opening in the sail.
14. Slide the rear section together with the nose section and check for any bends by rolling the assembled LE on a large flat surface and viewing down the tube while supported at several points on a flat surface.

Reassembly:

1. In general, when re-assembling, simply perform the above tasks in reverse order. A few notes may be helpful.
2. Be careful to align the rear section LE properly. With the wing upside down it is easy to get the sprogs facing the front of the LE instead of the back. It may not be obvious this has happened until later in the re-assembly and some re-work will be required.
3. You will probably not be able to get the sail screw near the nose back in place until the wing is completely re-assembled and tensioned. At that time, the grommet in the sail can be more easily twisted by hand to align with the screw hole in the LE. It is helpful to have a second person assist with this.

4.2.7 Keel Tube Replacement

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" box or open end wrenches
¼" Hex wrench (Allen wrench)

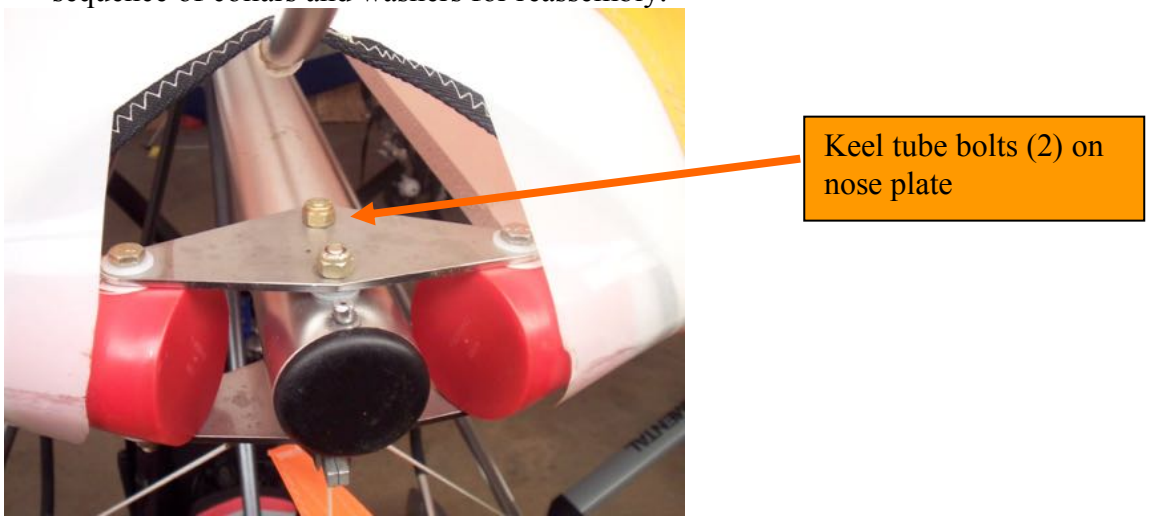
Materials: Replacement keel tube
AN4 Nylock nuts

Task Description:

The keel tube can be removed and replaced without removing the sail or any other elements of the wing frame following the sequence outlined below:

1. Remove the wing from the trike using the procedure described in the Owner's Manual.
2. Remove wing struts and ribs following the procedure shown in the Owner's manual as if you were going to put wing in bag for transporting.
3. Disconnect the nose wires from the swan hook and lay the wing flat on the ground with top of wing up. Pull the washout tubes out of their sockets and fold back toward the tips. Fold the sprogs back toward wing tips.
4. Bring wing tips together simultaneously (requires 2 people) or in 3-4 small stages (if only one person) being careful not to force them together. The tensioner cable must slide clear of the wing penetration hole when bringing the wing tips together. If the tensioner hardware catches on the sail, it can easily tear the sail causing significant damage.

5. Roll the wing onto its back so the bottom of the wing is facing up. Spread the wing tips out until the wing is about one quarter open.
6. Remove rear cable assembly and tensioner hook assembly at the rear of the keel tube.
7. Remove both trike collars by removing both Allen bolts from the collar halves.
8. Remove the control frame apex block assembly.
9. Remove two ¼" keel tube bolts from the nose plate. It may be helpful to slightly loosen the other bolts to slide the keel tube saddles and washers out easily. Note sequence of collars and washers for reassembly.



10. Slide keel tube out of the nose plates toward the rear of the wing, then slide it out of the keel pocket forward.

4.2.8 Crossbar Replacement

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" box or open end wrenches

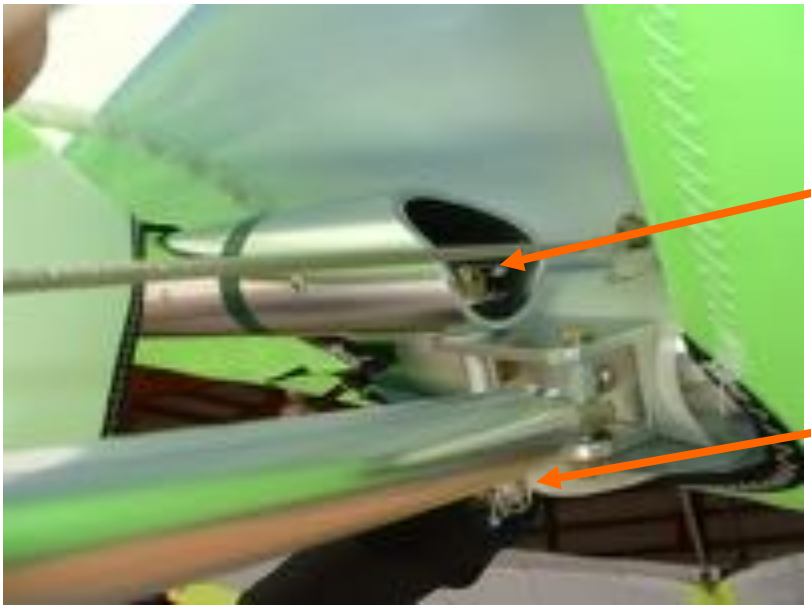
Materials: Replacement crossbar
2 – Thin AN4 Nylock nuts
1 – Thin AN5 Nylock nut

Task Description:

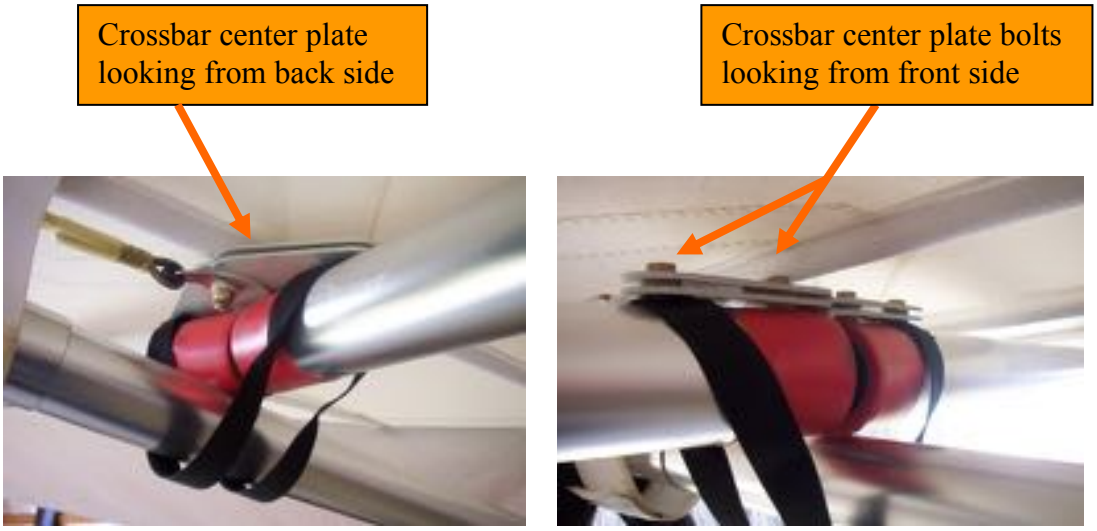
The crossbar can be removed and replaced without removing the sail or any other elements of the wing frame following the sequence outlined below:

1. Remove the wing from the trike using the procedure described in the Owner's Manual.
2. Remove wing struts and ribs following the procedure shown in the Owner's manual as if you were going to put wing in bag for transporting.

3. Disconnect the nose wires from the swan hook and lay the wing flat on the ground with top of wing up. Pull the washout tubes out of their sockets and fold back toward the tips. Fold the sprogs back toward wing tips.
4. Bring wing tips together simultaneously (requires 2 people) or in 3-4 small stages (if only one person) being careful not to force them together. The tensioner cable must slide clear of the wing penetration hole when bringing the wing tips together. If the tensioner hardware catches on the sail, it can easily tear the sail causing significant damage.
5. Roll the wing onto its back so the bottom of the wing is facing up. Spread the wing tips out until the wing is about one quarter open.
6. Unbolt the damaged crossbar from the leading edge attachment by removing the castle nut on the inside of the tapered end of the crossbar using a 9/16: wrench with a screw driver to hold the eye bolt. Lift the crossbar off the bolt. Do not remove the bolt from the attachment bracket. Put the castle nut back on the bolt loosely until the new crossbar is attached.



7. Unbolt the crossbar from the crossbar center plate, and slide the crossbar free of the wing. To do this, it is necessary to slide a 7/16” wrench inside the crossbar to hold the nut from turning since the bolt does not go all the way through the cross bar.



Re-assembly Note:

When re-assembling, remember to use a safety pin or ring on the castle nut on the crossbar attachment to the leading edge bracket.

4.2.9 Front and Rear Pitch Cables (Lower Rigging) Replacement

Skill Level: LSR-M, or A&P

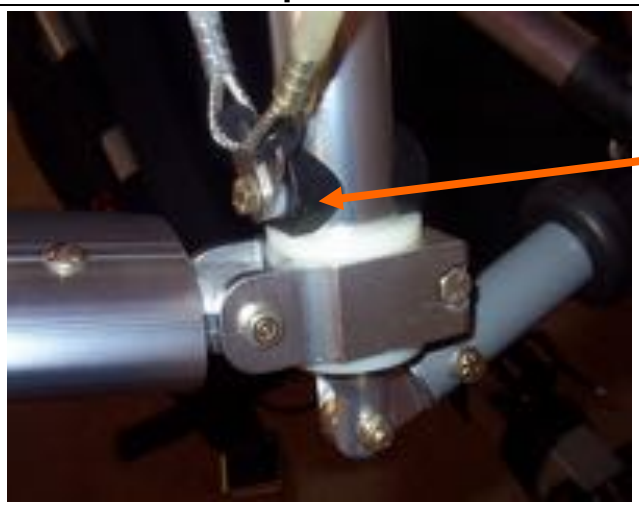
Tools Required: Two 7/16" box or open end wrenches

Materials: Replacement cables
3 – ¼" Thin Nylock nuts

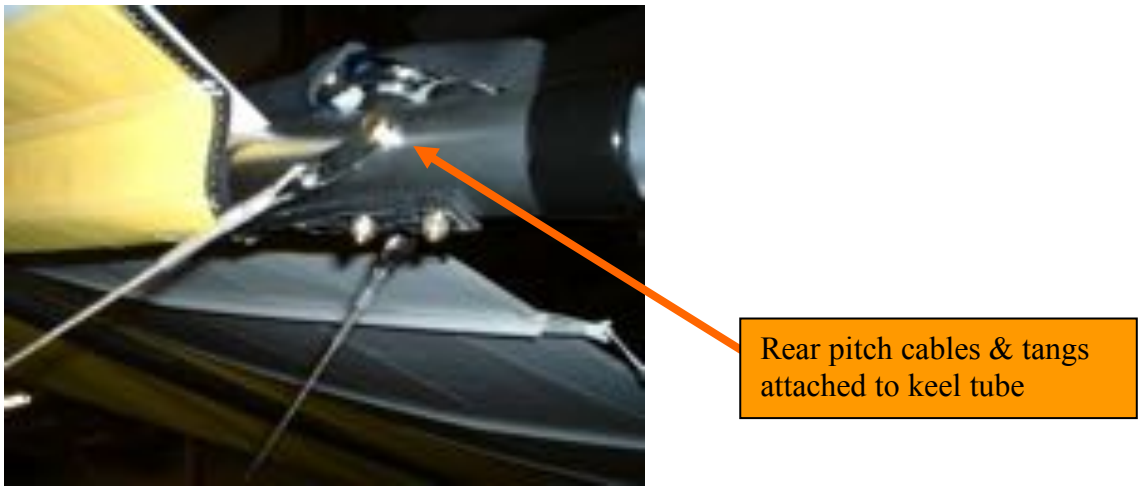
Task Description:

The front and rear pitch cables and mounting tangs come as two separate cable assemblies. Although they can be replaced separately if damaged, it is recommended both assemblies be replaced at the same time. These cables should be replaced every 400 hours of flight time or if any one of them becomes kinked or shows any sign of wear or abrasion.

1. Perform Steps 1-5 in Section 4.2.2, Sail Removal.
2. With the wing lying on its top side and the control frame folded "back" toward the rear of the wing, remove the cable attachment bolt (1) in each down tube and discard the bolt and nut.



3. Remove cable attachment bolt at rear of keel tube. This is one of the two bolts that retain the tensioner hook to the keel tube. Inspect the bolt and replace bolt and nut if any signs of wear on the bolt.



4. Replace the rear cable tang on the new nut and re-assemble at the keel tube and down tube attachment points. Tighten bolts to "SNUG" per torqueing discussion.

4.2.10 Replacing Wing Fittings and Hardware

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" box or open end wrenches

Materials: Replacement Fittings and Hardware

Task Description:

Wing fittings and hardware include the following items:

- Nose plates
- Cross bar plates
- Crossbar to leading edge attachment hardware
- Sprog attachment hardware
- Front swan hook attachment
- Pull back cable attachment hardware

In all cases replacement of this hardware requires the removal of the wing from the trike. The common element among these items is that they all attach to the tubing and care must be taken to avoid over tightening bolts and thereby crushing or distorting the tubing excessively.

1. Remove wing ribs
2. Spread wing on clean floor or ground surface upside down.
3. Open wing zipper or nose cone to expose part to be replaced.
4. Remove safety wire and bolts securing hardware to wing tubes taking particular care to note the sequence of washers, saddles, and nut positions.
5. Replace the worn or damaged part checking the holes in the tubing at the same time for wear or fatigue cracks.
6. Replace the bolts and nylock nuts with new ones if there is any sign of wear or the nylock has been used more than 3 times.
7. Tighten the bolts to SNUG making sure the tubing is not distorted excessively which would weaken the tube.

4.3 Carriage Maintenance

4.3.1 Cleaning Exterior

Skill Level: Owner and higher

Tools: Pail and hose

Materials: Water and mild detergent

Task Description:

The trike frame is made of powder coated aluminum and the optional fairing is a gel coated fiber glass resin composite. Both can be cleaned with any mild degreasing detergent such as Dawn. For heavy accumulations of grease or oil, first identify and fix the source. Heavy grease or oil can be removed by spraying the area with WD-40 and wipe off with a dry rag or paper towel. Follow up with mild detergent to remove the residual film and rinse well with

clear water. Avoid wetting electrical wires and connections, air filter, and throttle, choke, and BRS cables by protecting with a plastic cover. Avoid spraying WD-40 or other degreaser on air filter, fabric side bags, wing fabric, electrical components, or metal components when they are hot. Most degreasers are flammable.

Minor scratches on the fairing can be buffed out using a high quality auto polish and soft rag. Do not use rubbing compound.

4.3.2 Remove Rear Wheel Pants

Skill Level: Owner and higher

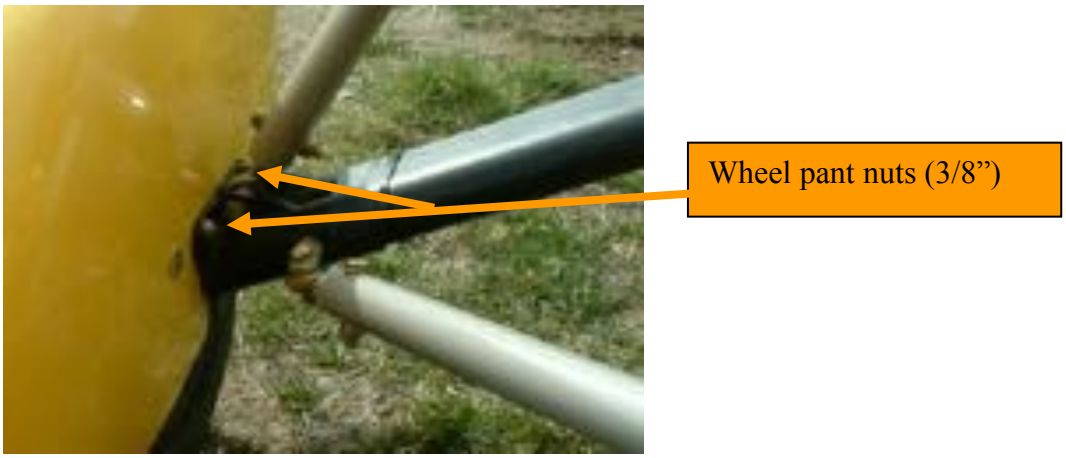
Tools: ½" , 3/8" wrenches or sockets

Materials: None

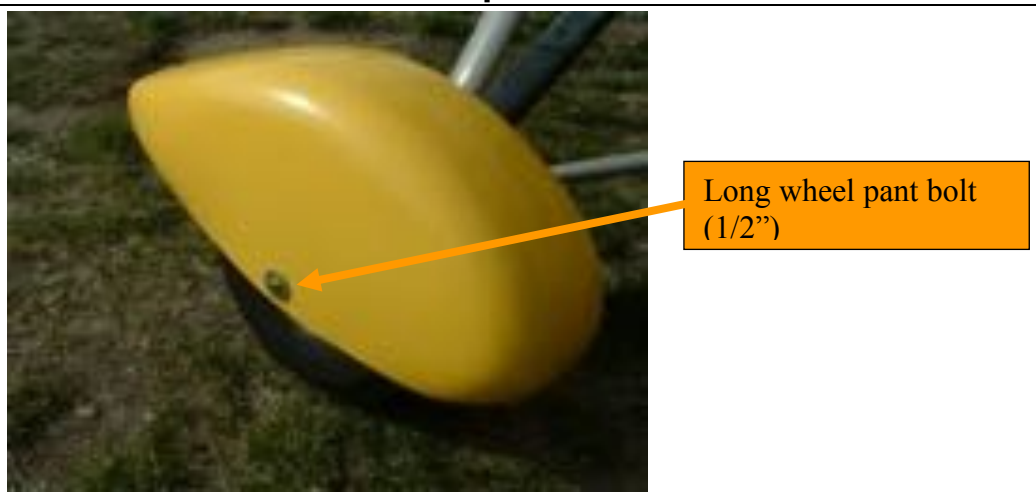
Task Description:

Prior to any other maintenance tasks on the rear wheels, the wheel pants must be removed. They have three mounting bolts, two on the inside and one on the outer side of the wheel pant.

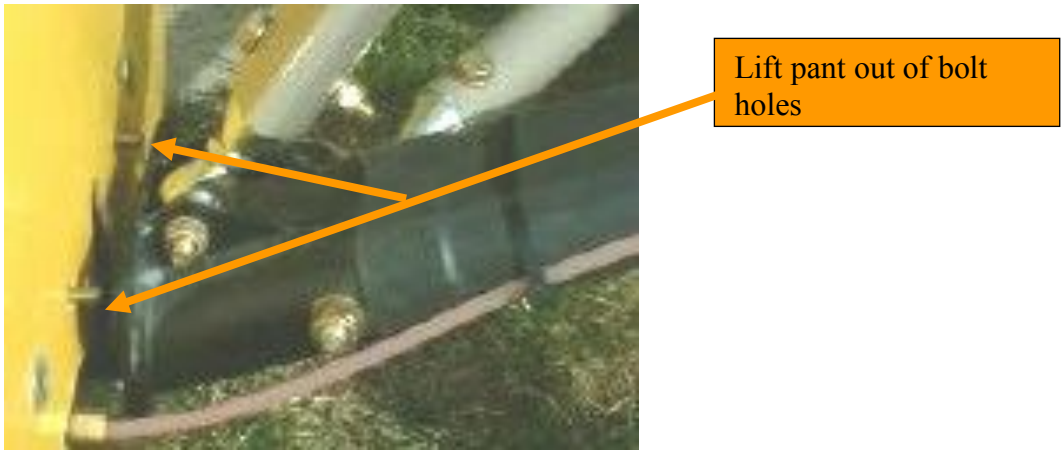
1. Remove the two bolts on the inside (or backside) of the wheel pants using a 3/8" wrenches.



2. Remove the long bolt holding the outer side of the pant along with the 2 7/8" spacer. This AN 533A bolt is threaded into the end of the wheel axle. When you remove this bolt, a long nylon spacer will fall out of the wheel hub.



3. Lift wheel pant out of bolt holes on back side and off of wheel.



4.3.3 Replace Rear Tire

Skill Level: Owner, LSR-M, A&P

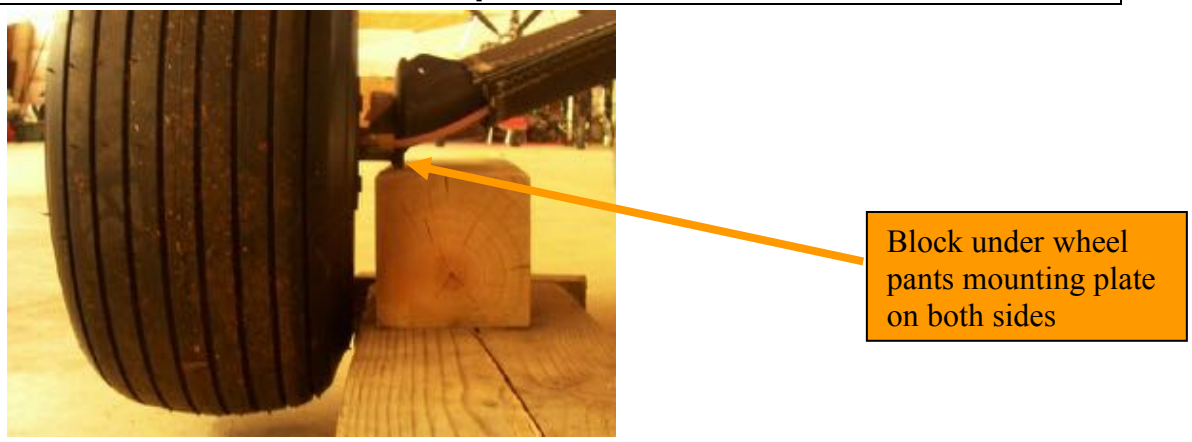
Tools: 1-1/8" Socket , two 7/16" wrenches, 3/8" Hex wrench, ½" socket

Materials: Replacement tire, inner O-rings

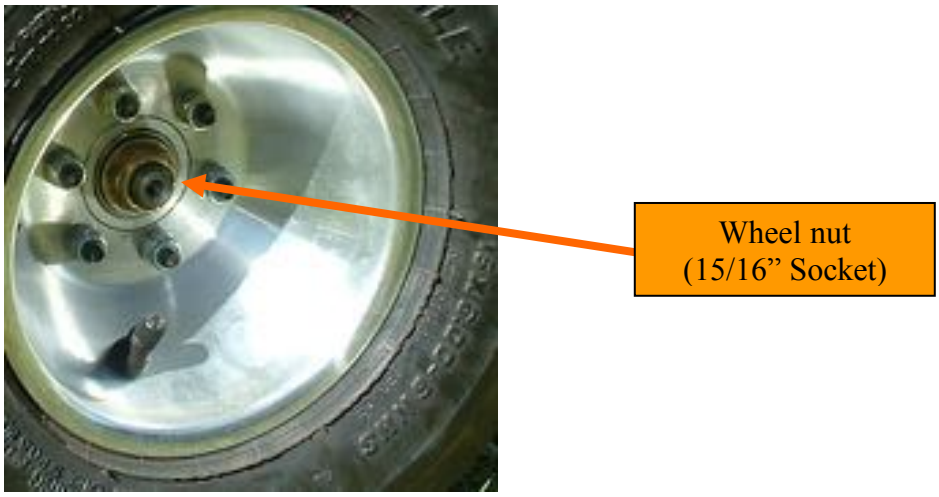
Task Description:

If the tire is being replaced due to wear, it is recommended the O-rings seals inside the rim be replaced at the same time to avoid additional downtime in the near future.

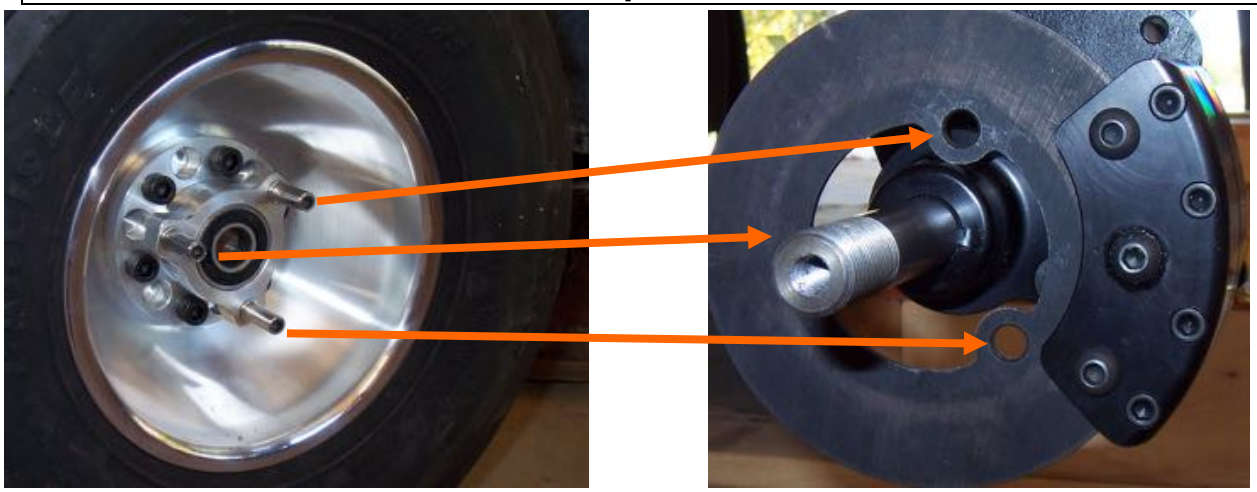
1. Remove wheel pants as described above in Section 4.3.2.
2. Raise both axles off ground with wood blocks as shown below.



3. Remove large nut on end of wheel with 15/16" socket. DO NOT remove six smaller bolts. Wheel is a tubeless split hub and the two halves are held together with these six bolts.



4. Slide wheel off axle. Wheel may have a tight fitting on the brake disc pins and need to be bumped off with a rubber mallet or block of wood. A three pin adapter is attached to the back side of the wheel as shown below. These three stopping pins engage the brake disc, which passes through the brake caliper when turning. When the brake pedal is depressed, the caliper stops the brake disc which, through these pins, stops the wheel.



Stopping pins slide into brake disc holes as shown above

5. With wheel removed from axle, remove the six 5/16" bolts holding the split rim together. The plate holding the brake stopping pins will also be removed when these bolts are removed.
6. Using a smooth flat bar, pry the rim halves off the tire. Note, there is an inner circular disk with 2 O-rings sandwiched between the rim halves. These O-rings seal the two halves from air leakage. If the O-rings are not being replaced, be careful not to damage them.
7. Put the plate holding the brake stopping pins in position on the inboard rim half and put bolts in holes through both the plate and the inboard half of rim.
8. Mount new tire on inboard rim.
9. Put seal disk with O-rings onto inboard rim.
10. Align inboard half rim bolt holes with outboard rim and re-assemble rim. Torque rim bolts to specified values in torque table.
11. Re-inflate tire to 15 psi and check for leaks using soapy water or a water bath deep enough to submerge tire to center of rim.
12. Remount wheel and wheel pants. DO NOT over tighten wheel nut. Bring nut snug on bearing, then back off ¼ turn.

4.3.4 Replace Rear Wheel Bearing

Skill Level: LSR-M, A&P

Tools: 1-1/8" Socket , two 7/16" wrenches, long drift pin

Materials: New bearings

Task Description:

1. Remove wheel as described in Section 4.3.3 above.
2. It is NOT necessary to separate the rim halves.
3. Using a long drift pin, reach in from one side and tap the bearing out of its seat by tapping around the circumference of the outer bearing race.
4. Turn the tire over and tap the bearing on the other side out.
5. Align new bearings in their seats and gently tap them in with a rubber or wooden mallet or block of wood. Be careful not to drive them hard when they are not aligned with the seat.
6. Remount wheel and wheel pants.

4.3.5 Replace Rear Brake Pads, Calipers, and Disc, and Bleed Brakes

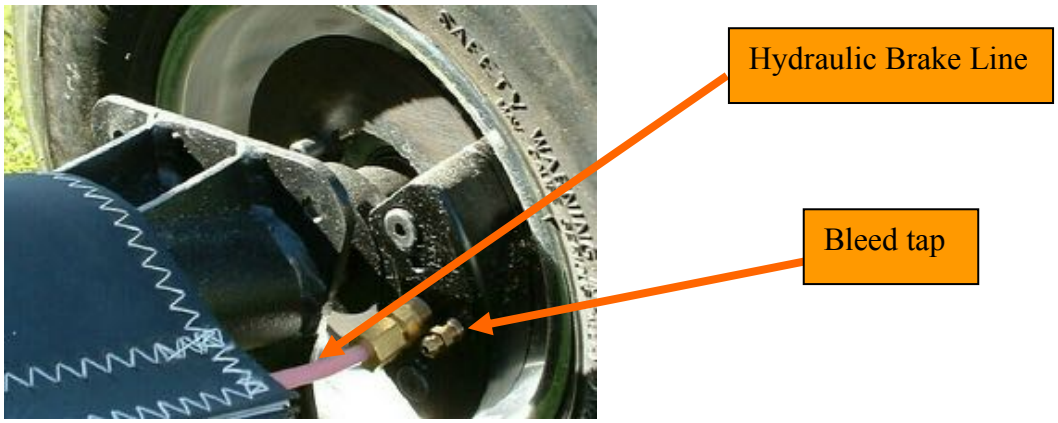
Skill Level: LSR-M, A&P

Tools: 1-1/8" Socket, ¼" Hex (Allen) key , 1/8" ignition box wrench, clean pump type oil can or syringe for brake fluid injection.

Materials: Replacement brake pads, ATF fluid, 12" x 1/8" rubber or neoprene tubing

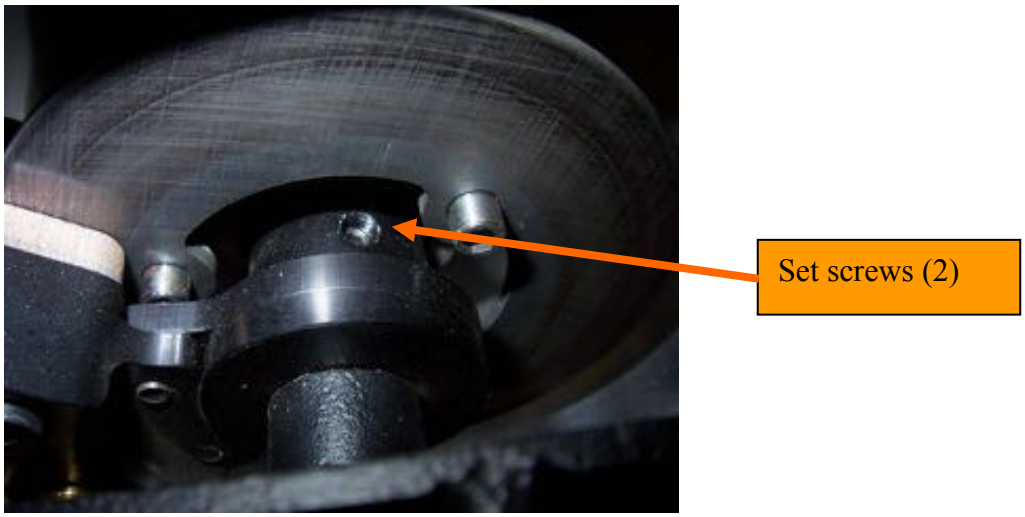
Task Description:

1. Remove wheel as described in Section 4.3.3 above.
2. If the brake caliper is being replaced, disconnect the hydraulic brake line from the rear of the caliper. Catch and discard any brake fluid that drains from the lines. DO NOT attempt to re-use the brake fluid. If the caliper is not being replaced or serviced, leave the brake lines attached.



3. Loosen the two 1/8" hex set screws securing the caliper on the spindle. If the caliper is being replaced or serviced, slide the caliper off the spindle. Since the caliper is keyed onto the spindle, it may be necessary to bump the caliper off the key with a mallet.

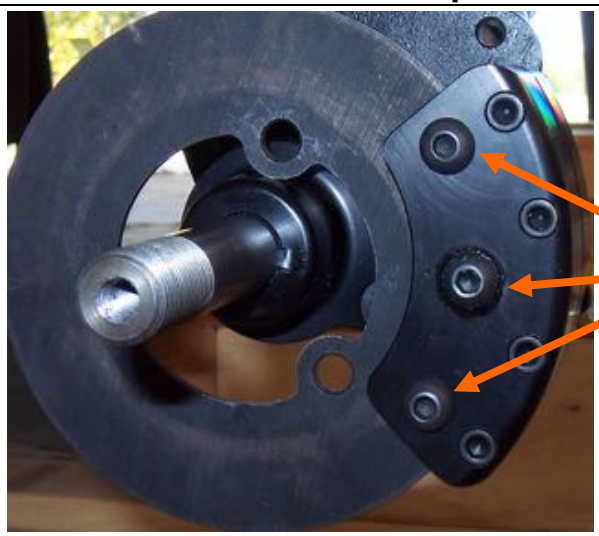
   If the caliper is NOT being replaced or serviced, slide it just past the key so the bolts on the back side can be removed in subsequent steps.



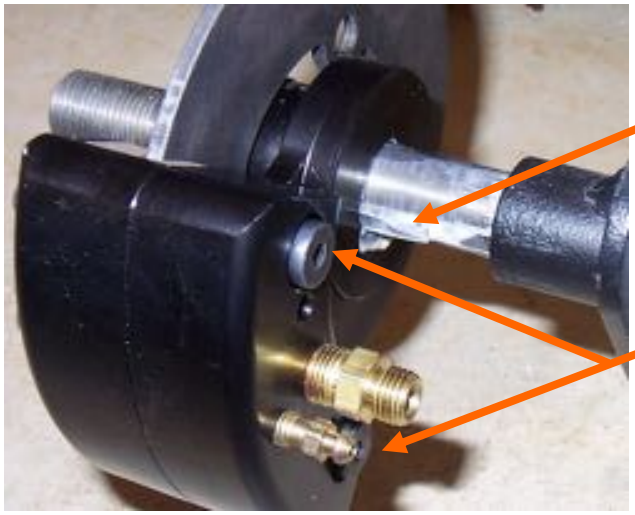
4. At this point the disc can be removed and replaced if necessary, and the brake pads can be removed and replaced.

Replacing Brake Pads

5. Using a 5/32" hex wrench, remove the 3 button head screws on the outboard side of caliper and remove outboard pads. **NOTE!** Do not remove the 4 smaller screws on the outboard side of caliper. Install new outboard pads and replace screws. **NOTE!** The center screw ONLY is a fine thread. Replace pads with new pads and replace the three screws.



6. Remove the two 5/32" hex screws from the inboard side of the caliper and place screws and springs aside. Remove old pads, install new ones, and replace the hex screws.



Bleeding Hydraulic Brake Lines

If the hydraulic line was disconnected, it will be necessary to bleed the brake lines. It may also be necessary to bleed the lines if there was air in the lines prior to beginning the brake repair. Air in the lines will result in a very soft brake pedal and excessive pedal movement. If sufficient air is in the system, there will be no braking action at all.

Bleeding the brakes is best done with two people.

For best results, it is necessary to have the bleeder valve on the rear calipers at the lowest point. This is because the brake fluid will be forced from the brake caliper back to the master cylinder. The bleeder valve on the master cylinder is already at the top, and, consequently, it is best to force the fluid in this direction. When the caliper is keyed onto

the spindle, the bleeder valve is on the side and some air will be trapped at the top of the chamber in the caliper. Although bleeding in this position still results in adequate braking, better braking can be achieved if the caliper if rotated. Therefore, it is best to bleed the brakes with the caliper just off the key so the bleeder valve can be rotated to the lowest point. This puts the fluid line fitting at the highest point so air can be pushed through to the master cylinder.

7. To position the bleeder valve at the lowest point, it is necessary to slide the brake hub partially off of the axle beyond the key that holds the hub from turning. Be sure the 1/8" set screws in the caliper hubs are loose. It may require tapping the back side of the hub with a hammer to free it from the tight fitting keyway. The hydraulic line is coiled about 1 ½ turns under the root tube which will allow the caliper to slide further out while the brake line is connected. Be careful not to slide the hub completely off the axle or the hydraulic line may be damaged. Once the caliper is clear of the key, rotate it until the bleeder valve is at the bottom or at the lowest point.
8. Slide a 12" piece of 1/8" flexible clear plastic tubing over the outlet of the bleeder valve on the master cylinder. Put the other end of the tubing in a glass container on the ground. If the tubing is not a tight fit, it will try to slide off if particularly when you open the bleeder valve. Using a 1/4" wrench open the bleeder valves (normal right hand thread) on the master cylinder and on one (1) wheel caliper about ½ turn. One person should hold the tubing on the master cylinder and work the bleeder valve at that end while a second person pumps ATF fluid (Dextron II or III) through the line from the caliper to the master cylinder. The fluid can be pumped using a syringe or a pump-type oil can with a piece of tubing connected from the oil can spout to the caliper bleeder valve. Be careful not to apply too much pressure with the oil can pump or syringe because the brake fluid will simply blow out at the tubing fittings. When no air bubbles are seen in the line from the caliper to the tee at the rear of the root tube, close both bleeder valves. Note, there may still be air bubbles in the line from the tee to the master cylinder at this point.

Brake fluid pump connected to bleeder valve with ¼" tubing

1st person pumps fluid through lines from rear caliper

2nd person bleeds front master cylinder into container using ¼" tubing on bleeder valve

9. Move the pump/syringe to the caliper on the other side and repeat the bleeding procedure above. However, this time continue pumping fluid until no bubble can be seen coming out of the master cylinder.
10. Close both bleeder valves and slide calipers back on key. While holding the key in keyway, line up slot in caliper and tap caliper back into place.
11. Tighten the two 1/8" set screws.
12. Remount wheels and wheel pants.

4.3.6 Replace Front Tire

Skill Level: Owner, LSR-M, A&P

Tools: 1-1/8" wrench and socket, smooth flat bar, ½" socket, hex wrench

Materials: Replacement tire

Task Description:

The front tire can be replaced without any disassembly of any other elements of the carriage following the procedure below.

1. Chock rear wheels on both front and rear sides of both wheels. Raise the front wheel about 12" off the ground. This is best done by setting a saw horse on each side of the trike and laying a 2x4 or larger beam between them so that the 2x4 crosses the root tube just in front of the front seat. Tie a rope to this board and then down under the root tube and back up to the beam. Lift the front wheel to the desired height, tension the rope, and tie it off. Be careful not to crush the wire harness or any tubing running along the under side of the root tube. DO NOT support the carriage on the fiberglass fairing. Also, be very careful not to lift the front of the trike too high with the wing off. It will rapidly reach its balance point and flip onto the prop if lifted too high.

Support nose wheel off ground using sawhorses and rope under root tube

2. Remove the nut from the front axle bolt using a 15/16" wrench and socket. Pull the axle bolt out of the drag link suspension arms being careful to support the wheel as it comes loose. The two long bushings that hold the wheel centered will also fall out as the axle is removed. Set these aside for re-installation.

3. Lower the tire and wheel assembly out from under the carriage fairing and front suspension system.
4. With wheel removed from axle, remove the six 1/2" nuts holding the split rim together. The bolt requires a 3/16" hex wrench.
5. Using a smooth flat bar, pry the rim halves off the tire. Note, there is an inner circular disk with 2 O-rings sandwiched between the rim halves. These O-rings seal the two halves from air leakage. If the O-rings are not being replaced with new ones, be careful not to damage them.

6. Mount inboard rim on new tire
7. Put seal disk with O-rings onto inboard rim.
8. Align inboard half rim bolt holes with outboard rim and re-assemble rim. Torque rim bolts to specified values in torque table.
9. Re-inflate tire to 15 psi and check for leaks using soapy water or water bath.
10. While wheel is off the carriage, the wheel bearing can be replaced by using a drift pin or long aluminum ½" diameter bar to tap the bearing out from the opposite side. Lay the wheel on the ground and reach through the center of the wheel and place the drift pin against the back side of the outer race of the bearing. Gently tap around the circumference of the bearing until the bearing is driven out of its seat.
11. Align new bearings in their seats and gently tap them in with a rubber or wooden mallet or block of wood. Be careful not to drive them hard when they are not aligned with the seat.
12. Remount wheel. DO NOT over tighten wheel nut. Bring nut snug onto bearing, then back off ¼ turn.

4.3.7 Reposition Front Fork Assembly

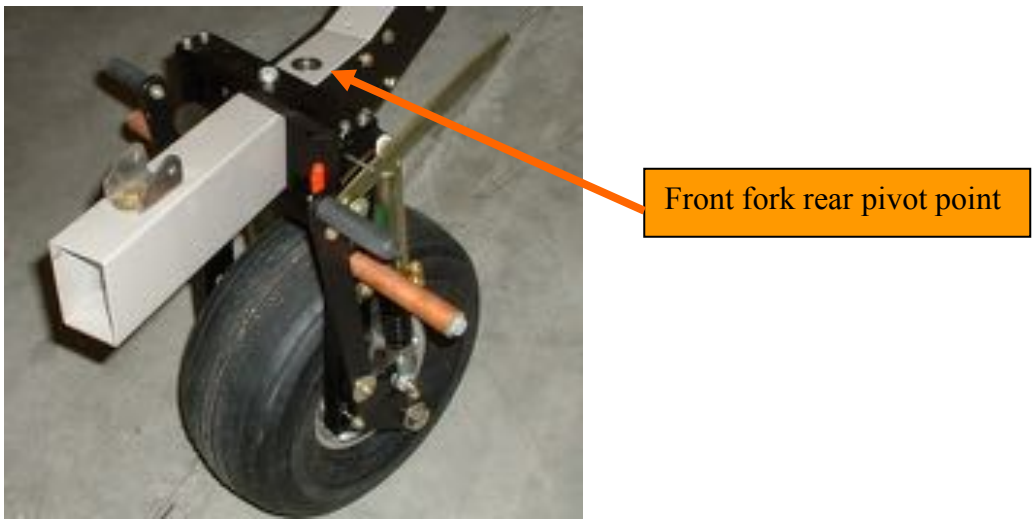
Skill Level: LSR-M, A&P

Tools: 1/2" wrench and socket, 2 7/16" wrenches

Materials: None

Task Description:

The front fork pivot point can be adjusted to one of two pivot points to match the owners preferred leg position. In the picture below, the fork assembly is shown in the forward position. The rearward position is 2 ½" behind the forward position.



1. Chock rear wheels on both front and rear sides of both wheels. Raise the front wheel off the ground at least 2" and support using saw horses as described in Section 4.3.7 above.
2. If the trike has an instructor steering link, remove the bolt located mid-way on the connecting tube to allow the inner tube to slide inside the outer tube as the fork assembly in moved.
3. Remove the long fork pivot bolt by reaching under the front fairing under the instrument panel.
   Note! On the Navajo, the front mounting bolt for the instrument pod may have to be removed and the rear mounting bolt loosened so the pod can be rocked rearward slightly to allow the bolt to be removed or inserted. For the Sport model, there is just enough room to remove the bolt from the rear position without removing the fairing, but the instrumentation wiring must be temporarily repositioned to get the bolt out.
4. Slide the fork assembly to the desired position and re-insert the pivot bolt and nut. Be careful not to catch or kink the hydraulic brake line on the fork assembly.
5. Align the steering pegs in a "NO Turn" position.
6. Align the instructor steering pegs to be parallel with the front steering pegs and mark the position on the inner tube through the hole in the outer tube where the locking bolt needs to be. Drill a new 3/16" hole in the inner tube. Do not drill straight through. Drill each hole from its respective side.
7. Re-insert the bolt in the instructor's connecting link between the front and rear pegs.

4.3.8 Repair/Replace Front Fork Assembly

Skill Level: LSR-M, A&P

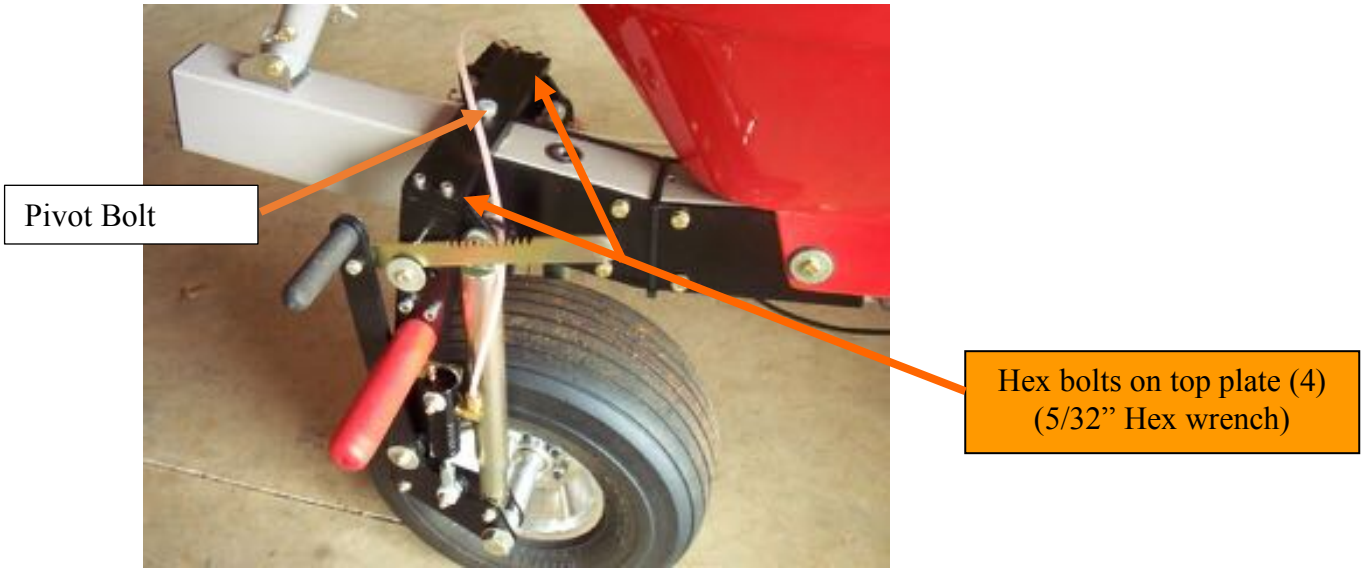
Tools: Hex wrenches

Materials: Replacement parts

Task Description:

If the fork assembly is bent or twisted as may occur on a very hard landing, the fork arms or top or bottom plates will have to be replaced as described below. Other parts connected to the fork assembly can be replaced directly without having to remove the entire fork assembly.

1. Remove front wheel as described in Section 4.3.7 above.
2. Disconnect throttle cable and pull free of throttle pedal.
3. Unbolt brake master cylinder at both ends and tie back from fork assembly. You will have to route the brake line away from the fork assembly. DO NOT disconnect brake hydraulic line.
4. Remove nut from fork pivot bolt.
5. Using 5/32" hex wrench, remove four hex head machine screws from top plate of fork assembly. Support the fork assembly before removing the last screw as it will fall out when all 4 screws are removed.



6. Remove the pivot bolt from the root tube along with the top plate.
7. Inspect all pieces to assure all damaged parts will be replaced.
8. Re-assemble with new parts.

4.3.8A
REPLACING FRONT FORK TO 2016 TRIPLE TREE COMPLETE ASSEM.

Task Description:

1. On the old fork disconnecting the Steering stabilizer, brake line and throttle cable.
2. Remove the older front fork by removing the center pivot bolt (see picture about)
3. Simply put the new fork on and install the new pivot bolt. Nut -tighten to snug.
4. Hook up the Steering stabilizer, brake line and throttle cable.
5. Bleed the brake line per section 4.3.5

Check all fitting and connection

4.3.9 Repair/Replace Seat Frame and Front Seat Backrest

Skill Level: LSR-M, A&P

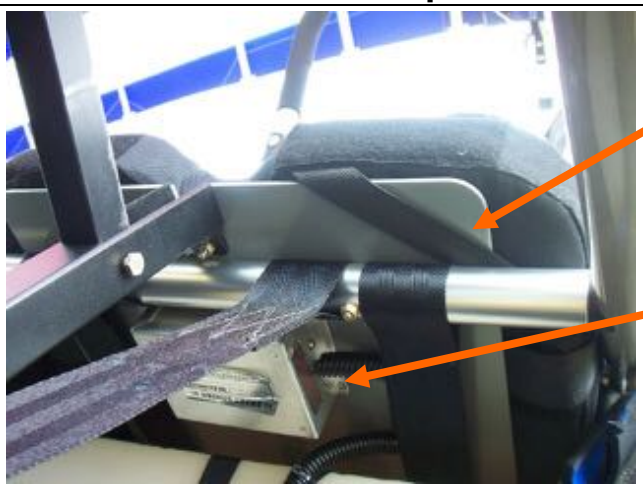
Tools: Two 7/16" wrenches, Philips head screw driver

Materials: Replacement parts

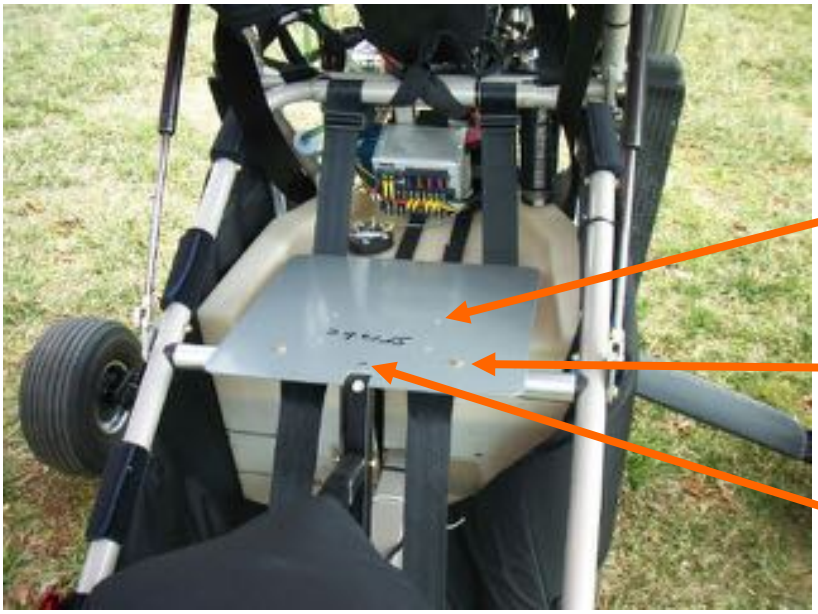
Task Description:

The seat frame is a structural member when the wing is in place. Therefore, the wing must be removed before the seat frame can be removed.

1. Remove wing from trike.
2. Tie main mast in upright position using a soft piece of rope tied from the mast to the gear case.
3. With mast in upright position, unclip and remove the attachment pin at lower end of cylinder on both sides and tie pneumatic cylinders clear of seat frame.
4. Pull seat belt straps out from seat cushions.
5. Remove seat cushions by pulling them loose from their velcro attachments. There are straps on the front corners on the underneath side of the seat cushions that slide over the metal plate under the cushions. Be sure to slide the front edge of the cushion off these metal plates.

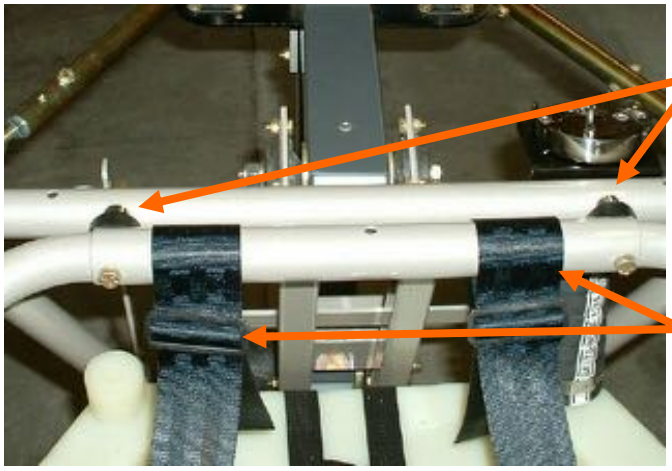


6. Remove the lower bolts attaching the front seat backrest post to the root tube.
7. Remove the hold down bolts attaching the rear metal seat plate to the crossbar shown below. Note on trikes with the optional strobe light, the electronic box for the strobe light may be mounted under the rear seat metal plate. If this is present, remove the bolts holding the electronics box to the metal plate and lower the box clear of the seat frame straps.

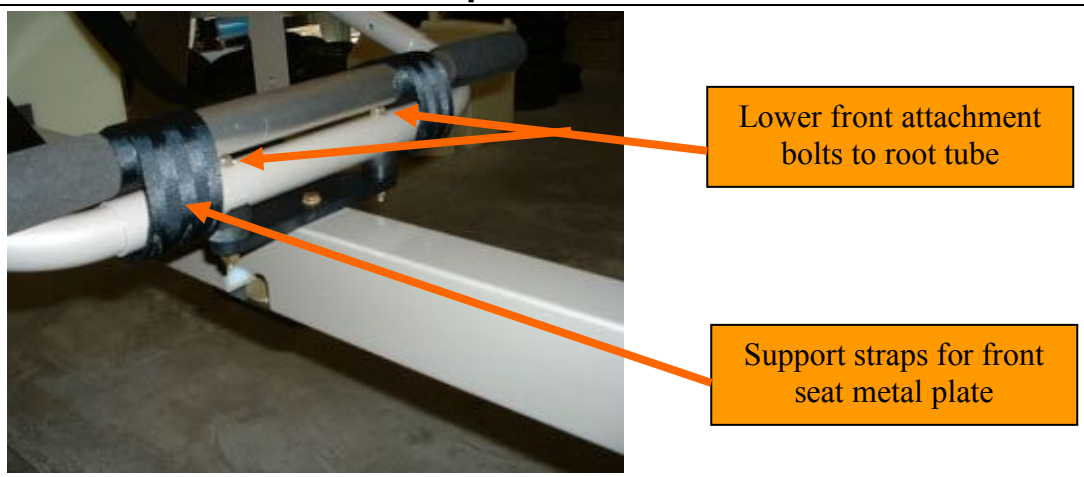


8. The rear metal seat plate, along with the front seat backrest can now be lifted out from the seat frame as a unit and set aside.
9. Remove screw in front seat plate holding plate to support tube. Remove front seat plate and set aside.
10. If a fairing is installed, remove the top screws securing the fairing to the metal plate attached to the seat frame.

11. Pull the fairing just slightly clear of the metal anchor plate and prop in position with wood block or other soft material.
12. Remove two ¼" bolts from top back of seat frame where it is attached to the backframe.



13. Remove two ¼" bolts from lower front of seat frame where it is attached to the root tube mounting plate.



14. Lift seat frame out of trike and repair or replace.
15. When re-assembling, if the web strapping running from the top back of the seat frame to the middle cross bar of the frame is removed, it must be re-installed at the correct length. Note that this strap is used to support the seat metal plate from resting directly on the fuel tank. The front seat straps are not adjustable but the rear ones are. Consequently, the strap must be adjusted to the correct length at the upper end to avoid sitting directly on the fuel tank.

4.3.10 Replace Main Dual Mast

Skill Level: LSR-M, A&P

Tools: Two ½" wrenches

Materials: Replacement parts

Task Description:

If the main mask is bent or damaged, it must be replaced as follows.

1. Remove wing from trike.
2. Release mast hold down so that mast is in full upright position.
3. With mast in upright position, unbolt pneumatic cylinders from mast end and rotate cylinders clear of mast
4. With help from a second person, remove the pivot bolts from the bottom of the mast on both sides and lift mast off of backframe.
5. To remove the velcro strap for the back seat hold-down, drill out the rivets in the short retaining straps holding the horizontal straps to the mast. Slide strap off the bottom of the mast. Position it on the new mast and re-rivet.
6. Install new mast and re-assemble.

4.3.11 Replace Seat Belts

Skill Level: Owner, LSR-M, A&P

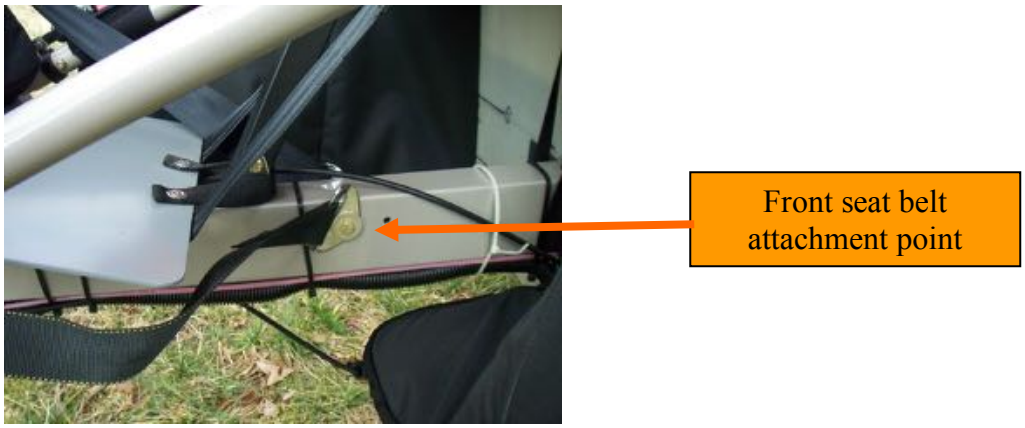
Tools: Two 7/16" wrenches

Materials: Replacement parts

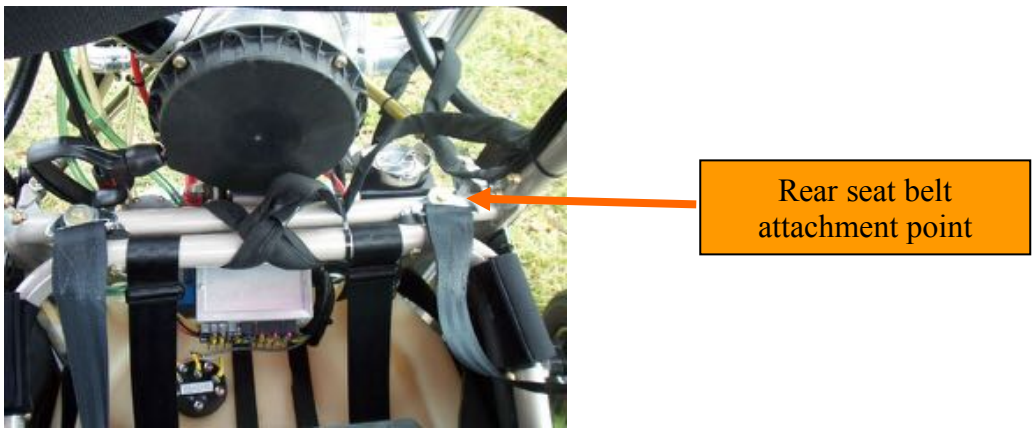
Task Description:

The front seat belts are attached to the root tube under the rear seat. The rear seat belts are attached to the top of the backframe. The front seat shoulder harness (2 straps) are attached to the lower portion of the backframe. The rear seat shoulder harness is attached to the main mast.

1. Pull seat belt straps out from seat cushion slots.
2. Remove seat cushions by pulling them loose from their velcro attachments. There are straps on the front corners on the underneath side of the seat cushions that slide over the metal plate under the cushions. Be sure to slide the front edge of the cushion off these metal plates. (See picture above in Section 4.3.10)
3. Unbolt front seat belt tangs from root tube using two 7/16" wrenches.



4. Unbolt rear seat belt tangs from backframe using two 7/16” wrenches.



5. Replace with new belts.
6. The front seat shoulder harness straps (2) are fastened to the lower portion of the backframe.
7. The rear seat shoulder harness (1) is fastened to the main mast.

4.3.12 Replace Mast Lift Cylinder

Skill Level: Owner, LSR-M, A&P

Tools: 7/16” wrench

Materials: Replacement parts

Task Description:

If the mast lift cylinder fails to hold mast upright with wing attached, the pneumatic cylinders should be replaced as follows.

1. Remove wing from trike.
2. With mast in full upright position, unclip and remove the pin at lower end of cylinder.

Pin Clipped

Pin Unclipped

3. Unbolt the upper end of the cylinder at the mast.
4. Replace with new cylinder.

4.3.13 Replace Engine Mount Tubes

Skill Level: LSR-M, A&P

Tools: Standard metric wrench set, Philips screw driver, wire cutters,

Materials: Replacement parts

Task Description:

1. Remove propeller from drive shaft.
2. Disconnect all electrical wires and label where they connect.
3. Disconnect throttle and choke cables at the carburetor.
4. Disconnect two fuel lines from fuel pump to carburetor. Be sure fuel line it tied up high to avoid siphoning gas from the fuel tank.
5. Drain coolant from cooling system and disconnect coolant hoses at water pump and radiator reservoir tank.
6. Disconnect exhaust manifold from muffler at the first exhaust ball joint flange.
7. Remove four 10mm nuts attaching engine to engine mount. Remove engine and set aside.
8. Remove two 3/8" bolts connecting engine mount to backframe and two ¼" bolts connecting sway bars.
9. Separate engine mount from the backframe and disassemble.
10. Replace with new parts and re-assemble in reverse order.

4.3.14 Repair Radiator or Hose Leak

Skill Level: LSR-M, A&P

Tools: Standard metric wrench set, Philips screw driver, wire cutters,

Materials: Replacement parts

Task Description:

Radiator leaks can be deceptive. A leaking hose fitting can allow coolant to run down unnoticed to a spot on the radiator and make it appear as if the radiator is leaking. Prior to beginning a radiator repair, be sure the coolant is not coming from some other source. If it is apparent the radiator itself is leaking, or damaged, it must be removed and sent to a radiator repair shop.

1. Drain all coolant from cooling system at system drain valve.
2. Remove hose clamps from leaking radiator at both ends. Typically, the hoses will be stuck on the radiator inlet and outlet and will need to be twisted. If they cannot be removed by twisting by hand, slide a small screw driver under the hose in several points around the fitting. Then try twisting hose again to break it loose from the fitting.
3. Unbolt radiator at top and bottom attachment points and remove.
4. Have radiator repaired at reputable repair shop and re-install in reverse sequence.

4.3.15 Install option, Remove and Repair Apache Sport Fairing

Skill Level: Owner, LSR-M, A&P

Tools: Fiberglass repair tools

Materials: Fiberglass repair

Task Description:

The fairing is made of a fiberglass polymer similar to that used on automobiles. Since this is not a critical or structural part of the trike, it may be repaired by the owner or any qualified individual. However, any cracks that allow a portion of the fairing to vibrate in the wind during flight, must be repaired before further flight. Any portion vibrating may break off and damage the propeller.

To remove the fairing:

1. Remove 9 screws along bottom edge of windshield, remove shield and set aside.
2. Remove 2 bolts on each drag strut, detach and set aside.

3. Remove fairing trim by gripping trim and gently pulling straight off. Do not pull on the portion of the trim that is already off like a rope to peel off the remaining attached portion. This will stretch the trim and possible tear it making remounting difficult.
4. To remove the side panels, remove the two screws on upper rear of side panels. Remove one bolt on lower rear of each panel. Remove MAG switch housing under right panel. Support panels and remove 6 remaining bolts attaching panels to the belly pan and fairing front.
5. To remove fairing front, remove one bolt under fairing nose. Disconnect pitot tube hose. Remove 4 bolts attaching fairing front to instrument panel. Support fairing and remove remaining 6 bolts attaching front to belly pan. Lift fairing front from trike.
6. To remove instrument panel, disconnect all wires from instruments and switches. Remove two screws attaching lower panel to root tube. Lift panel from trike.
7. Remove belly pan by removing 4 bolts attaching belly pan to brackets.

Installation is the reverse order.

4.3.16 Remove and Replace rear Fiber glass rod axles

Skill Level: Owner, LSR-M, A&P

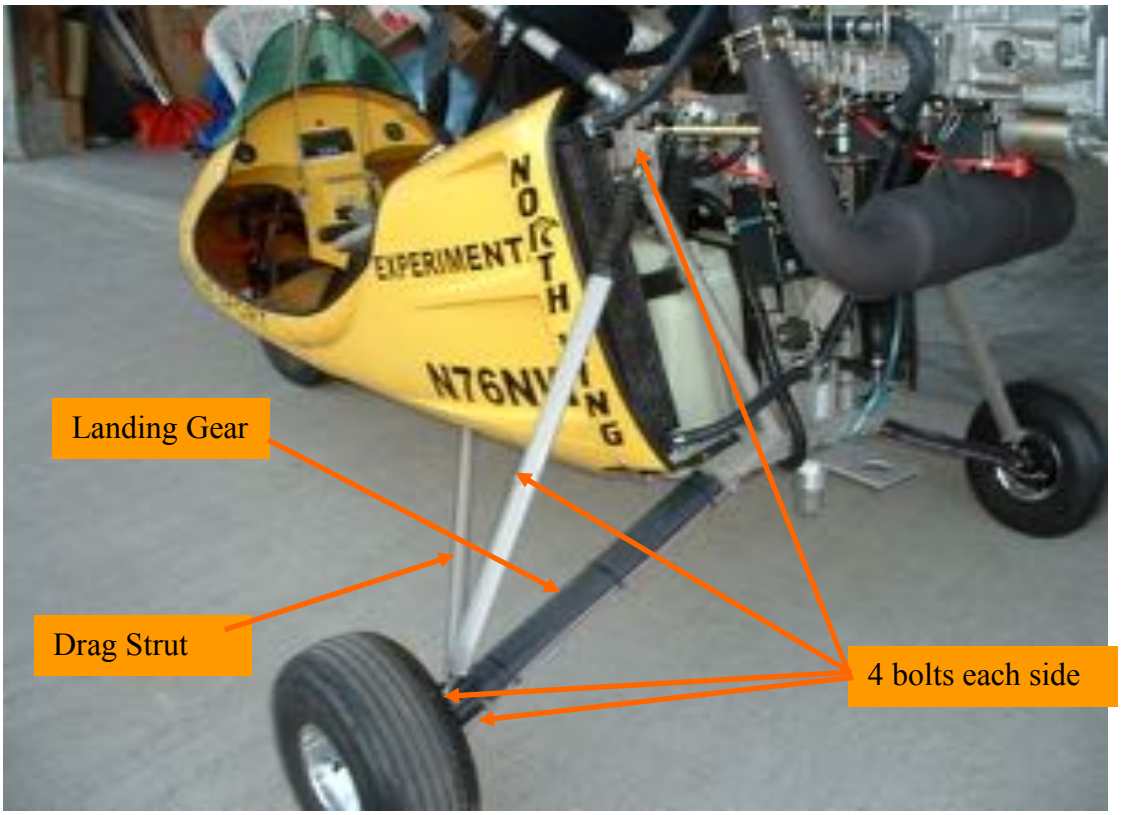
Tools: 7/16 and 3/8" wenches. Wheel nut socket

Materials: Fiberglass axle rod

Task Description:

1. Do one side at a time. Jack up trike underneath back frame. Remove tire and brakes.
2. Be sure not to pull on brake line and beak the fluid line.
3. Remove the drag strut and the shock tube connections (ball end fittings) at the spindle fitting.
4. Remove upper 4- bolt the hold the rods to the back frame.
5. To pull rod out of the back frame: Hold on to the spindle and rotate back and forth about 20 degs as you pull on the rods.
6. Install axles using a 1/2" rotation motion to "wriggle" them into the receptacle tubes. Align holes and insert bolts from top down. Be sure to install lower radiator brackets at this time. These are installed in the forward two holes using the 2 longer bolts. Tighten the 4 nuts "Snug". (See definition of "Snug in Maintenance Manual Section 2.1.9)
7. Re install the parts in reverse order.

8. Install drag struts and side landing gear (Gas Spring) strut. (Section 4.3.6) Tighten all 8 nuts to snug.



9. Install rear wheels. (See section 4.3.3.) Use zip ties to secure the brake lines along the back of axles as shown in above picture.

4.3.17 Remove and Replace Alum Leaf Spring Gear

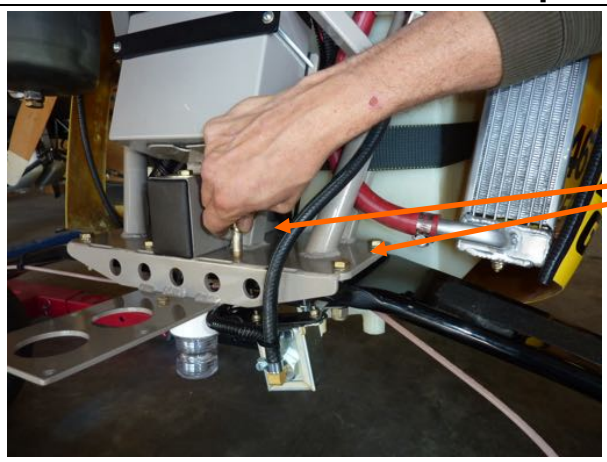
Skill Level: Owner, LSR-M, A&P

Tools: 9/16, 1/2", 7/16" and 3/8" wenches. Wheel nut socket

Materials: new leaf spring

1. Left the trike using blocks or a jack. Only do one side at a time.
2. Remove the tire and breaks. Make sure you set the break to the side carefully so you don't pull the break line out of the fitting
3. Remove the upper 4-3/8" mounting bolts. Replace gear.
4. Put the two outer bolts into position first. Put the leaf spring legs into position and put the two washers and nuts on hand tight.

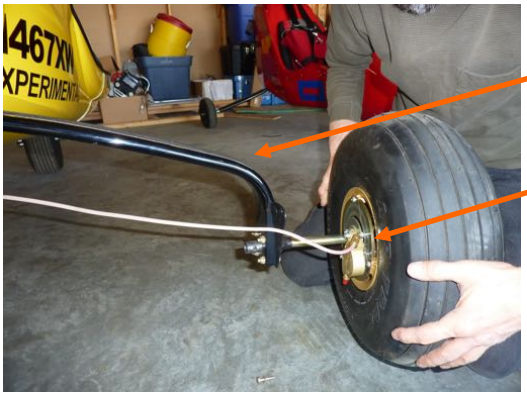
5. Now install the inside bolts, washers and nuts. On the right side gear you will need to attach the fuel pump on the rear bolts. . Tighten the 4 nuts "Snug". (See definition of "Snug in Maintenance Manual Section 2.1.9)



Mounting bolts
(4 on each side)

Fuel pump on rear holes

6. Install rear wheel spindles into the spindle bracket. Install the bolt and nut to secure the spindle in place. (See section 4.3.3.) Use zip ties to secure the brake lines along the back of axles as shown in above picture.



Landing Gear

spindle

4.3.18 Remove and Replace Root Tube

Skill Level: Owner, LSR-M, A&P

Tools: 9/16, 1/2", 7/16" and 3/8" wenches. Wheel nut socket

Materials: New Root Tube

Tools and Supplies Needed

¼" Drill Bit, "F" (oversize) Drill Bit, Open-End Wrench Set.

Assembly Notes – Connect Front Root Tube to Main Root Tube

1. Attach Root Tube Angle Plate (HT463) to Front Root Tube (HT431A) and Main Root Tube with 6 bolts (AN4-27A). Use AN960-416L Thin Washers on both sides, and secure with MS21083N4 Thin Nylock Nuts.

2. Insert Root Tube Bearings into top holes. Use a rubber mallet to gently pound bearings into holes. Note how the picture shows a ¾" socket placed over bearings to aid the compression of bearing into hole as you pound it in. There are two holes with bearings, so you can choose which hole to use. A taller pilot would prefer to mount the front fork in the hole near the front of trike, and a shorter pilot may elect to use the rear hole, for a comfortable distance from seat to fork pedals for steering, braking, and foot throttle.

Main Root Tube to Back Frame Assembly

Tools and Supplies Needed

¼" Drill Bit, "F" (oversize) Drill Bit, Open-End Wrench Set.

Assembly Notes – Connect Main Root Tube to Back Frame

Refer to "Leaf Spring To Frame" diagram and parts list for exploded parts view.

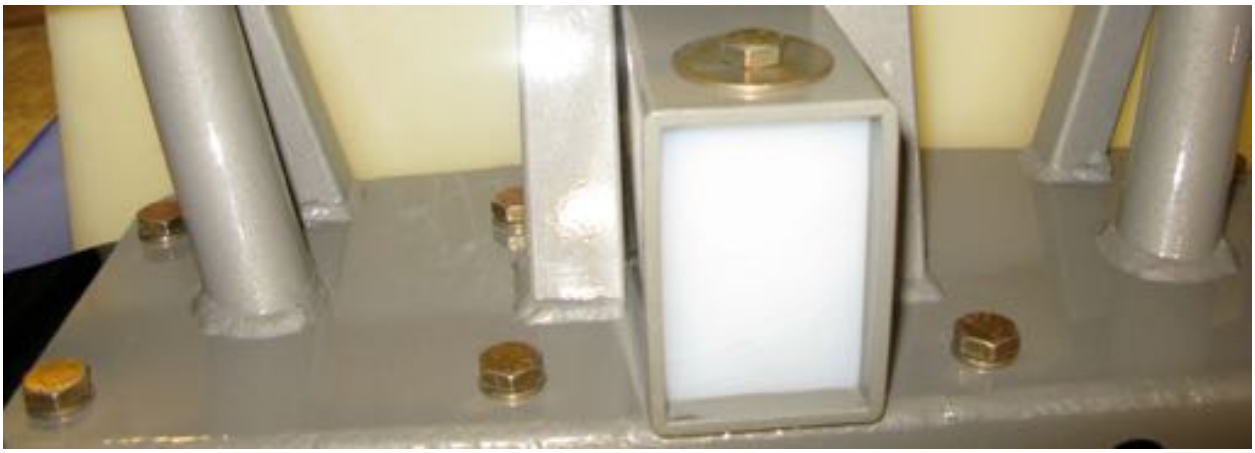
1. Set rear end of Main Root Tube between center supports on Back Frame.

2. Insert Delrin spacer into rear of Main Root Tube.

3. Align bolt holes in Root Tube to holes in Main Root Tube.

   Insert both AN5-36A bolts through holes, using a AN970-5 washer at head of bolt, and two AN960-516 washers at bottom of bolt, and secure with a AN365-524A Nylock Nut. By using 2 washers at bottom of each bolt, you can ensure that when you tighten the bolt securely, you will minimize the chance of over-tightening the bolt and compromising the threads and bolt shank.

4.3.19 Photo - Main Root Tube mounted to Back Frame



4.4 Fuel System Repairs

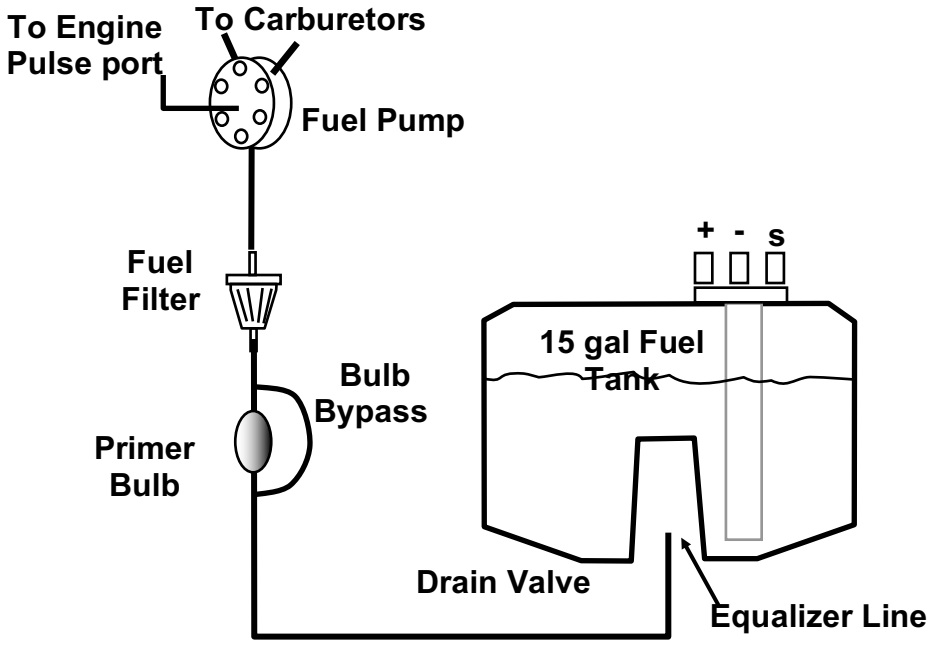
The fuel system schematic is shown below. The fuel tank is a 15 gallon polypropylene tank designed to straddle the root tube. An aircraft style drain valve allows removal of a sample of fuel to assure no water is present in the tank. An equalizer line, located slightly above the bottom of the tank to avoid picking up contaminants, balances the level of fuel in the left and right halves. The fuel supply to the engine is taken from the equalizer line with a tee in the line.

A squeeze bulb primer pumps fuel into the fuel pump, lines, and carburetor float chamber. Its internal check valve was intended to prevent fuel from running back into the tank when the engine is not running. However, due to reports of check valve failures in the industry, North Wing uses a bulb by-pass to assure fuel flow passage to the engine when it is running even if the check valve does fail closed. This by-pass will allow some fuel to drain back to the tank when the engine is shut down. Therefore, the bulb should be pumped until firm by pinching off the by-pass line and squeezing the bulb several times until firm before each engine start. This is a small inconvenience for the added safety of the by-pass line.

The fuel pump is a standard Mikuni dual pump driven by a pulse line from the pulse port on the Rotax 582 engine. The pump has two separate outlets to feed each carburetor.

The fuel lines are ¼" alcohol resistant urethane tubing with clamps or wire wraps at both ends.

The pulse line is standard ¼" pulse line which is heavier than the fuel line to transmit pressure pulse with little loss in pressure.



North Wing 582 S-LSA Fuel System

4.4.1 Replace Fuel and Pulse Lines

Fuel lines harden with time and exposure to sunlight leading to cracks and leaks and a possible fire if fuel leaks onto hot surfaces. The pulse line is exposed to a milder environment than fuel lines since it is shielded somewhat from sunlight and does not carry liquid fuel. However, the inside of the pulse line is subjected to fuel vapor from the engine crankcase and some moisture may also be visible at times. This is normal. Pulse line also must be stiffer than fuel line. If a pulse line becomes too stiff to return to its shape quickly after being bent, or if cracks are visible, it should be replaced with new Pulse line.

In general, if one section of fuel line needs to be replaced, all fuel lines should be replaced at the same time.

Skill Level: LSR-M, A&P

Tools: Knife, pliers, wire twisting pliers

Material: Replacement ¼" urethane fuel line and/or ¼"Pulse line

Task Description:

1. Remove any standoffs or line hold downs along the line run. and note where they were attached.
2. Remove the clamp or safety wire from both ends of the lines being replaced.
3. Twist the fuel line on the fitting to break the bond between the line and the fitting. Do not hold the line with pliers to break this bond. It may damage the fitting itself which would require replacing the part connected to the line. Work the fuel line off in a twisting and pulling motion and catch any fuel that may drain from the line or the filter itself. If the line is not easily removed by pulling with a twisting motion, slice the line along the length at the fitting end for just the length of the fitting. The line should easily slide off the fitting once sliced.
4. Cut new lines the required length using the old line as a guide. Be sure to allow for ends that were cut off separately.
5. Route the lines around and through other components as the original line was routed.
6. Slide the new line onto the fitting dry. DO NOT USE any lubricant to help the line slide over the fitting.
7. Clamp or safety wire the line on the fitting.
8. Re-install new standoffs and hold downs at the required locations to hold lines from flapping or rubbing against other parts or lines.
9. Check tubing for any rubbing against other parts or excessive unrestrained movement. If there is any risk of rubbing against other parts and it is not possible to restrain the line away from the risk, cut a piece of tubing one size larger and slide it over the fuel line and wire tie it in place where the rubbing risk occurs.

4.4.2 Replace Fuel Filter

Skill Level: LSR-M, A&P

Tools: Knife, pliers or wire twist pliers

Material: Replacement filter with ¼" inlet and outlet lines, clamps or safety wire

Task Description:

Since the fuel filter should be replaced every 100 hours, this is a good time to check the fuel lines also.

1. Have a small container available to catch any fuel that may be in the lines both upstream and downstream of the filter. Discard any fuel drained. Do not put back in fuel tank.
2. Remove the clamp or safety wire from both ends of the filter.
3. Work the fuel line off one end of the filter in a twisting and pulling motion, and catch any fuel that may drain from the line or the filter itself. If the lines are not easily removed, they are probably hardened and need to be replaced. Cut them off with wire dikes and a knife and replace them with new fuel line per Section 4.4.1 above.
4. When installing the new filter, be sure the fuel flow will be in the correct direction as indicated on the filter body.
5. Use new clamps or safety wire on both ends of the filter. Do not tighten safety wire excessively as it can cut through the fuel line.

4.4.3 Replace Fuel Pump

Skill Level: LSR-M, A&P

Tools: Screw driver, 5/16" wrench, pliers and/or wire twisting pliers

Material: Replacement pump, clamps or safety wire

Task Description:

Mikuni fuel pumps can be rebuilt using readily available parts from aircraft suppliers. Rebuilding the pump is outside the scope of this manual, but it can be done by any competent, responsible A&P or Task Specific mechanic.

1. Remove the fuel pump from its mounting brackets and pull out where it is easier to work on it. Note the orientation of the pump to be sure the new pump is installed in the same way.
2. Remove the three fuel lines connected to the fuel pump as described under fuel line replacement

   a. feed line from the filter
   b. supply lines to each carburetor
3. Remove the pulse line from the back of the fuel pump
4. Again, if any of the lines are difficult to remove, cut them off and replace them.
5. Connect the fuel lines and pulse line being careful of the routing so the pump can be returned to its original position under the main mast.
6. Clamp or safety wire all lines

4.4.4 Replace Fuel Tank

Skill Level: LSR-M, A&P

Tools: US sockets set, box wrenches, Philips screw driver

Material: Replacement tank

Task Description:

The fuel tank is very durable and it would be rare that it needed to be replaced. If damaged sufficiently to need replacement, the steps given below are necessary. In some cases the tank might be repairable by a professional welder experienced with Plastic Welding. Of course the tank would need to be flushed thoroughly to eliminate any possibility of explosion from the fuel vapors, and it may still need to be removed. If so, it is recommended that the tank be replaced rather than welded.

1. Drain all fuel from the tank through the drain valve at the bottom of the tank.
2. Remove the seats and backrest
3. Remove the backrest mounting tube
4. For the Apache model with fairing, remove the four screws on the aft panels so that the top of the panels can be pulled apart a few inches to allow removal of the tank.
5. Disconnect the wing spring assist list from the seat rail
6. Remove the four (4) ¼" bolts securing the seat rail. Two bolts attach to the backframe and the other two attach to the root tube. Lift seat rail from the trike.
7. Remove the one ¼" bolt holding the angle plate to the root tube in front of the tank and remove the plates.
8. Remove the nylon webbing securing the tank.
9. Disconnect and label the three (3) wires from the fuel sending unit. Secure wires away from the tank.
10. Disconnect and remove the fuel filler hose, the vent line, and the fuel supply line attached to the equalizer line.
11. Slide the tank forward about 6" and lift tank from trike.
12. Remove fuel level sender from old tank and install in new tank.

Installation is simply reverse order.

4.4.5 Replace Fuel Tank Drain Valve

Skill Level: Owner, LSR-M, A&P

Tools: 5/8" wrench

Material: Replacement drain valve, Seal All (gas/oil sealant)

Task Description:

If the drain valve shows any sign of leaking, check to determine if it is the valve or the tank that is leaking. If it is the valve, it should be replaced by a North Wing supplied drain valve.

1. Drain all fuel from the tank and put in clean container if intended to be put back in fuel tank after repair.
2. Unscrew the drain valve (normal right hand thread) from the bottom of the tank.
3. Coat the valve threads with a high quality plumbers sealant certified for use with gasoline and oil
4. Start screwing the new valve into the bottom of the tank by hand first to assure the threads are aligned.
5. Tighten the drain valve with the 5/8" wrench, but with very light torque. BE CAREFUL to void stripping the threads out of the valve opening.

4.4.6 Calibrate Fuel Gage

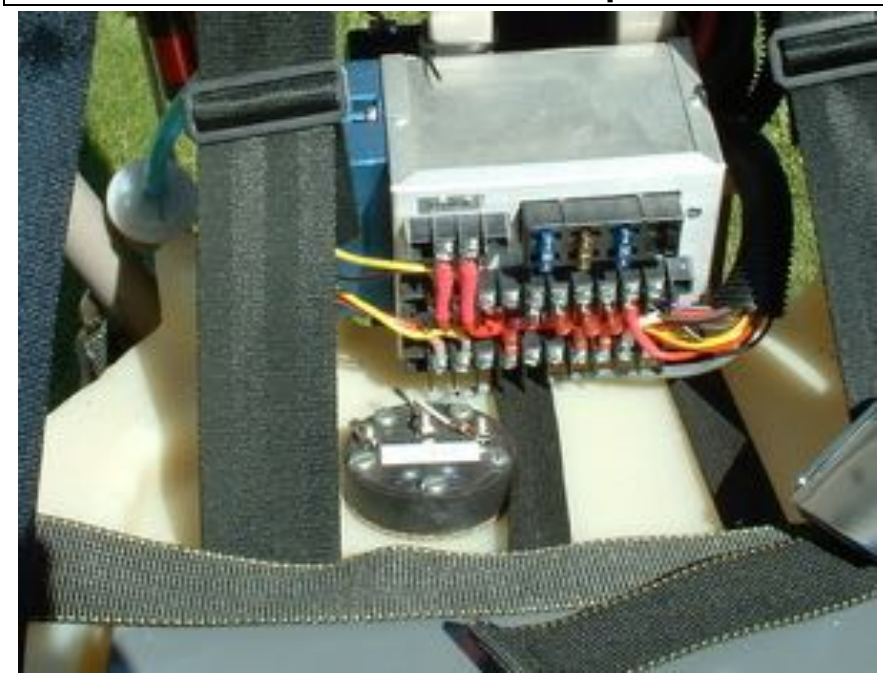
Skill Level: Owner, LSR-M, A&P

Tools: Small flat blade screw driver

Material: None

Task Description:

The fuel sending unit must be calibrated using the procedure below to properly indicate the range of operation. The gage is located under the rear seat on top of the fuel tank and just below the electrical hot box. To access the adjustment screws, remove the rear seat by releasing the velcro straps and slide the seat cushion forward on the seat belts sufficiently to have clear access to the gage.



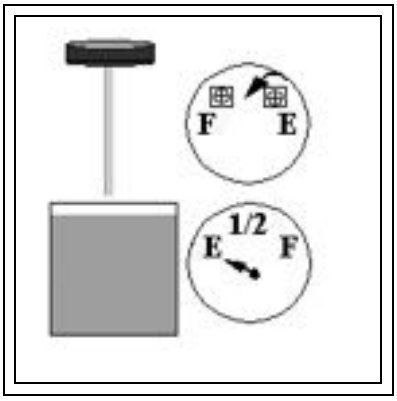
If the fuel gage must be removed for the EMPTY calibration, there a **two important facts** to keep in mind:

1. The 5 retaining bolts shown in the above picture are NOT in a symmetrical pattern. Therefore, the gasket and the inside ring that the screws attach to line up only one way. You need to plan on that when re-installing the gage.

2. The 5 retaining screws engage a ring that is on the INSIDE of the tank. If you remove all 5 screws, the retaining ring will fall into the tank making for an unpleasant day. Before removing the last 2 screws, insert a thin wire or string through one of the empty screw holes all the way through the gage, gasket, and retaining ring. Loosen the remaining 2 screws to allow some gap between the gage head and the tank body. Then slip a screw driver under the gage to hold the gap between the gage head and the tank body. This will provide enough clearance to hook the string on the inside of the tank using a stiff wire with a hooked end and pull it out. Tie the two ends of the string or wire together so that one end cannot slip out of the bolt hole when the remaining two screws are removed. Now remove the remaining 2 screws and remove the retaining ring through the hole in the tank. There is a notch in the ring to make this fairly easy to do. Re-assemble using the same technique, but make sure the asymmetrical bolt holes line up before starting assembly.

Turn on the ignition switch. Turn the FULL and EMPTY adjustment screws located on top of unit to the full CW (clockwise) position.

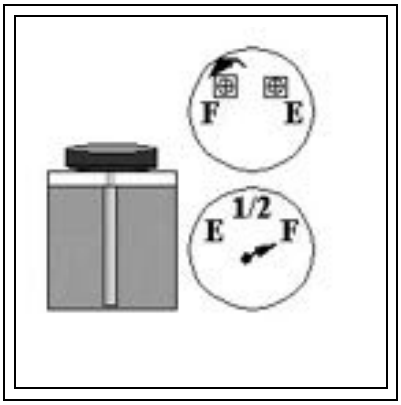
Setting The "Empty " Point



Setting the "Empty" must be done with the probe out of the tank or when tank is empty.

Slowly turn the EMPTY screw CCW (counter clockwise) until the needle on the meter just stops moving downward. The needle should be on or just below the empty mark. Now turn the screw CW (clockwise) to make sure the needle starts moving upscale immediately, then turn CCW until the needle just stops moving downward again. This is the EMPTY reference mark. Repeat this step until you are sure the EMPTY reference is obtained.

Setting The "Full" Point



Put the probe into your tank. Turn the FULL screw CCW until the needle indicates the liquid level in your tank. For best results, the probe should be fully immersed in a full tank. If you accidentally adjust below your tank level, turn the FULL screw full cw and repeat this setting.

Remove the unit from the tank. Shake the unit a few times to remove the residual liquid. The needle should now rest on or below the empty mark. This completes the calibration. Do not make any more adjustments.

4.5 Electrical System

The wiring schematic for the electrical system is shown on the following page for the Apache 582 model. The Rotax 582 engine outputs a maximum of 170 watts of electrical power from the lighting coils inside the engine. These coils produce a crude AC power source that must be rectified and regulated by the Key West Rectifier/Regulator mounted on the side of the Hot Box. All power is fused and distributed through the hot box terminals shown in the middle of the schematic and hard wired leads to the engine. Note particularly that the starter solenoid is located inside the Hot Box. The fused supply terminals are the top three left hand terminals where the fuse amperage is indicated.

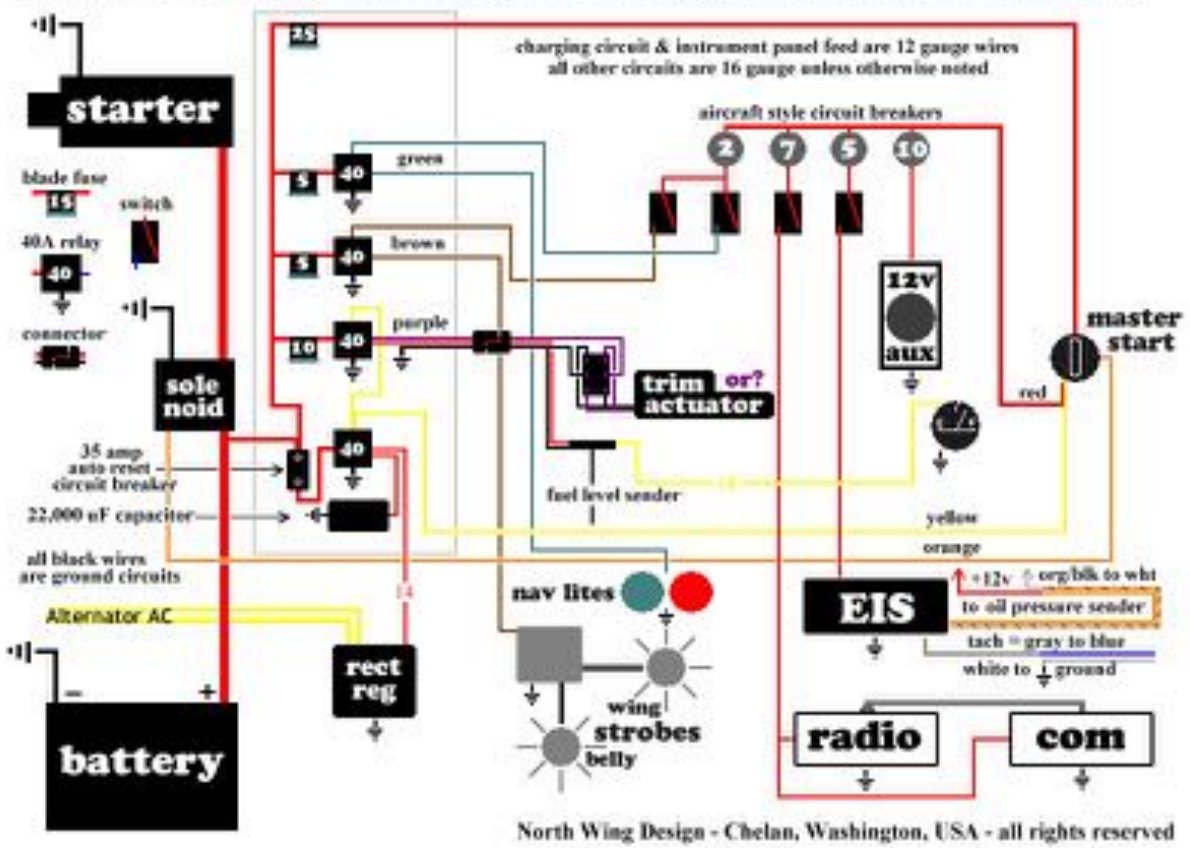
Although the lighting coils are capable of outputting 170 watts of power, it is advisable to restrict the continuous power consumption to about 150 watts. This amounts to about 12.5 amps of electrical load. Otherwise, the lighting coils may overheat and be damaged. The cost of the coils alone is quite expensive plus the time and expense to tear down the electrical end of the engine to replace the coil assembly. The lighting coils cannot be individually replaced. Instead, the entire set of lighting and ignition coils must be replaced as a single unit. Operation at the full 170 watts for short periods of time is acceptable and should not damage the coils.

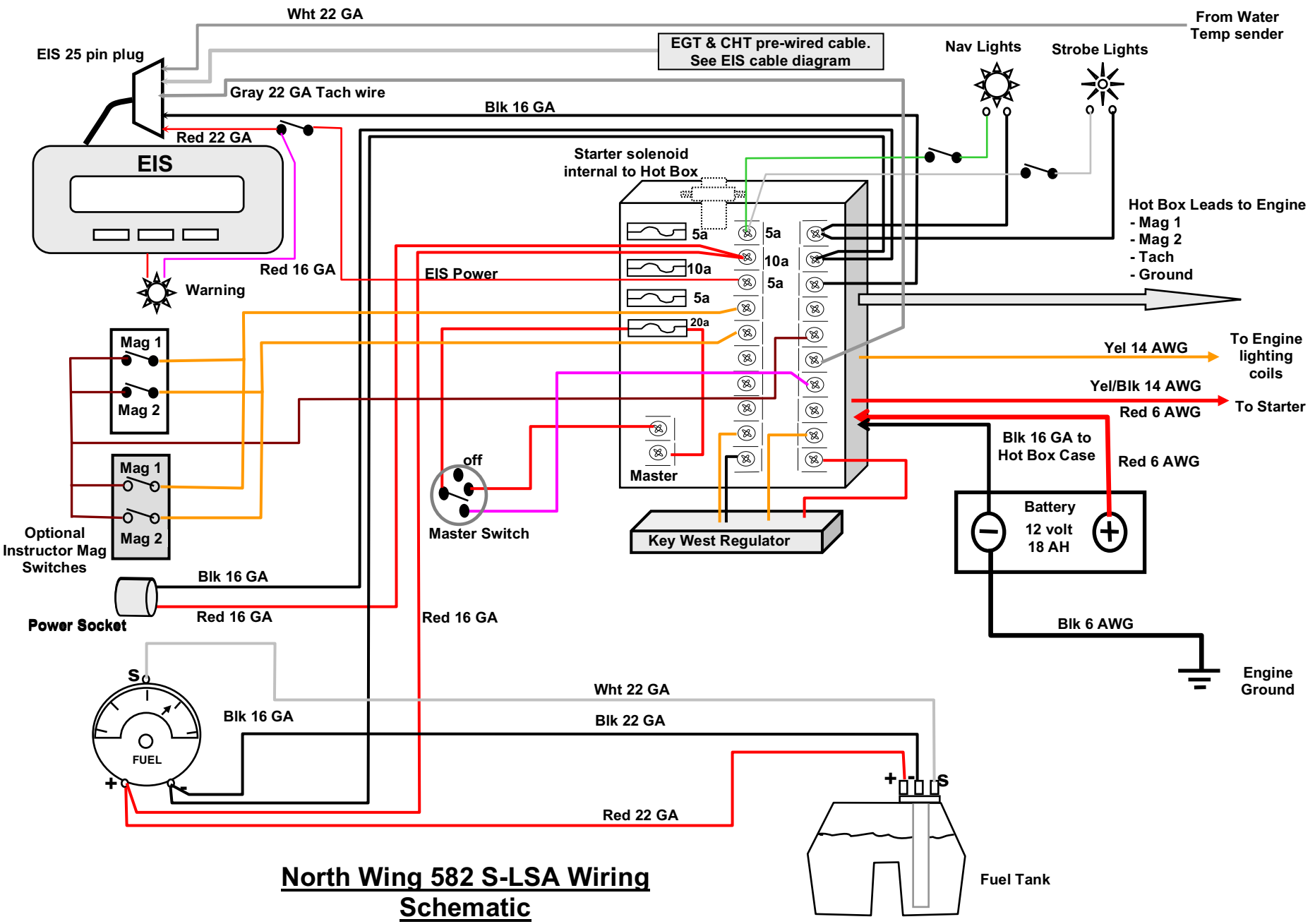
For miscellaneous accessories, a power socket is provided on the instrument panel that will accommodate up to approximately an 8 amp load allowing about 2 amps for the fuel gauge. Accessories can be hardwired into the Hot Box provided they do not exceed the fuse limits. All hard wired accessories must be connected to one of the three fused terminals. NEVER hardwire any electrical equipment directly to the incoming line from the engine lighting coils. This is AC and is a “dirty” unregulated power that will damage electrical equipment. Also, NEVER hard wire any electrical devise directly to the output of the voltage regulator. An excessive un-fused load can damage the Regulator requiring an expensive repair that could have been avoided.

The Electronic Instrument System (EIS) has a pre-wired cable for the EGT and CHT temperature probes. The wiring schematic excerpted from the EIS documentation is shown on the second schematic following this page.

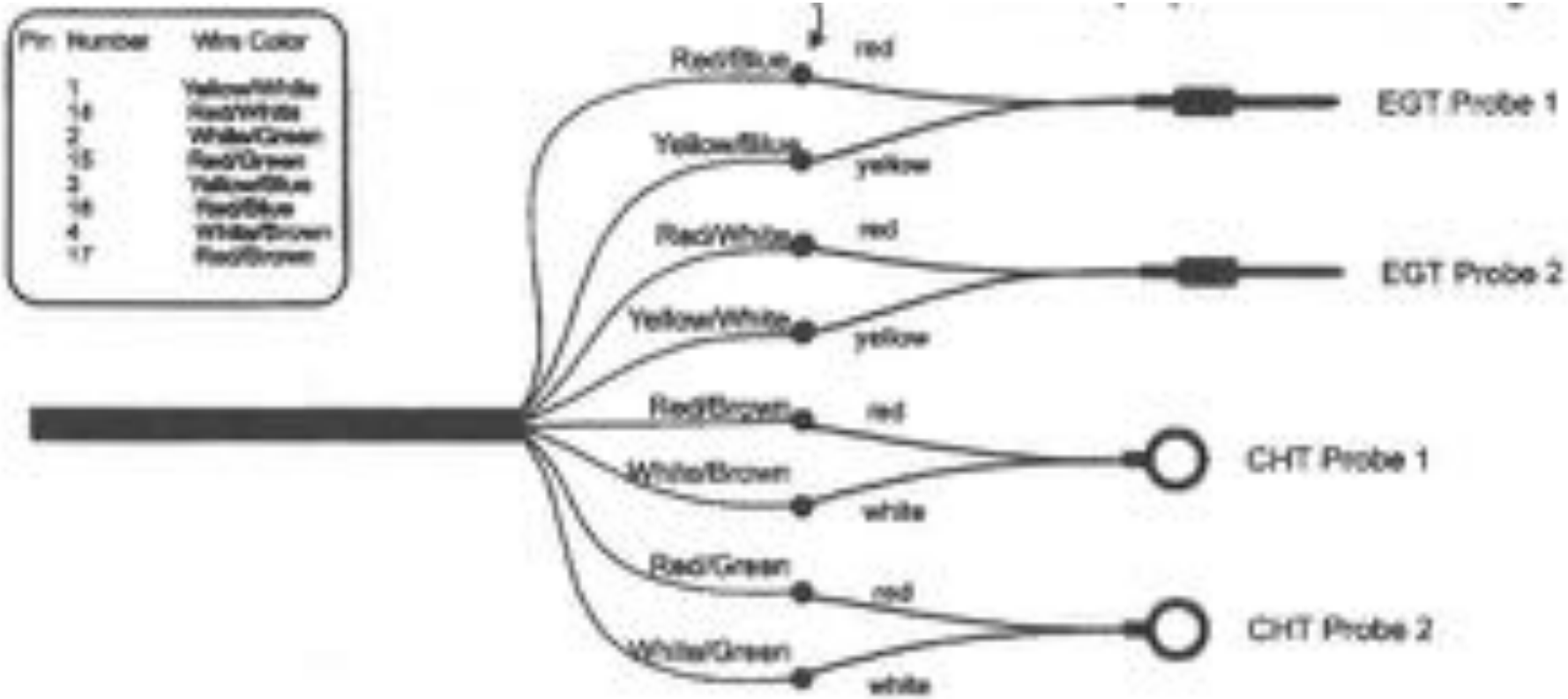
Repairs to the electrical system are limited to replacing broken wires, voltage regulator, starter solenoid, ignition switch, magneto switches, battery, and lights.

Rotax 582 Scout X/C Accessory & Charging System Wiring Schematic





North Wing 582 S-LSA Wiring Schematic



EIS EGT and CHT Probe Connections to Pre-Wired Cable

4.5.1 Replacing Battery

Skill level: Owner and higher

Tools: Philips screw driver, 5/32" wrench

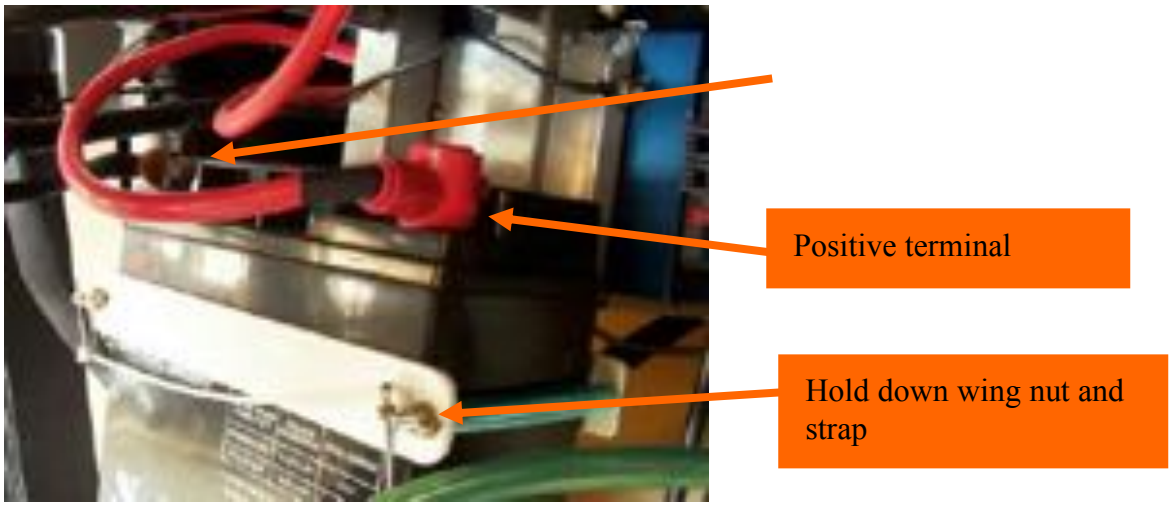
Parts: Replacement battery

Task Description:

Battery technology for ultralights uses a sealed dry cell 12 volt battery that cannot be serviced. However, it will become discharged after extended periods of non-use and can be charged for continued service. The easiest way to recharge the battery is to start it manually using the pull starter and fly the aircraft for at least 30 minutes. This is sufficient to restart the engine that day while it is warm, but will probably have to be recharged again a day or two later. Fly the aircraft for a couple hours on one day will bring the battery up to a level that will sustain enough power to start the engine a week or so later.

If the battery does not accept or hold a charge as described above, it will not hold a direct charge either, and it needs to be replaced following the procedure below.

1. Disconnect two black ground wires from negative terminal of battery and move them a safe distance from the battery so as not to short on the positive terminal when exposed.



2. Disconnect the red positive wire from the positive terminal of the battery and secure it away from the battery.
3. Loosen the wing nut on one side of the battery hold down a couple turns. DO NOT take it completely off.
4. Remove the wing nut on the other side of the hold down and swing the hold down strap out of the path of the battery.

5. Lift battery straight out of the support plate and replace with new battery.

4.5.2 Checking and Replacing Voltage Regulator

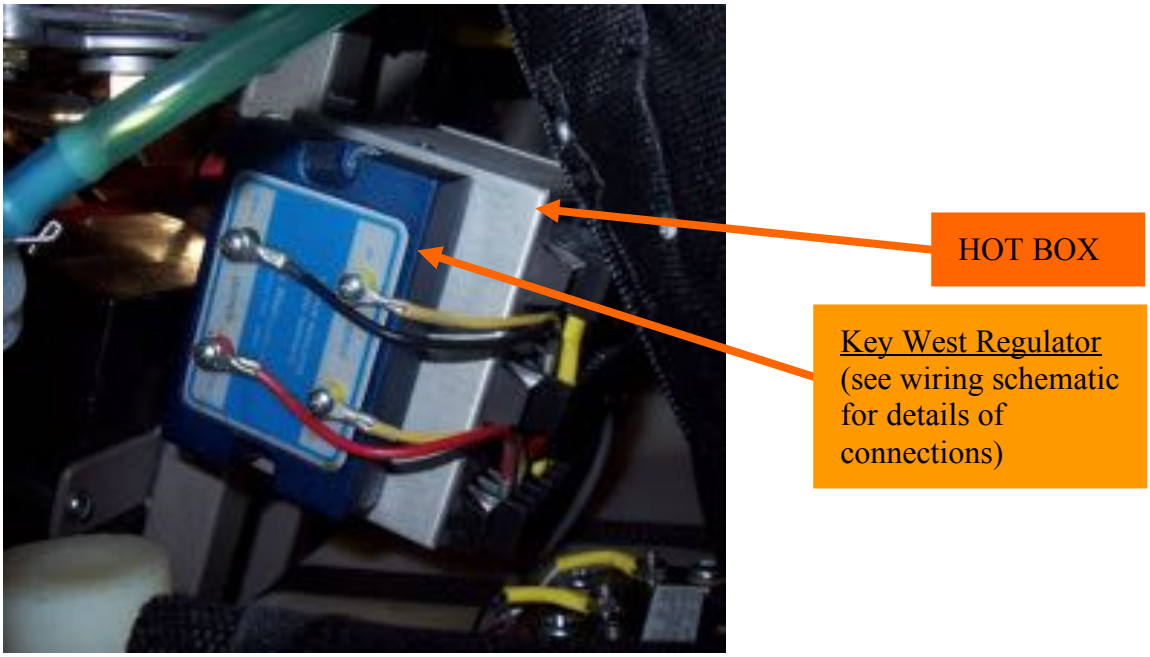
Skill level: LSR-M, A&P

Tools: Philips screw driver

Parts: Replacement Key West Regulator

Task Description:

The voltage regulator is attached to the side of the Hot Box as shown below. It can be tested using the procedure below.



1. Remove RED wire from the Hot Box end, not the regulator end, and connect an extension that will allow you to measure the voltage while the engine is running.
2. Secure aircraft so it will not move when engine is running slightly above idle.
3. Start engine, warm up until it will idle smoothly at around 2000 rpm.
4. Using a volt meter, measure the DC voltage between the red lead you just removed from the Hot Box and ground (which can be the case of the Hot Box). If 12-14 VDC is present, regulator is functioning.
5. If no voltage is present, or the voltage is lower than 12 volts, measure the "AC" voltage being provided by the engine. This is done by measuring the voltage between the two yellow wires going to the regulator. Note! This is AC, not DC current.

6. If there is voltage on the AC input wires, but not the Red output wire, the regulator is defective and must be replaced.

Replacing the Regulator

1. Remove the 4 wires from the regulator end.
2. Remove the two recessed nuts, top and bottom, attaching the regulator to the Hot Box.
3. Install new regulator.

4.5.3 Testing and Replacing Magneto Switches

Skill level: LSR-M, A&P

Tools: Philips screw driver, Ohm meter or continuity tester

Parts: Replacement Switches or wire connectors

Task Description:

The North Wing Apache may have one set of mag switches (2 switches) or two sets (four switches). The second set is optional and would only be used when the aircraft is intended to be used for instruction. This gives the instructor the ability to easily shut down the engine if it becomes necessary. The primary set is mounted on the front control panel as shown below and the second set is mounted on the upper right corner of the seat frame as shown below.

A mag switch works by grounding out the ignition charging coil so that the high voltage spark CANNOT be generated. If either the ground connection to the switch is broken, or the line from the charging coils to the switch is broken, the mag switch cannot ground out the engine ignition and the engine will continue to run. Since there are two independent ignition systems,

the failure of only one switch will allow the engine to continue running on that ignition system, and without special tools, it is not obvious which switch has failed. The table below shows the results of different combinations of switch positions and conditions.

For Pilot Switches Only:

Pilot Switches		Results
Ign. A	**Ign. B**	
On	On	**Engine runs on both ignition systems**
On	Off	Engine runs on Ignition system A only
Off	On	Engine runs on ignition system B only
Off	Off	Engine will not run
Fails Open	Off	Engine runs on ignition system A only
Off	Fails open	Engine runs on ignition system B only

In this case the only way to shut the engine down with a failed switch is to either choke it or, if possible, starve it by pinching the fuel line until the engine stops. Fuel shut offs are not provided on North Wing aircraft because of the high probability of someone forgetting to open it but still having enough fuel in the carburetor to get off the ground.

With Instructor Switches Installed:

Pilot Switches		Instructor Switches		Results
Ign. A	**Ign. B**	**Ign. A**	**Ign. B**	
On	On	On	On	**Engine runs on both ignition systems**
On	Off	Off	Off	Engine will not run
Off	Off	On	On	Engine will not run
On	Off	On	Off	Engine runs on ignition system A only
Fails Open	Off	On	On	Engine runs on ignition system A only
Off	Fails Open	On	On	Engine runs on ignition system B only
Off	Fails Open	On	Off	Engine will not run

Note that with the instructor switches installed, the ignition system with the failed switch can still be turned off unless the failure is in the leads coming from the engine to the Hot Box. A properly functioning "OFF" position overrides the ON position because it is able to ground out the ignition coil, thereby making that ignition coil inoperable.

Once the engine is stopped, trace the ground and yellow coil wiring to the mag switches using an Ohm meter or continuity meter to assure they are indeed grounded when the mag switch is in the OFF position. Locate and repair the break in the ground circuit.

4.5.4 Testing and Replacing Master Switch

Skill level: LSR-M, A&P

Tools: Philips screw driver

Parts: None

Task Description:

The Master switch provides power to the instruments and other accessories and is used to start the engine. Unlike an automobile switch, it does NOT affect engine "ignition" in any way. Any of the following symptoms may occur with a faulty Master switch:

1. The EIS will not be operational when the switch is in the on position. If the engine is not running, this may also be an indication of a dead battery.
2. Other accessories, including the starter, may not be powered.
3. The EIS and/or other accessories do not turn off when the Master switch is turned to the OFF position.

If any of these symptoms occur, the Master switch most likely needs to be replaced using the following procedure.

1. Disconnect the negative terminal of the battery and secure it away from the battery
2. For the Navajo model, remove the six screws holding the control panel in the instrument housing, and rotate the panel forward to expose the back side of the Master switch. For the Apache model with the full fairing, it may be possible to reach around the instrument panel sides to the opening in the back side and "feel" around to remove the switch. Otherwise, it will be necessary to remove the fairing enough to allow access to the back side of the instrument panel.
3. Remove and mark with tape which terminal each wire on the back side of the Master switch was connected to.
4. Holding the Master switch body firmly from the back side, unscrew the collar on the front side of the panel and extract the switch from the pod from the back side.
5. Replace with the new switch in reverse order.

4.5.5 Replacing Starter

Skill level: LSR-M, A&P

Tools: Metric Allen wrenches, box wrenches, sockets

Parts: New Starter or ring gear

Task Description:

Two different starters are used depending upon whether a clutch is used in the drive system or not. The standard Rotax configuration is "without" a drive clutch. In this case the starter is integral to the Rotax E-box drive system. For engines with a clutch installed, a GPL aftermarket starter in installed on the electrical end of the engine adjacent to the manual pull started instead of at the PTO end of the engine.

Before replacing the starter, confirm that the starter is the problem by eliminating the Master switch, the battery, the starter solenoid, and the wiring as the source of the problem. This is most easily done by using a loop-type amp meter around the heavy (#6) red wire between the Hot Box and the starter terminal.

1. With the amp meter loop in position around the heavy red wire, turn the Master switch to the "Start" position and note the amp reading.
2. As the Master switch is turned to the Start position, a click from the starter solenoid inside the Hot Box and/or the starter itself should be audible. If at the same time, the amp meter indicates at least 12 amps and the starter itself does NOT turn, then the starter is faulty or jammed and must be removed.
3. Note! if the starter turns, but the engine does not turn, the starter ring gear or the starter drive gear has most likely been stripped and must be replaced. In this case, the amp meter will read a low value since there is no electrical load on the starter. Skip to the replacement procedure outlined below to replace the gear ring or drive gear.
4. If the amp meter indicates near zero, then it is necessary to determine if the problem is in the current supply circuit or in the starter. This is easily done by measuring the voltage applied to the starter terminal when the Master switch is turned to the start position.
5. Repeat Step 2 above only this time measuring voltage at the starter terminal. If the voltage is near zero, then the problem is between the battery and the starter. This could be wiring breaks, the Master switch, the battery, or the starter solenoid. Further diagnosis is best done measuring the voltage at each successive point moving upstream from the starter toward the battery until 12 volts is finally detected when the Master switch is turned to the Start position. At that point, the last device showing zero voltage at the out is the faulty item, and it should be replaced.
6. If the voltage is 12 volts at the starter terminal, then the problem is most likely the starter itself, and it should be replaced.

Replacing the Rotax starter on the E-Box:

1. Disconnect the ground wire from the battery and secure a safe distance from contact with the battery.
2. Disconnect the positive red wire coming out of the Hot Box from the starter terminal.
3. Remove the bolts holding the starter in the E-Box housing and lift starter out of housing.
4. Inspect the ring gear by looking through the starter mounting opening.
5. If problem is with the gear in the housing or the Sprag clutch internal to the gear box, it will be necessary to have these parts replaced by a Rotax repair center.
6. If only the drive gear on the starter is stripped, it can be replaced with a new gear ordered from any Rotax parts supply dealer.
7. If the problem is the starter itself, install new starter in reverse order.

Replacing the GPL aftermarket starter:

1. Repeat Steps 1 and 2 above for the Rotax starter.
2. Remove the bolts holding the starter in the GPL starter ring, and lift the starter out of the housing.
3. Inspect the gear teeth on both the starter and the starter ring inside the housing.
4. If the gear teeth on the starter ring gear are damaged, remove the manual pull starter.
5. Remove the bolts holding the gear ring to the fly wheel, and replace with a new ring gear.
6. If the gear on the starter itself is damaged, the starter must be replaced.
7. Lightly grease the drive gear on the starter and install the new starter.

4.5.6 Replacing Hot Box

Skill level: LSR-M, A&P

Tools: Electric drill, 3/16" drill bit, Philips screwdriver, 5/16" box wrench

Parts: Replacement Hot Box

Task Description:

With the exception of physical damage from impact or corrosion, there is little that can fail in the Hot Box that would require the entire box to be replaced. If replacement becomes necessary, follow the procedure below.

1. Disconnect the both the negative side and the positive side of the battery in that order and secure the wires away from battery.
2. Disconnect heavy (#6) red wire coming from Hot Box going to starter.
3. Disconnect the two electrical plugs between the Hot Box and the engine
4. Label and remove all wires connected to the Hot Box
5. Drill out the 4 rivets holding Hot Box to the backframe with a 3/16" drill
6. Remove Hot Box and install new box in reverse order.

4.5.7 Replacing Starter Solenoid (inside Hot Box)

Skill level: LSR-M, A&P

Tools: Drill, 3/16" drill bit, Philips screw driver, 5/16" box wrench

Parts: Replacement solenoid

Task Description:

It is necessary to open the Hot Box to reach the starter solenoid. Therefore, be sure the starter solenoid needs replacement before beginning this task. If it is clear the solenoid has failed, then replace using the following procedure.

1. Remove the Hot Box following the steps above in **Replacing the Hot Box**.
2. Open the Hot Box to expose the starter solenoid
3. Replace the solenoid
4. Re-assemble as described under **Replacing the Hot Box**.

4.5.8 Connecting 12 Volt Power to Auxiliary Equipment

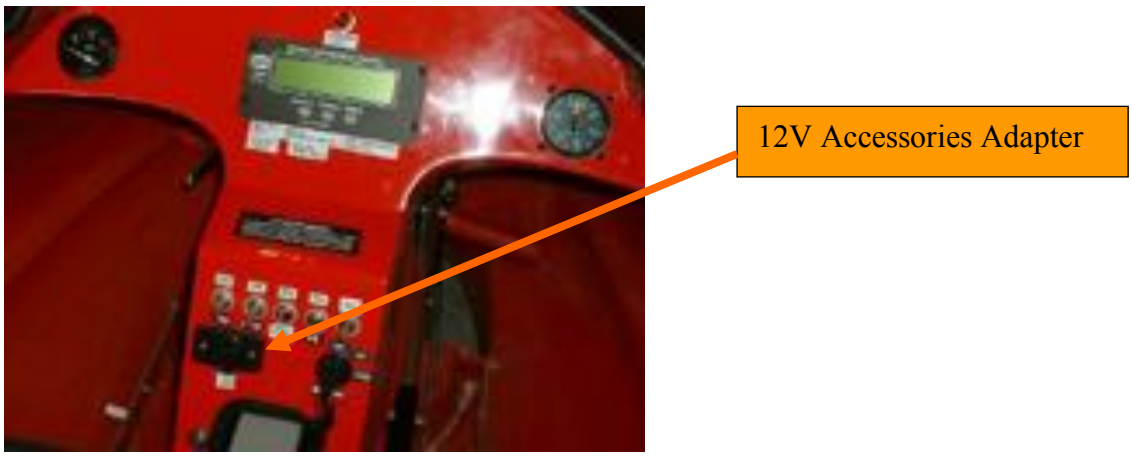
Skill level: LSR-M, A&P

Tools: Crimping tool for electrical connectors

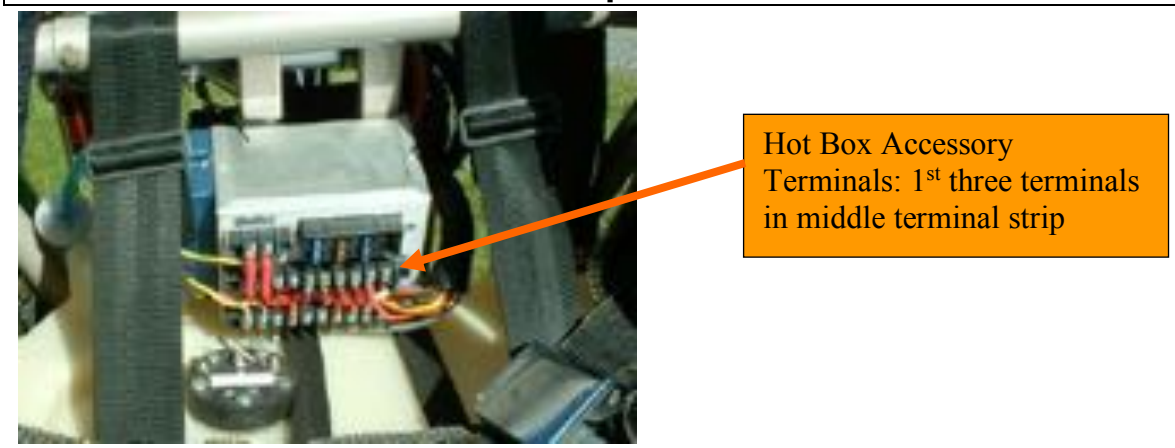
Parts: Crimp-on Electrical connectors, 12V accessory plug

Task Description:

Electrical accessories can be added to the aircraft provided they do not exceed the continuous load output of the lighting coil internal to the Rotax 582 engine. Note the description at the beginning of this Section on Electrical Repairs. The easiest way to add accessories is to use the 12V plug on the instrument console with an adapter for the specific accessory.



If a more permanent connection is desired, a wire can be connected to the terminal strip of the Hot Box.



Note from the electrical schematic above that only the first three terminals on the middle terminal strip are connected to a fused power supply. Any wires connected to the Hot Box should use a good crimp-on loop or open-loop connectors to slide under the terminal screw of the desired power tap. Be sure the power consumption does not exceed the fused amperage or the fuse will blow out possibly causing failure of other components on the same circuit. Anyone wiring accessories to the Hot Box must have a good understanding of electrical power calculations and wiring techniques. Faulty wiring can cause an in-flight fire or direct component failure.

4.6 Engine

4.6.1 Changing spark plugs

Skill level: Owner, LSR-M, A&P

Tools: Spark plug socket, ratchet handle and extension, calibrated torque wrench, spark plug feeler gage.

Parts: 4 NGK BR8ES spark plugs

Task Description: See procedure for replacement of spark plugs in the Rotax 2 Stroke Maintenance Manual page 11-4

Changing gearbox oil

Skill level: Owner, LSR-M, A&P

Tools: 17mm Metric socket or 17mm box end wrench, ratchet handle, calibrated torque wrench, safety wire pliers, drain pan.

Parts: 85W-140 gear oil, Safety wire

Task Description: See procedure for replacement of gearbox oil in the Rotax 2 Stroke Maintenance Manual page 11-9

4.7 Ballistic Recovery System (BRS Parachute)

Skill level: Owner, LSR-M, A&P

Tools: Standard sockets and open end wrenches and drill

Parts: All components provided by BRS shipped separately in two separate packages

Task Description:

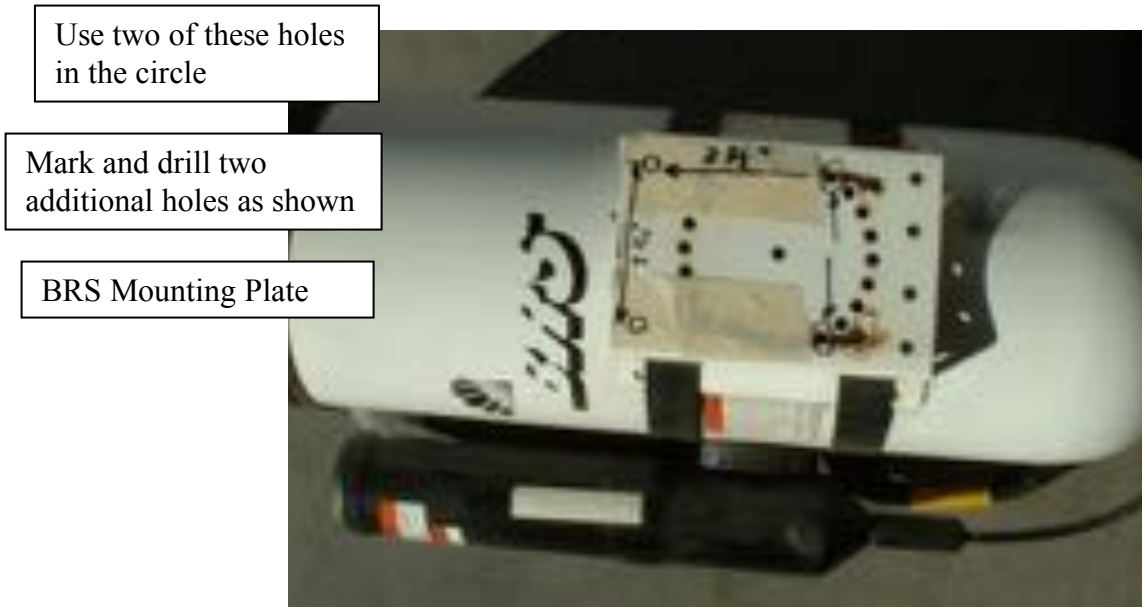
The BRS is a special option that is addressed herein because it cannot be mounted by the factory due to shipping restrictions of hazardous material (the rocket fuel). For the same reason, a ballistic parachute is shipped in two separate shipments or packages. One shipment contains the parachute and all related mounting equipment, and a second shipment contains the rocket propellant. They may arrive on different days.

The installer is referred to the BRS manual for installation, maintenance, and repairs. However, the parachute canister itself must be mounted to the trike on a mounting plate unique to North Wing. This mounting is not addressed in the BRS installation procedures. Furthermore, when the parachute is due for re-packing, it must be removed from the frame and sent back to the BRS factory. With the exception of mounting the BRS bracket to the NW trike mounting plate, the installation and removal tasks are described in the BRS manual. All tasks associated with the BRS can be performed by a conscientious and mechanically adept owner.

The BRS mounting plate on the North Wing trike is located at the lower back of the root tube as shown below.

The BRS canister bracket is a white flanged bracket with a ring of holes. The recommended mounting arrangement for the BRS on an Apache is to aim the chute to the left. To attach the bracket to the trike mounting plate, follow the procedure below.

1. Align two of the holes in the BRS bracket with two of the holes on the trike mounting plate and install a bolt in each holes. See BRS bracket below.



2. With these two bolts in place and using a felt tip pen, reach underneath the mounting plate and mark the location of the other two mounting plate holes on the BRS bracket.
3. Remove the BRS mounting bracket and drill a ¼" hole where marked for the mounting plate.
4. Replace the BRS bracket on the mounting plate and install and tighten all four bolts.
5. Continue from this point on using the BRS supplied instructions.