

***Airglas, Inc.***®

**Installation Instructions**



***MANUAL NO. LH4000-105***  
**MODEL LH4000 Ski Kit**  
**For**  
**Cessna 180 and 185 Aircraft**

**Cage Code 17564**

**MANUAL REVISION D**

**November 17, 2016**

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## 1.0 INTRODUCTION AND DESCRIPTION

**Introduction:** Since 1955 **Airglas, Inc.** has designed and manufactured a full line of composite skis that dramatically increase the usefulness of the aircraft by allowing it to operate on snow or frozen surfaces. The installation of the LH4000 hydraulic wheel ski kit allows the aircraft to operate on paved or hard surfaces, and snow. The skis are actuated by a hydraulic cylinder on each ski with an electric/hydraulic or hand pump to provide operating pressure. The ski is pushed down as a sliding door closes the opening in the ski and causes the tire to ride up on top of the door. The door closes off the wheel opening, thus creating the performance characteristics of a "straight ski". When the airplane is on snow, deploying to the ski position dramatically improves the takeoff performance (compared to wheel penetration skis). The simplicity of this design allows for a low maintenance high performance ski kit.

**Description:** The LH4000 ski kit consists of essentially 4 systems;

**1. The Mechanical System** – This includes the ski with all attaching hardware (interface to the gear leg) and the rigging components.

**2. The Hydraulic System** – This includes hydraulic lines (both onboard and external), hydraulic actuating cylinders (on the skis), all the hydraulic fittings on the skis, and the hydraulic pump.

**3. The Electrical System** – This includes pressure switches, a circuit breaker, wiring, a control switch and indicator lights (the electric pump is covered under the hydraulic system).

**4. Placards and Markings**- This includes the flight manual supplement, placards, and instrument markings.

**Control and Operation Information:** The door for the LH4000 Ski Kit is actuated by the electric/hydraulic pump (preferred) or a manually operated hand pump in the cockpit. The electric/hydraulic pump is controlled via a 3 position toggle switch and indicator lights that are located on the instrument panel.

1. When the switch is lifted up, the cylinder will extend and slide the door under the tire. While the switch is held up an operation indicator yellow light will illuminate showing the ski position has been selected and the pump is cycling. When the cycle is complete, a second (Skis Locked) yellow light will illuminate and stay on to confirm full deployment of the skis. As the switch is released the operation light will extinguish, but the position locked light will remain lit as long as the skis are extended.
2. When the switch is pressed down, the door will retract and expose the tire. While the switch is held down an operation indicator green light will illuminate showing the wheel position has been selected. When the cycle is complete, a second (Wheels Locked) green light will illuminate and stay on to confirm retraction of the skis. When the switch is released the selector light will extinguish, but the position locked light will remain lit as long as the skis are retracted.

## 2.0 PLACARDS AND MARKINGS

### PLACARDS

The following information must be displayed in the form of composite or individual placards in addition to those specified in the aircraft basic handbook.

DO NOT EXCEED **150 KIAS**  
WITH AIRGLAS LH4000 SKIS INSTALLED

Place Airspeed Restriction Placard on instrument panel immediately adjacent to Airspeed Indicator and **in full view of pilot.**

AVOID SLIPS WITH FLAPS EXTENDED WHEN  
AIRGLAS LH4000 SKIS ARE INSTALLED

Place placard on instrument panel **in full view of pilot.**

DO NOT EXTEND OR RETRACT SKIS AT SPEEDS ABOVE 125  
KNOTS

DO NOT EXTEND OR RETRACT SKIS WHILE IN MOTION ON  
THE GROUND

Place placard on instrument panel **in full view of pilot.**

IN FLOATPLANE, AMPHIBIAN AND SKIPLANES EQUIPED WITH  
AIRGLAS LH4000 RETRACT FLAPS TO 20° IMMEDIATELY AFTER  
APPLYING POWER FOR BALKED LANDING GO-AROUND

Place placard on instrument panel **in full view of pilot.**

DO NOT LAND ON SNOW WITH TIRES DOWN WHEN AIRGLAS LH4000  
SKIS ARE INSTALLED

Place placard on instrument panel **in full view of pilot.**

### 3.0 INITIAL INSTALLATION

**PERSONNEL REQUIRED:**

- A&P MECHANIC
- ASSISTANT
- Approximately labor 30-40 hours will be needed for initial installation

**Tools Required:**

- HAND TOOLS, SMALL KIT
- #10, #13, and a 1/8" drill bit
- DRILL MOTOR
- FUNNEL
- HOIST OR WING JACK
- ELECTRONIC LEVEL
- CABLE TENSIOMETER

**Materials Required:**

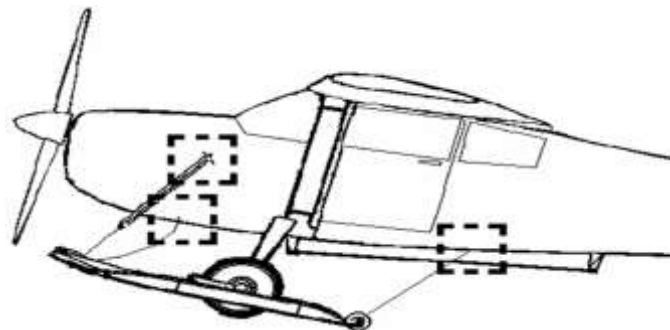
- 1 OZ. SCOTCH WELD 3M 2216 B/A EPOXY
- 18 EA. THOMAS & BETTS TY527MX TY-WRAPS
- 80 GRIT SAND PAPER
- 1 GAL. MIL-H-5606 HYDRAULIC FLUID
- LOCTITE (REMOVABLE) THREADLOCKER 242
- 6 EA. AN380-3-2 COTTER PINS
- LPS-2 lubricant
- MULTIPURPOSE HEAVY DUTY GREASE
- RAGS

**Notes:**

1. All hardware in this kit shall be installed and torqued IAW AC 43.13-1B Chapter 7, Par 7-40, Table 7-1 and table 7-2, unless otherwise specified.
2. Aircraft must be equipped with 8.50x6 main tires for ski operations.

### 3.1 SKI RIGGING BRACKETS AND ATTACH FITTINGS

The aircraft must have the brackets and attach fittings installed on the fuselage for the rigging to attach. (Reference: Drawing No. LW3600-180A-9 & LH3600-17 INST.)

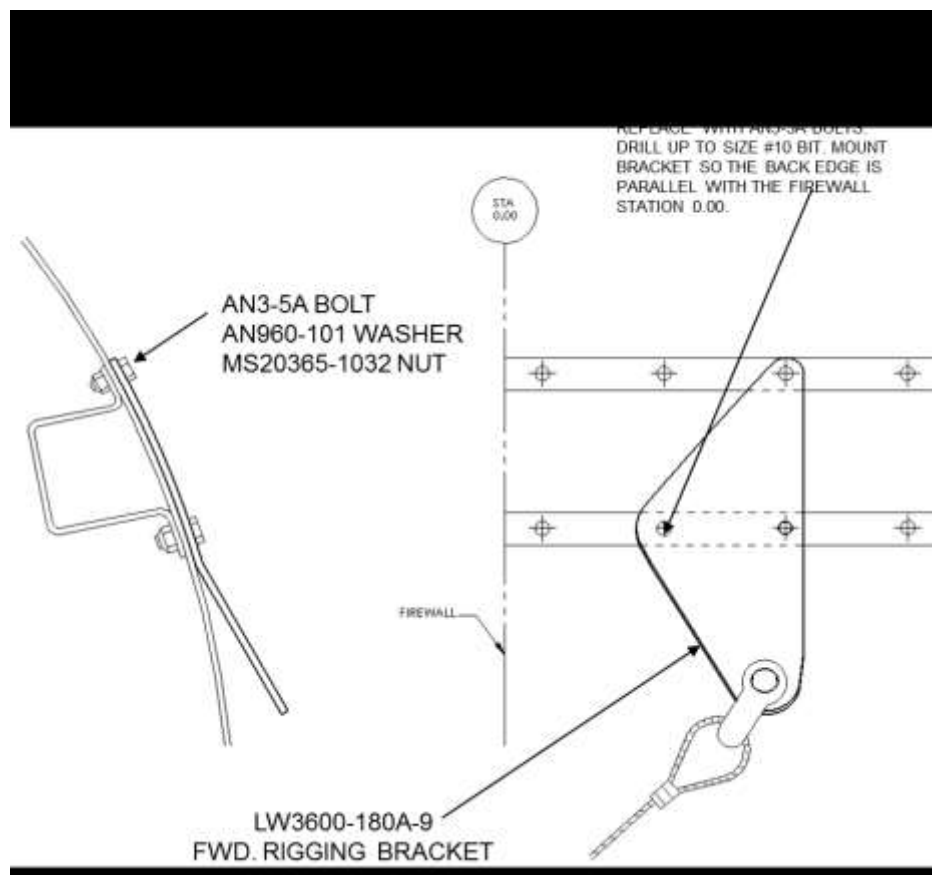


**Rigging Bracket Installations  
Figure 1**

### 3.1 SKI RIGGING BRACKETS AND ATTACH FITTINGS- CONTINUED

#### Rigging Bracket Installation:

1. Disconnect battery and tag "Maintenance in Progress".
2. Remove pilot and co-pilot seats (retain seat stops). Remove rear seat(s) (retain hardware).
3. Remove the left and right forward interior side panels (retain hardware).
4. Remove left and right aft cabin interior side panels (retain hardware).
5. Using figure 2 and photo 1, install the forward rigging cable attach brackets. Vacuum any chips from the interior of the aircraft when installation is complete.



**Left Forward Rigging Bracket Installation (LW3600-180A-10 Opposite)  
(See Drawing No. LW3600-180A-9 & LH3600-17 INST. for 180 thru 180F)  
Figure 2**



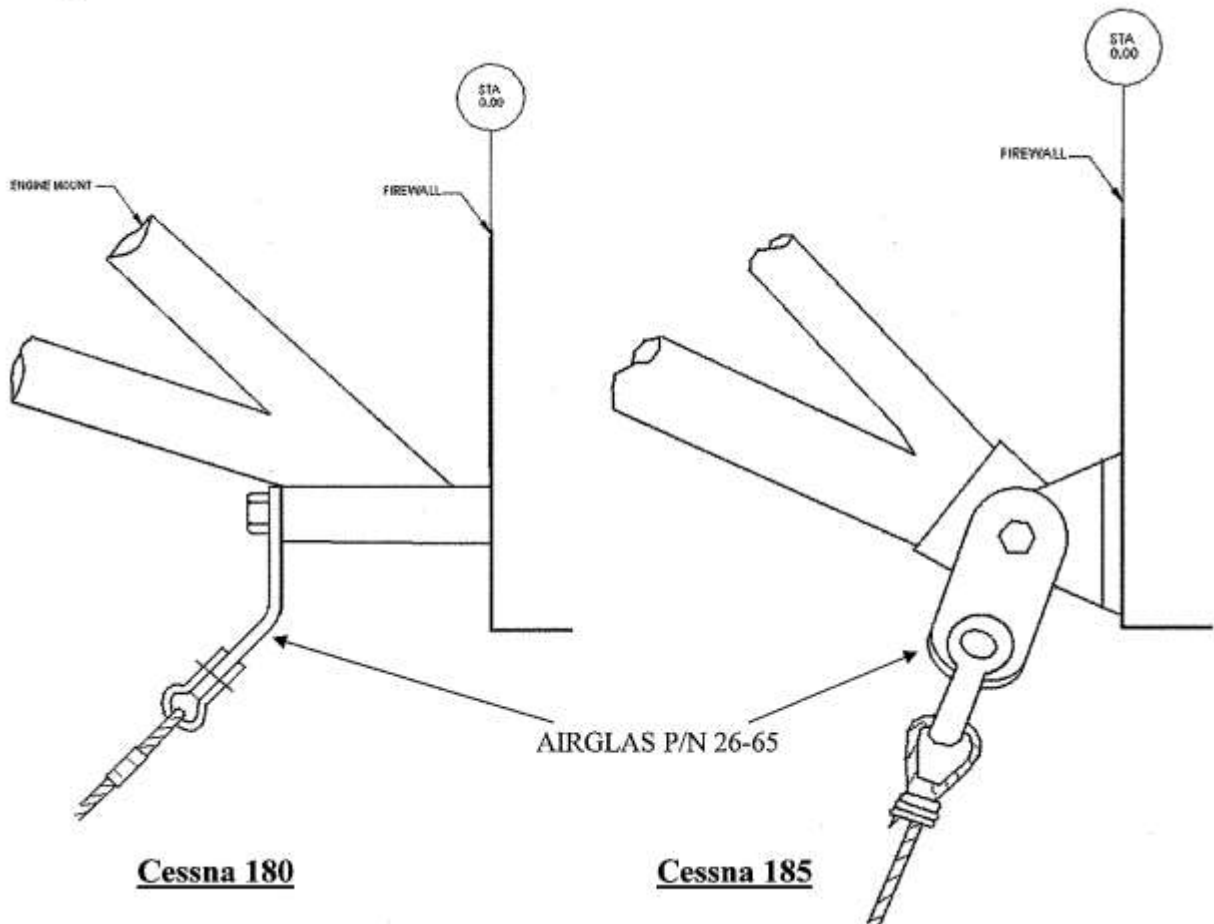
### 3.1 SKI RIGGING BRACKETS AND ATTACH FITTINGS-CONTINUED



**LW3600-180A-9 Forward Rigging Bracket Installed (LW3600-180A-10 is opposite)  
Photo 1**

6. Remove the cowling in accordance with Cessna Service Manual.
7. Support the engine with a hoist using the lifting eye provided by the engine manufacturer.
8. Remove the lower engine mount bolt and install the part number 26-65 rigging tab in accordance with figure 3, reinstall the engine mount bolt. Longer bolts may be required. Torque bolts in accordance with Cessna service manual.
9. Remove the hoist.
10. Notch the lower cowl to fit the 26-65 tabs. Remove all shavings, and reinstall the cowling.

### 3.1 SKI RIGGING BRACKETS AND ATTACH FITTINGS-CONTINUED

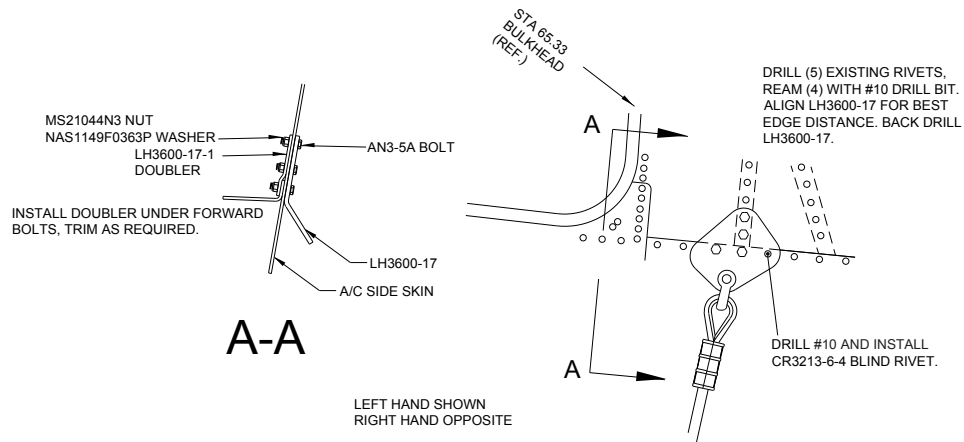


**Front Safety Cable Bracket Installation**  
**(Note: Notch lower cowling to clear bracket)**  
**Figure 3**

1. Using figure 4 and photo's 2 and 3, install the left and right rear check cable fittings part number LH3600-17 and LH3600-18. Ensure the LH3600-17-1 and LH3600-18-1 doublers are installed on the inside of the fuselage. Remove all shavings when installation is complete.
2. Reinstall cabin interior side panels.

**Note: Do not install rigging cables at this time.**

### 3.1 SKI RIGGING BRACKETS AND ATTACH FITTINGS-CONTINUED



**LH3600-17 Rear Rigging Bracket Installation (Left Hand Shown- Right Opposite)  
Figure 4**



**Rear Rigging Bracket Installation LH3600-17 (LH3600-18 Opposite)  
Photo 2**

### 3.1 SKI RIGGING BRACKETS AND ATTACH FITTINGS-CONTINUED



**Rear Rigging Bracket Doubler Installation LH3600-17-1 (LH3600-18-1 Opposite)  
Photo 3**

### 3.2 HYDRAULIC INSTALLATION-FUSELAGE

**Hydraulic System** – The hydraulic system supplied with the skis uses an Electric/Hydraulic Pump, (a hand pump is optional but not offered through Airglas, Inc.) to pump fluid to a hydraulic actuating cylinder mounted on the ski. The Electric/Hydraulic Pump is intended to be mounted behind the cabin area aft of station 108. Hydraulic lines are routed through the aircraft under the floor and out to the gear legs. The air is bled from the hydraulic system by cycling the skis several times. The electric pump is self-bleeding. MIL-H-5606 or compatible hydraulic fluid is required for filling, operating, and servicing the system. The fluid level should not be lower than 1/3 full in the reservoir, and should only be serviced with the cylinder fully retracted to prevent overflow. (Note: Some aircraft utilize an existing handpump)

**NOTE:**

**Special attention must be given to the routing of the lines through the aircraft. All lines must be supported in areas where there may be interference with cables, chains, pulleys or any moving parts. Lines that pass through bulkheads must either be secured clear of the lightening hole, or grommets must be installed at the lightening holes to protect from abrasion and chafing. Allow for proper bend allowances in the hose when necessary.**

### 3.2 HYDRAULIC INSTALLATION-FUSELAGE-CONTINUED

1. Remove aft cabin interior panel at fuselage station 108.
2. Remove carpet and floor inspection panels from fuselage station 27 to fuselage station 208.
3. If the aircraft is equipped with an aft baggage compartment, remove the baggage floor.
4. The electro/hydraulic pump will be mounted aft of station 109 (the baggage bulkhead) to the fuselage belly skin approximately 5.5" right of center. The bulkhead is reinforced at this location with a piece of 2024-T3 .091" aluminum (P/N LH3600-20) that is bolted to the bulkhead and through the belly skin. Secure the doubler as depicted in photo's 4 and 5, to the bulkhead using two AN3 bolts, MS21044N3 nuts, and NAS1149F0363P washers. Install the electro-hydraulic pump using two each MS20074-06-06 bolts, and AN970-6 washers. Torque bolts to 25 in. lbs. maximum and safety.



**Pump Mounting Reinforcement (LH3600-20)  
Photo 4**

### 3.2 HYDRAULIC INSTALLATION-FUSELAGE-CONTINUED



**Electric Pump Mounting -Photo 5**

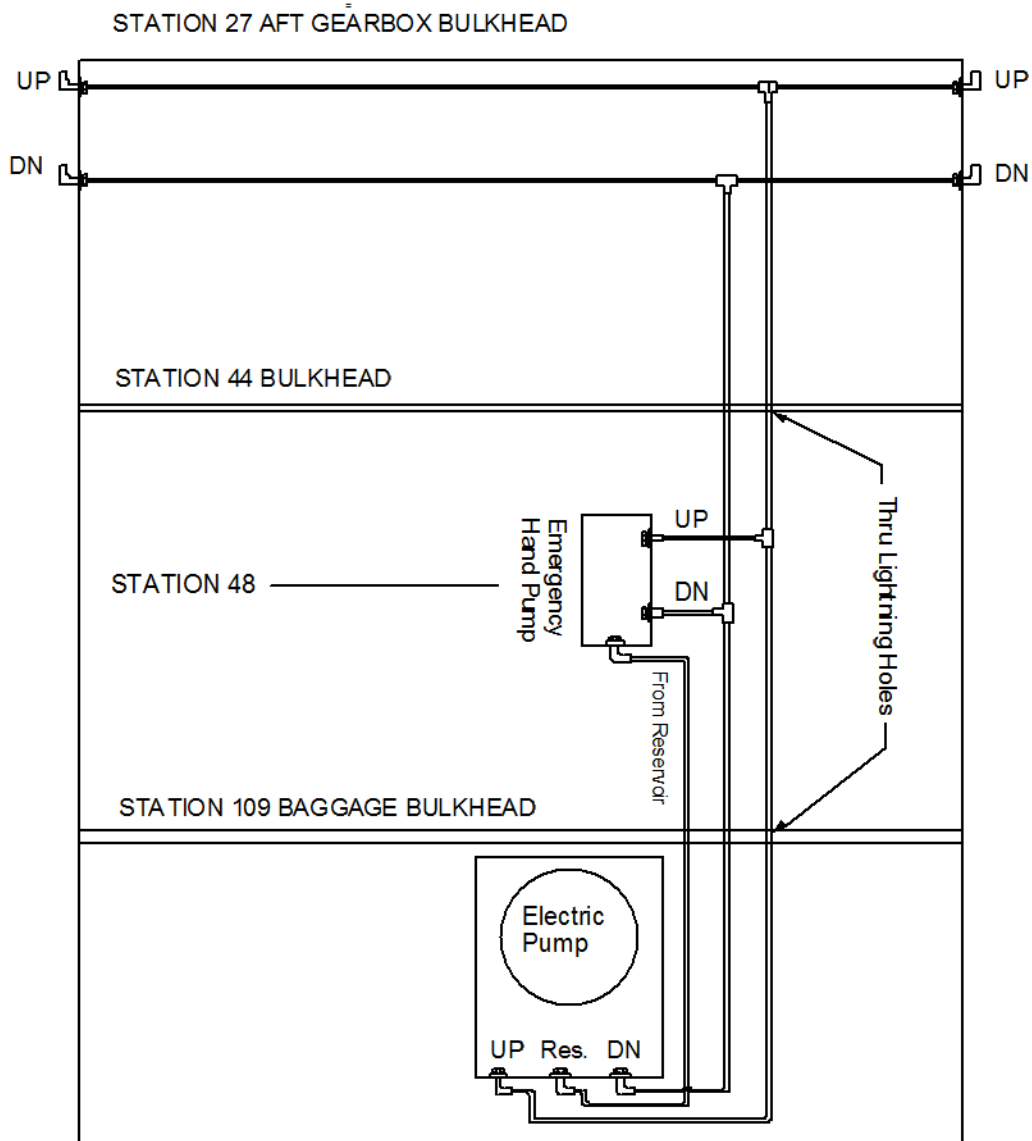
5. Use Figure 5 as a guide to fabricate and route the hydraulic lines. Use care to ensure they do not interfere with flight controls and are not able to chafe.
6. The hydraulic lines will run crossways aft of station 27 (gearbox bulkhead) from the AN833-4D fittings to two (2) AN824-4D tees located at station 31 (inspection hole co-pilot's side floorboard).
7. From this point the lines travel aft through a lightening hole at station 44 (bulkhead) to station 55 (inspection hole co-pilot's side floorboard) to two (2) more AN824-4D tees. (These tees are for an optional hand pump, and can be capped off if no hand pump is installed. If a hand pump is installed, a third line will be required to run from the pump reservoir port to the supply inlet on the hand pump.) From this point the lines will continue aft through lightening holes through remaining bulkheads to the baggage bulkhead, where they will pass through and up to the pump.

**NOTE:**

The optional hand pump installation location may vary from aircraft to aircraft. Some will mount at the seatbelt bracket location others may require additional structural enhancement to support the pump. Aircraft with pre-existing hand pumps will tap into the AN824-4D tees. Manual hand pump only configurations are allowed using existing hand pump installations.

### 3.2 HYDRAULIC INSTALLATION-FUSELAGE-CONTINUED

8. Remove all drill shavings.



**Hydraulic Schematic – Figure 5**

### 3.2 HYDRAULIC INSTALLATION-FUSELAGE-CONTINUED



**Optional Hand Pump Mounting - Photo 6**

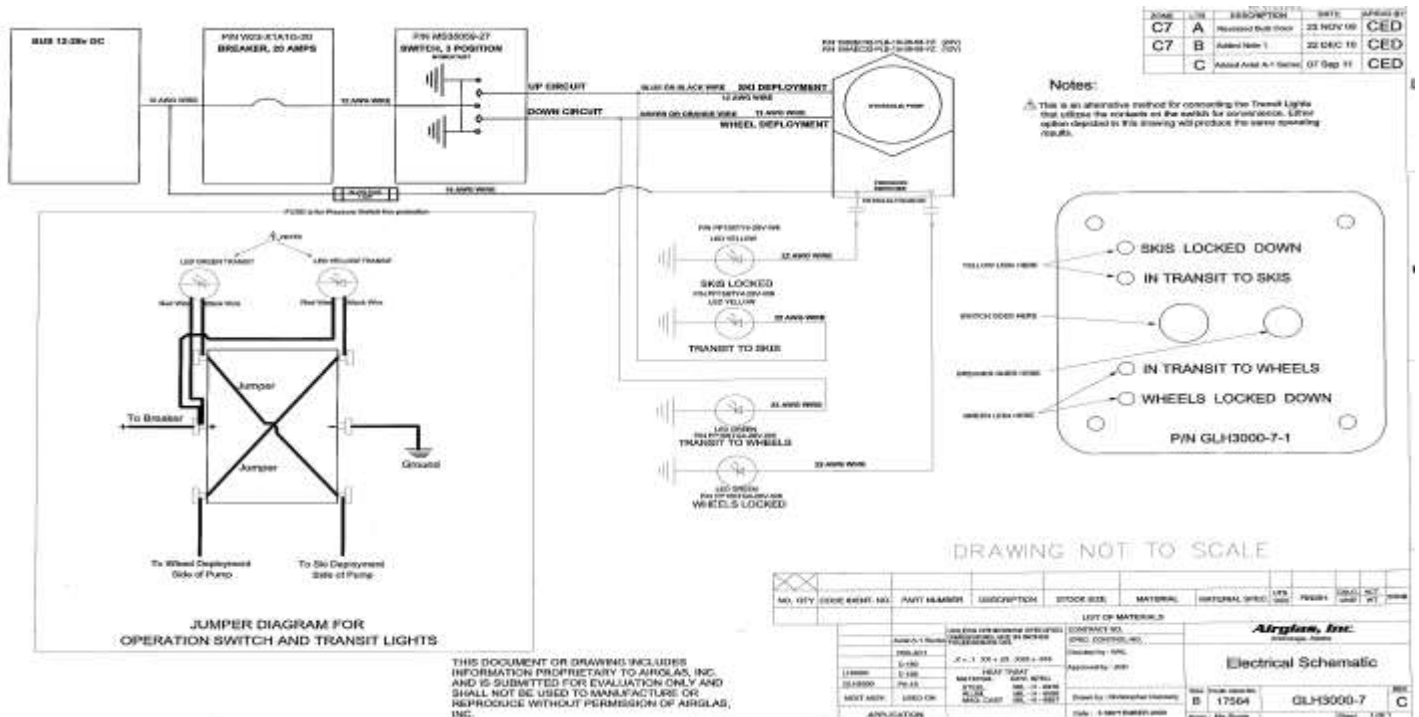
### 3.3 ELECTRICAL INSTALLATION



**Ski Pump Switch Installation-Photo 7**



### 3.3 ELECTRICAL INSTALLATION-CONTINUED



**Ski Pump Electrical Schematic-Figure 6 (Ref: Drawing GLH3000-7)**

1. Select an unused instrument hole to the left of the throttle control and to the right of the pilots control yoke. If no unused instrument hole is available, install the switch, lights, and circuit breaker between the pilots yoke and the throttle as depicted in photo 7.
2. The power supply and control wires for the pump must be routed through the aircraft IAW AC 43.13 chapter 11 practices.
3. Determine the lengths of wire required to reach the master side of the main bus and route the wires IAW AC 43.13 recommended practices.
4. Follow the GLH3000-7 wiring diagram provided to insure the connections are correct.

**Note: Wiring instructions for the Parker-Electro/Hydraulic pump.**

1. Make sure that the polarity for the pump is correct.
  - BLUE 12 V or Black 24V (SKIS)      GREEN 12V or Orange 24 V (WHEELS)
  - a. Switch sends power to blue or black wire during "Ski" selection. This will pressurize the "UP" port of the pump.

### 3.3 ELECTRICAL INSTALLATION-CONTINUED

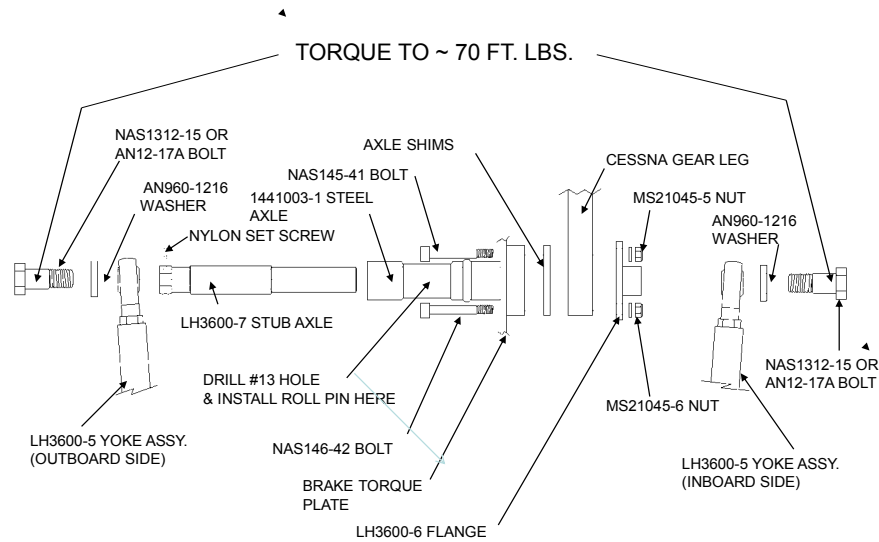
b. Switch sends power to the green or orange wire when "Wheels" are selected. This will pressurize the "DOWN" side of the pump.

c. Make sure the "UP" Port on the pump goes to the FWD fitting on the ski actuator cylinder.

2. When arranging the switch and indicator lights on the control panel, make sure that the switch "UP" position is for **Skis (Yellow Lights)** and switch "DOWN" is for **Wheels (green lights)**.

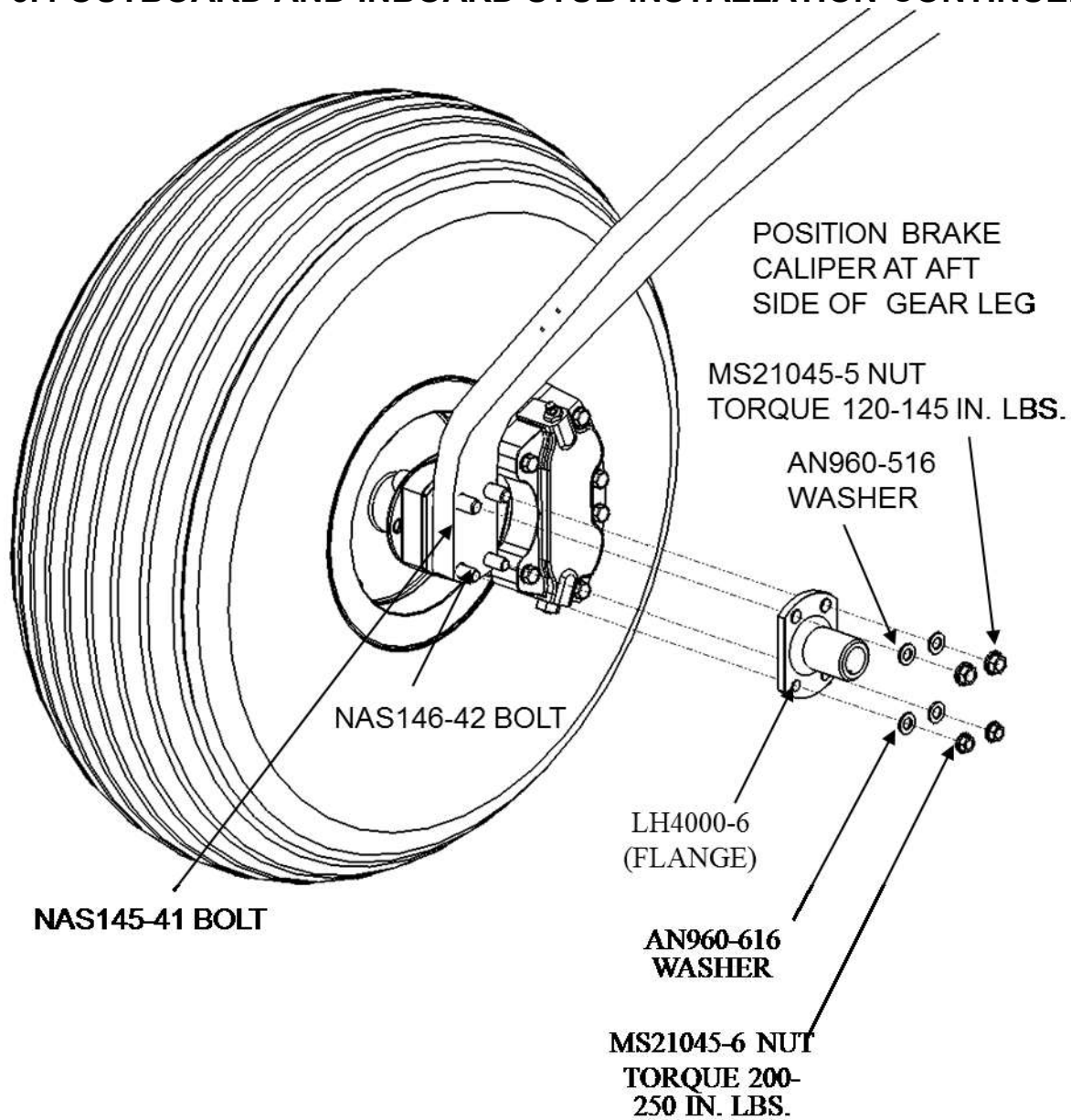
**NOT following these instructions WILL make the system OPERATE INCORRECTLY.**

### 3.4 OUTBOARD AND INBOARD STUB INSTALLATION



**Breakdown  
Figure 7**

### 3.4 OUTBOARD AND INBOARD STUB INSTALLATION-CONTINUED



**Inboard Stub Axle Installation-Figure 8**

**Note: It is suggested that the aircraft wheel alignment is confirmed using Cessna service instructions prior to installation of the skis.**

1. Hoist or jack aircraft until wheels are clear of ground.
2. Remove tire and wheel using standard practices. (Always deflate tire before removing axle nut)
3. Confirm that the axle is Cessna part number 1441003-1 or equivalent (hollow steel).

### **3.4 OUTBOARD AND INBOARD STUB INSTALLATION-CONTINUED**

4. Inserted the LH3600-7 stub axle into the outboard end of the 1441003-1 axle until its shoulder butts firmly to the aircraft axle. Drill a hole midpoint between the two shoulders on the 1441003-1 with a # 13 bit all the way through both the LH3600-7 and the 1441003-1 axle as depicted in figure 6. The hole should be drilled straight through without angling or tipping the hole. Drive a MS171597 (3/16 x 1 3/8) roll pin flush into the two parts.
5. Using the axle as a guide, drill the cotter pin hole through the LH3600-7 using a 1/8" drill bit. It is helpful to drill this hole from both sides to reduce the chance of misalignment. De-burr and smooth any rough edges left from drilling.
6. Repeat steps 1 thru 5 on the other landing gear.
7. Referencing figure 7 and figure 8, remove all 4 nuts from the axle retaining bolts and discard. Confirm that NAS145 and NAS146 bolts (or equivalent) are installed on the aircraft. No AN bolts may be used to secure the axle to the gear leg with the LH4000 ski installation.
8. Place the LH3600-6 inboard flange on the landing gear leg. Confirm that the bolts are long enough to allow the MS21045 nuts to fully engage with at least 1 thread protruding beyond the nut. If the current bolts are too short, install new bolts. Up to 3 washers may be installed under the nuts. There must be an MS20002 washer installed under the head of the NAS145 and 146 bolts. (Note the bolt lengths depicted in figure 8 may not allow for the gear alignment shim stack installed on the aircraft.) Install new nuts on the axle to gear leg bolts.
9. Torque the nuts in accordance with figure 8.
10. Reinstall the wheels, torque the axle nuts in accordance with Cessna service manual instructions and install new cotter pins.

### **3.5 SKI INSTALLATION**

1. Prior to initial ski installation, the aircraft will need to be hoisted or jacked to attain clearance enough to slide the ski beneath the tire. Once the ski is positioned, the aircraft may be lowered to the ground.
2. Remove the MS21044N3 nut and AN3 bolt from the LH3600-10 yoke safety cable and slide the strap around the outboard stub axle. Reinstall the cable, AN3 bolt and tighten the MS21044N3 nut. See photo's 8 and 9.
3. The rod ends on the yoke can next be temporarily thru-bolted to the stub axle and inboard flange using the NAS1312-15 (OR AN12-17A ALTERNATE) bolts.
4. With the aircraft tires on the ground adjust the yoke to align the skis parallel with the fuselage center line by adjusting the length of the rod ends. Center the tire within the yoke by adding or removing AN960-1216 washers between the rod end and the stub axle or inboard flange. After alignment is performed, remove the NAS1312-15 bolts and screw the nylon set screws into the stub axle and inboard flange until it is flush with the minor diameter. Install the NAS1312-15 bolts and torque to 70 ft. lbs. Tighten the jamb nuts on the rod ends.

### 3.5 SKI INSTALLATION-CONTINUED



**LH3600-10 Installation-Photo 8 and 9**

### 3.6 EXTERNAL HYDRAULIC INSTALLATION



Additional clamp location.

#### **Additional Clamp Installation-Photo 10**

1. Fabricate hydraulic lines using MIL-H-8794-4 hose and compatible MS24587-4, MS27226-4, or MS27224-4 connectors.
2. Assemble hoses in accordance with AC 43.13-1B Chapter 9 Section 2 paragraph 9-30.
3. Route hoses so that smooth bends of at least 3" radius are maintained in all ski operational positions.

### 3.6 EXTERNAL HYDRAULIC INSTALLATION-CONTINUED

4. Secure the hoses along the top of the ski using the two MS21919WDG16 clamps provided. (larger or smaller clamps may be used if required)
5. Secure hoses using additional clamps Cessna part number 1441001-2 or equivalent as indicated in photo 10.
6. Secure clamps as follows:
  - a) Tape off an area the same size as the clamp on both sides of the leg.
  - b) Rough-up the surface with 80 grit sandpaper inside the taped area.
  - c) Remove any corrosion, loose paint, grease, oil, etc.
  - d) Slightly rough-up the inner surface of the clamps.
  - e) Mix and apply Scotch Weld 3M 2216 B/A grey epoxy to the leg and to the inside of the clamp.
  - f) Push the clamp onto the leg and wipe off the excess with acetone.
  - g) Tape the clamp to the leg to prevent any creep while curing.
  - h) Allow to cure for 24 hours at room temp, before employing the clamps.
  - i) Follow these steps for all 4 locations on the gear leg. Remove tape when finished.
7. When clamps are cured, place hoses in the clamps and secure with ty-wraps or rubber lacing.
8. Ensure master switch is "OFF" and all personnel are clear. Reconnect battery and remove "Maintenance in Process" tag.

### 3.7 SKI RIGGING INSTALLATION

1. Hoist or jack the aircraft and install the LH3600-14 bungee cable assy. and the LH3600-15 safety cable assy. If there is not enough lift available to allow the cable to be installed, the bungee must be stretched using a mechanical bungee tool. Use caution when stretching the bungee. Ensure the bungee has at least one full twist when installed.
2. Raise the tail of the aircraft until it is in the level flight attitude with the tires retracted (skis deployed).
3. Install the LH3600-13 rear check cable.
4. Set the skis at +1.5° tip up in the ski position in level flight attitude. Crimp the Nicopress sleeves on the rear cables in accordance with AC 43.13-1B Chapter 7 section 8 paragraph 7-148.
5. Make sure all hardware is installed, torqued, and cotter pinned as necessary.

Note: *All hardware in this kit shall be installed and torqued IAW AC 43.13-1B Chapter 7, Par 7-40, Table 7-1 and table 7-2.*

### 3.8 SKI INSTALLATION CHECK OUT

1. Service the hydraulic pump reservoir with MIL-H-5606 hydraulic fluid.
2. Cycle the hydraulic system to first to deploy the skis and then to retract. Check the hydraulic reservoir frequently to prevent running the pump dry. At least 3 cycles will be needed to bleed the system. With the system fully bled and the rams retracted, service reservoir to 1/3 capacity.
3. Hoist or jack the aircraft to attain clearance enough to allow the ski to clear the ground in both the ski retracted and deployed conditions.
4. With the ski deployed, confirm that the ski angle is +1.5° tip up in the ski position relative to the level flight attitude of the aircraft. (Reference the Cessna service manual leveling procedure)
5. With the ski in the wheel position, check the tension of the ice cutter(bungee cable) cable. This tension must be greater than 80 lbs. Ensure the bungee has at least one full twist when installed.
6. Lower the aircraft to the ground and cycle the skis, confirm the indicator lights illuminate, the skis transition in both directions, and there are no leaks in the hydraulic system.
7. If the main landing gear tire sidewalls scuff the ski, increase tire pressures. A pressure of 35 – 42 psi is acceptable.

### 3.9 SKI INSTALLATION PLACARDS AND DOCUMENTATION

1. Remark the red line on the airspeed indicator at 150 KIAS.
2. Install the placards required by the FAA Approved Flight Manual Supplement Limitations Section.
3. Mark the electro/hydraulic pump circuit breaker "SKI PUMP".
4. Mark the ski selector switch "SKIS" and "WHEELS". Mark the ski locked and transit indicator lights in accordance with drawing GLH3000-7.
5. Place a copy of the Skiplane Model 180/185 Approved Flight Manual Supplement in the aircraft flight manual.
6. Revise the aircraft weight and balance and equipment list to reflect the ski installation. The skis weight is 135 lbs. located 12.5 inches forward of the main landing gear axle centerline. The electro hydraulic pump weight is 7 lbs. located at station fuselage station 114.
7. Install any floor inspection plates that were removed, cabin floor covering, aft baggage floor (if equipped), aft interior panel, pilot and co-pilot seats (using retained seat stops). Install rear seat(s) (using retained hardware).
8. File FAA form 337 installing Airglas LH4000 skis in accordance with STC SA02244AK.
9. Record installation in aircraft maintenance records.

## 4.0 SKI SPECIFICATIONS

**Ski Specifications are as follows:**

<b>Length=</b>	<b>84"</b>
<b>Width=</b>	<b>24"</b>
<b>Height=</b>	<b>5" TO TOP OF TUNNEL (7" at axle centerline)</b>
<b>Weight=</b>	<b>73 lbs. (each ski)</b>
<b>Square Inches=</b>	<b>1435 (each ski)</b>
<b>Center of Gravity=</b>	<b>12.5" FWD OF AXLE</b>

## 5.0 TROUBLE SHOOTING

**Problem:** Indicator lights illuminate inaccurately or erratically.

**Correction:** Reconnect the hydraulic supply lines to opposite ports on the pump and/or reverse the pump power polarity.

**Problem:** Skis do not cycle smoothly, or have pulsing or incomplete actuation.

**Correction:** Hydraulic Fluid (MIL-H-5606) level is too low.

**Problem:** Hydraulic fluid overflows from reservoir when skis are retracted. (tires extended)

**Correction:** Reservoir filled while skis were deployed. (Always fill with skis retracted)

**Problem:** Skis try to dive in flight.

**Correction:** Skis are rigged at too low angle of attack, or bungees are too weak.



## 5.0 TROUBLE SHOOTING-CONTINUED

**Problem:** Bungee's vibrate in flight.

**Correction:** Ensure the bungee has at least one full twist when installed.

## 6.0 DRAWINGS AND DIAGRAMS

### Descriptive Data List No. LH3600-1

ICA	LH4000-106	Rev B	December 3, 2012
Ski Installation and Assembly (side cylinder skis)	LH3600A-1 Sheets 1 thru 6	Original	9 Dec 2011
Ski Installation and Assembly (center cylinder skis)	LH3600-1 Sheets 1 thru 4	Rev A	6 Aug 2009
Skiplane Flight Manual Supplement	MODEL 180/185 SERIES	Original	June 8, 2005
Electrical Schematic	GLH3000-7	Rev C	07 Sep 2011

— END —