

REVISION LIST

CHAPTER 27: GENERAL WIRING

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the “Action” column, “R&R” directs you to remove and replace the pages affected by the revision. “Add” directs you to insert the pages shows and “R” to remove the pages.

PAGE(S) AFFECTED	REVISION # & DATE	ACTION	DESCRIPTION
27-1 through 27-17 27-17	0/02-15-02 1/09-18-02	None R&R	Current revision is correct Part # Correction
27-1 27-2 27-4	3/12-15-04 3/12-15-04 3/12-15-04	R&R R&R R&R	Updated table of contents with page numbers. Part number update. Part number update.
27-2, 27-5	6/08-10-07	R&R	Part number change only

Chapter 27: General Wiring

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1. INTRODUCTION

This chapter will deal with the wiring necessary to get your Lancair Legacy functional. We will show you how to get power to the engine starter, then after the engine is fired up, how to get power from the alternator into the cockpit. From this point various systems, such as lights, trim systems, hydraulic system, fuel pump, etc., will be shown in wiring diagrams from the cockpit.

We can't show you how to wire all the different types of radios, GPS's, VOR's, HSI's, NDB's, and all those other various systems that can fill up a panel so expensively. These items must be wired by the builder or a local radio shop using their own expertise. The basic goal of this chapter is to acquaint you with important parts of the electrical system, such as the alterna-

tor, starter and master solenoid, mag switch, and the primary and avionics power sources (buses).

Wiring can be one of the most intimidating of all the different skills you learn when constructing a homebuilt aircraft. What makes matters even worse is that when you ask three different wiring "experts" about the best way to wire an alternator system, you will most likely receive three different answers. If you plan on wiring your own Lancair Legacy, start reading! Tony Bingelis is the guru of homebuilding "how to". His *Sportplane Builder* column in *Sport Aviation Magazine*, and his books are a wealth of information on all aspects of homebuilding, including wiring. If you have kept your back issues of *Sport Aviation*, Mr. Bingelis' column in the April, May, and June 1990 issues are excellent for gaining a good understanding of electrical systems.

Robert Nuckolls is also an excellent reference for wiring. He publishes a newsletter, The AeroElectric Connection, and also contracts his services to individual builders to design custom electrical schematics. He can be reached at:

Medicine River Press
6936 Bainbridge Road
Wichita, Kansas 67226-1008
(316) 685-8617

Another popular option is to have a local electrical pro do your electric system for you. This is generally a good idea at least for the radio stack wiring, but for the basic electrical system in your Lancair Legacy, you might be surprised how simple it is to wire.

This chapter is a general wiring chapter. The diagrams are generalized for typical Lancair legacy installations. Equipment types and locations will vary from aircraft to aircraft. This chapter serves as a start to base your customized schematics on.

Since this is a composite airframe, you don't have the luxury of grounding to a convenient aluminum surface. You must bring a few ground posts into the cockpit, then terminate all your circuits to one of these posts. Although only one cockpit ground post is shown in the following schematic, it is a good idea to have several, even a couple in the gear box area for the systems behind the wings. Ahead of the firewall, circuits are usually grounded to one of the engine bolts, which is in turn grounded to the battery.

It seems that more and more breakers are being incorporated into the modern electrical system. You'll notice in most of the wiring diagrams, a breaker symbol is shown adjacent to the master bus bar. The number in the symbol is the breaker size.

Install circuit breaker sizes according to manufacturer's recommendations.



27-1

Chapter 27

REV.

3/12-15-04

GENERAL WIRING

2. PARTS LIST

#	PART NO. (P/N)	QTY	DESCRIPTION	OPTIONAL ITEM <i>(not included with kit)</i>	#	PART NO. (P/N)	QTY	DESCRIPTION	OPTIONAL ITEM <i>(not included with kit)</i>	
BASIC WIRING TECHNIQUES										
LEGACY GENERAL WIRING										
1)	4038	1	Battery Box Mount	Yes**	TRIM SYSTEM WIRING					Contact Lancair Avionics
2)	VB-35	1	Battery Box	Yes**	FLAP WIRING					Contact Lancair Avionics
3)	AN3-5A	4	Bolt, Undrilled	Yes**	PITOT TUBE					
4)	AN3-10A	4	Bolt, Undrilled	Yes**	ANTENNA PLACEMENT					Contact Lancair Avionics
5)	193-4	1	Hose	Yes**						
6)	145-0000 532HK14	1	Hose Clamp	Yes**						
7)	K1000-3	8	Nutplate	Yes**						
8)	PH-250 (1" x 3" x 3/8")	2	Phenolic Block, 1" x 3" x 3/8"	Yes**						
9)	737-L2K-14	1	Power grid	Yes**						
10)	MSC-34	8	Rivets	Yes**						
11)	AN960-10	8	Washer, Flat	Yes**						
12)	AN960-10	4	Washers	Yes**						
BASIC AIRCRAFT WIRING			Contact Lancair Avionics							
LANDING GEAR WIRING										
1)	710	1	Airspeed Safety Switch	Yes**						
LIGHTS WIRING										
1)	4926 (Left)	1	Taxi Light, Landing Light Kit	Yes**						
2)	4927 (Right)	1	Taxi Light, Landing Light Kit	Yes**						
3)	0144	1	Dimming Rheostat	Yes**						
4)	14-100	1	Instrument Light Switch	Yes**						
5)	A600 PR	1	Left, Nav/Strobe Lights (Whelen)	Yes**						
6)	A600 PR	1	Right, Nav/Strobe Lights (Whelen)	Yes**						
7)	14-100	1	Nav Light Rocker Switch	Yes**						
8)	A-413, HDA, CF	1	Power Pack (Whelen)	Yes**						
9)	14-100	1	Strobe Light Rocker Switch	Yes**						
ELECTRIC FUEL PUMP WIRING			Contact Lancair Avionics							

Note:

Optional Parts available through :

(*) Lancair Avionics

(**) Kit Components, Inc.



27-2

Chapter 27 REV. 6/08-10-07

GENERAL WIRING

3. CONSTRUCTION PROCEDURES

A. Basic Wiring Techniques

The wiring diagrams of this chapter do not include wire sizes. Wire sizes are determined from the wire size diagram.

The wire size depends on load, length and voltage. As an example:

- 1) 14 feet installation
- 2) 28V source
- 3) 20 ampere draw

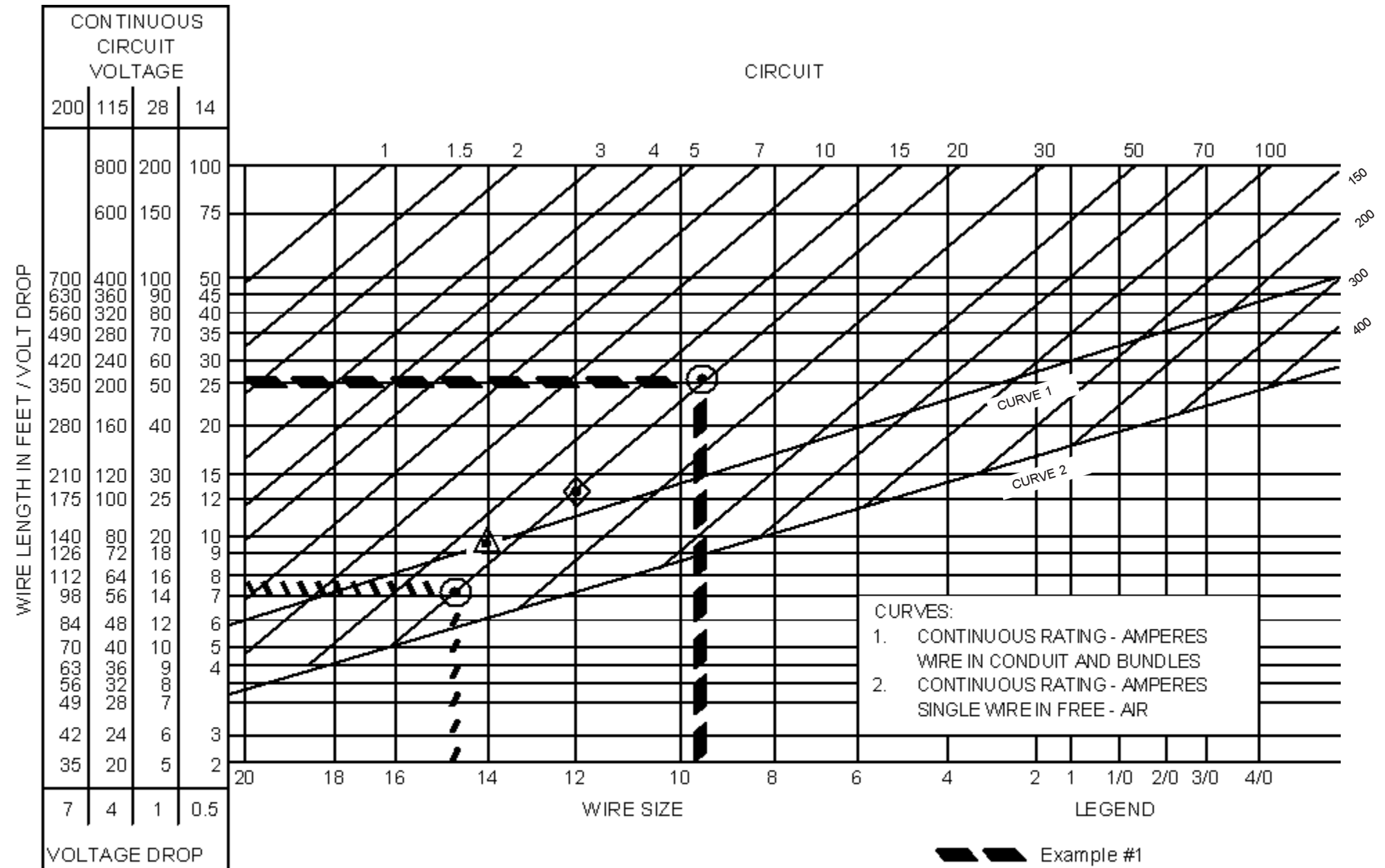
Find the wire size.

Answer:

Find the number 14 under 28 volts source column. Follow the horizontal line to the right until intersects the slant 20-ampere line. At this point drop to the bottom of the chart. The value falls between No. 16 and No. 14, select the larger size, No. 14.

The wire will be placed in conduit, so curve 1 applies. The maximum continuous current for No. 14 wire is 17 amperes.

Wire Size, Continuous Flow
Fig 27:A:1



Note: Use aircraft quality wire. In choosing the proper wire consider requirements, operating temperatures, and environmental conditions

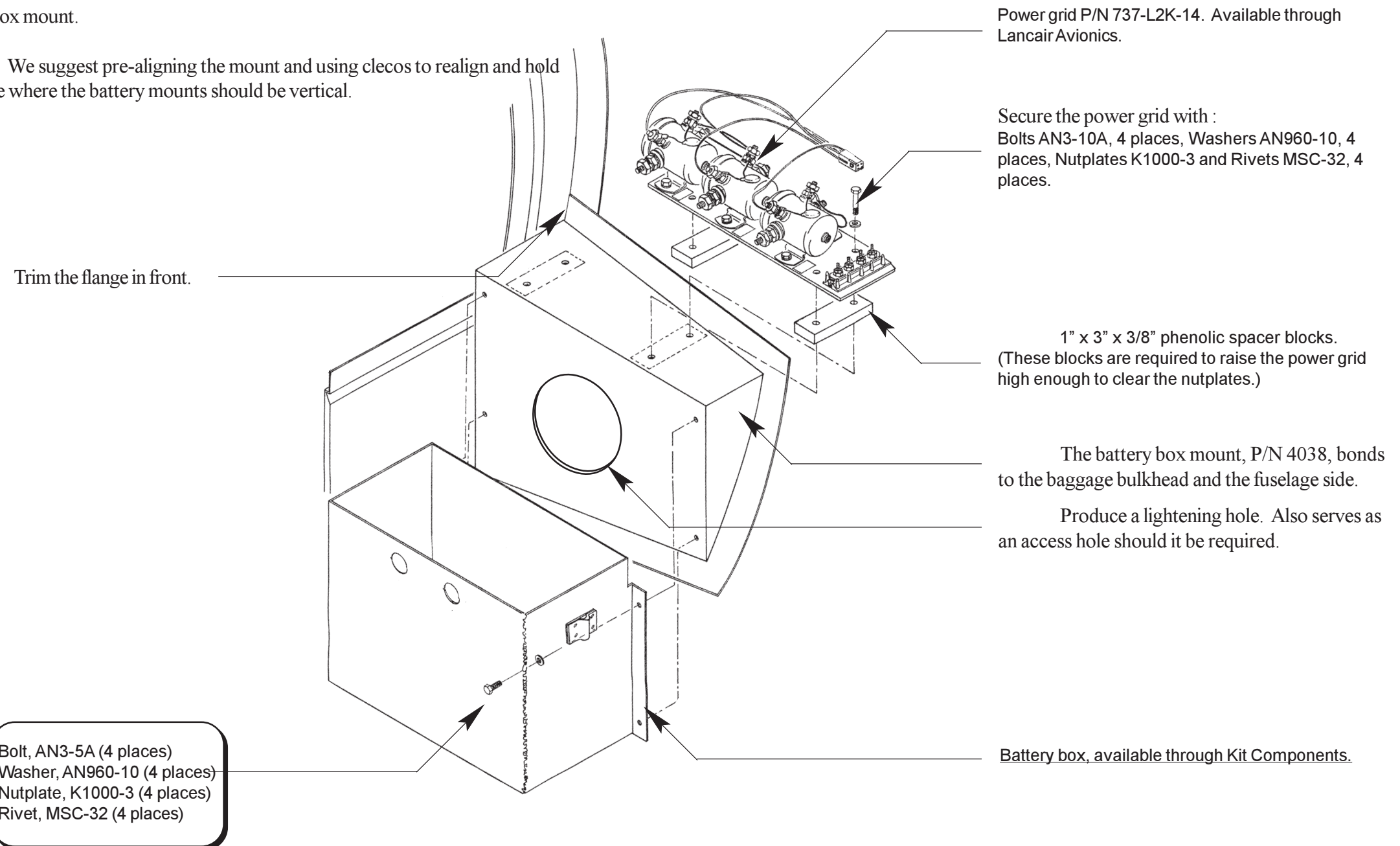
B. Legacy General Wiring

Battery Box Installation

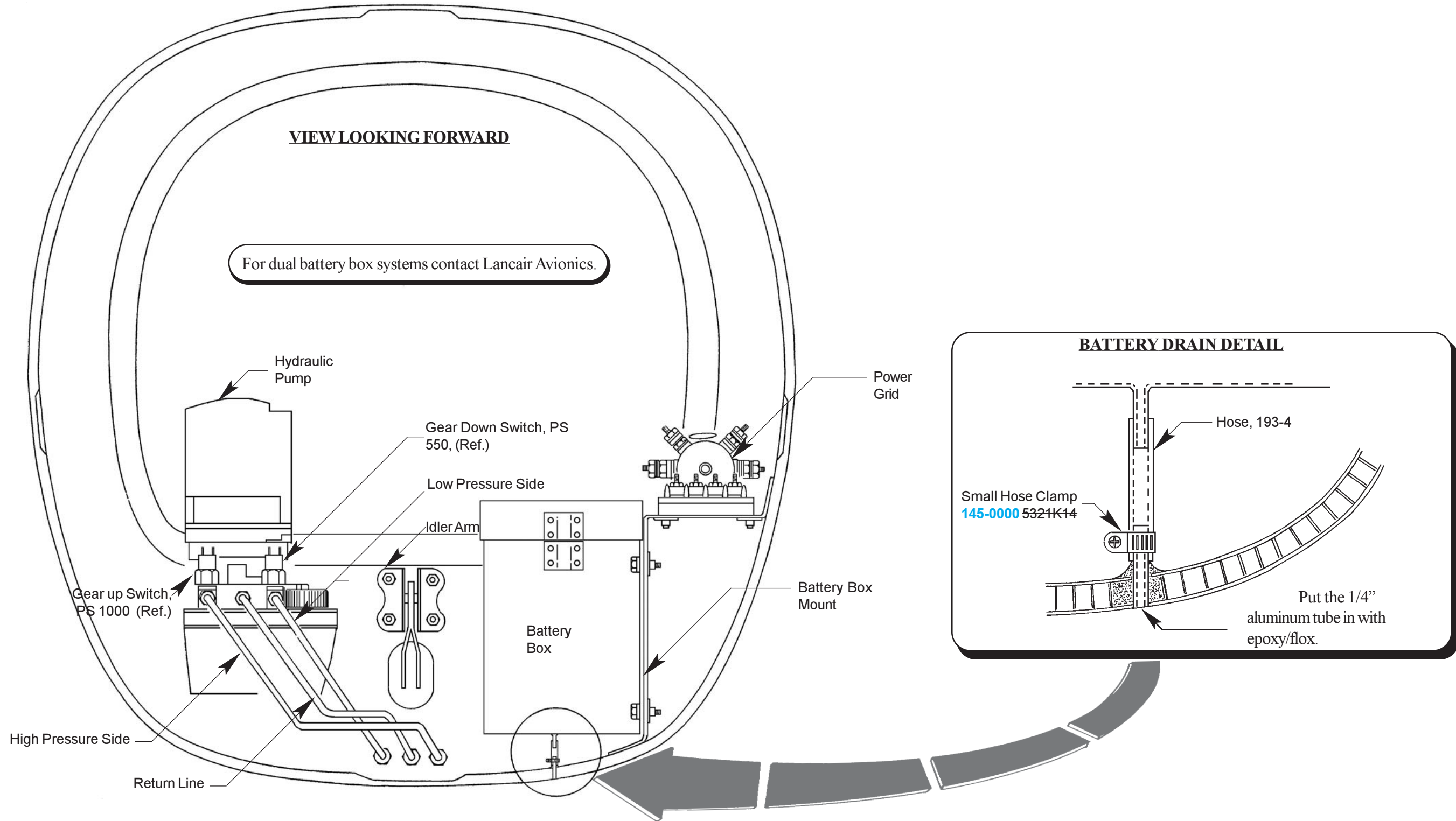
Fig 27:B:1

The battery box installs aft of the baggage bulkhead on the right side of the push-pull tube. You have been supplied with a premolded battery box mount that bonds to the fuselage side.

1. Mount the battery box to the battery box mount before bonding the mount in place. The battery box should mount as high as possible and be centered on the mount.
2. Install the power grid to the battery box mount.
3. Bond the battery box mount in place. We suggest pre-aligning the mount and using clecos to realign and hold in place during bonding. The flat face where the battery mounts should be vertical.



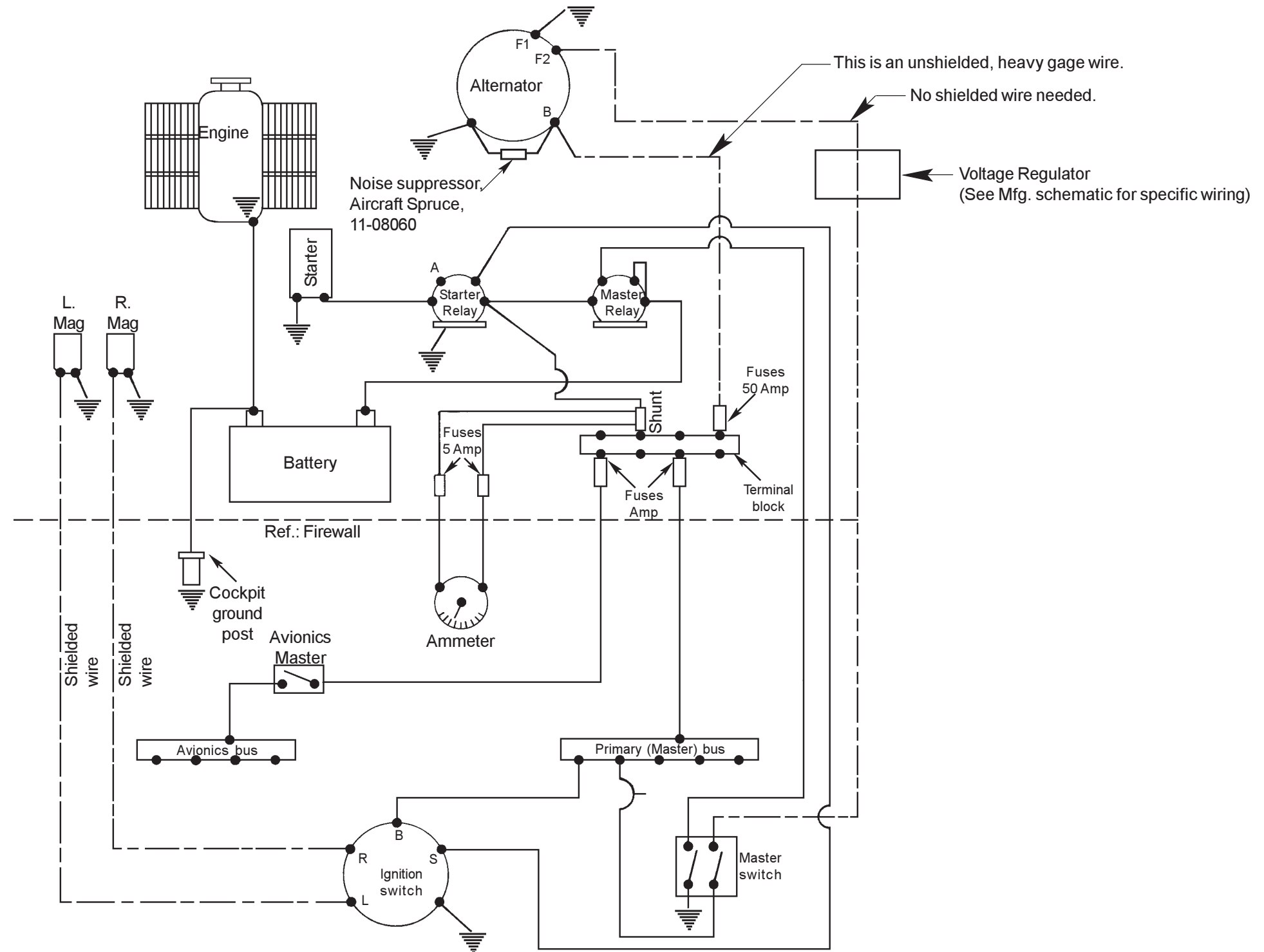
Battery Box Installation
Fig 27:B:2



C. Basic Aircraft Wiring

This diagram shows a very basic aircraft system. All other systems would branch off this system.

Basic Aircraft Wiring Diagram
Fig 27:C:1



D. Landing Gear Wiring

The landing gear wiring consists of three main systems, hydraulic pump, gear indicator light, and an airspeed safety switch. The hydraulic pump is controlled through pressure switches that activate the solenoids. The gear up solenoid should be protected by an airspeed safety switch. This switch basically leaves the circuit open until the aircraft reaches a pre set speed. This is to prevent accidental gear retraction on the ground. The switch has an adjustment feature for setting the speed. We suggest you set the speed between 80 to 90 KIAS. The switch is available through KCI.

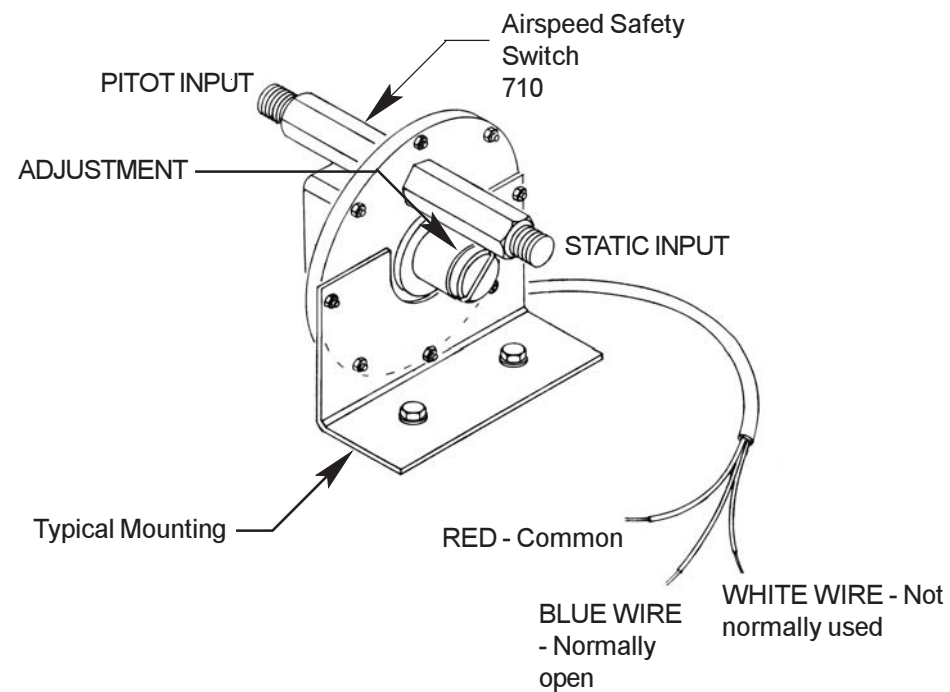
An important part of the gear system is the gear indicator lights. The gear indicator light switches are installed on the over center links. This very simple circuit basically closes when the over center link is locked in the down position.

There is also a light to indicate the pump is running. This light is typically amber in color and indicates when either the up or down circuit is activated.

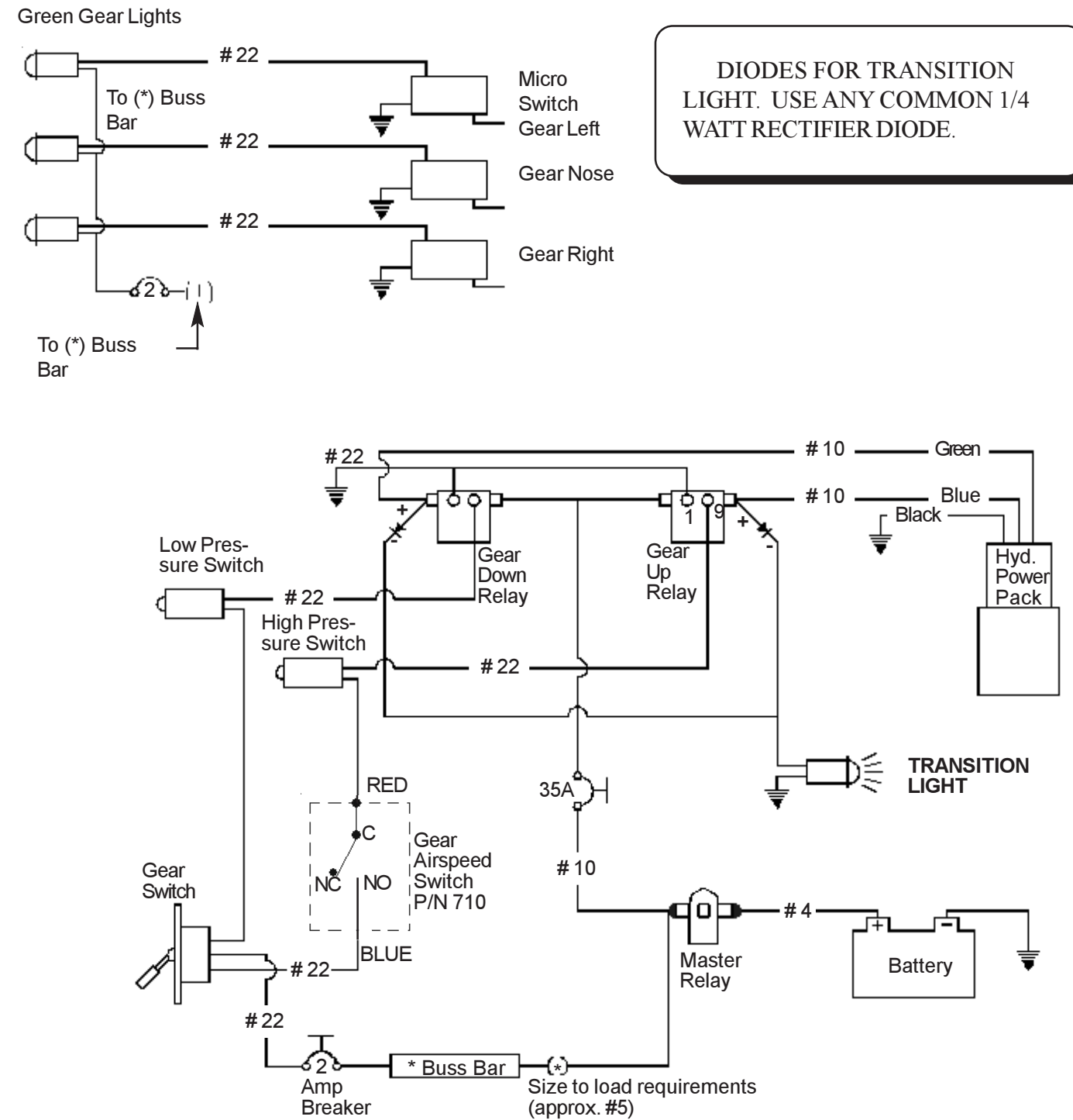
Mount the indicator lights as high as possible on the panel to take advantage of the shade provided by the glare shield. As with any light it is hard to see if it is lit if the sun is shining on it. The lights are usually mounted in a triangular pattern, with the nose gear indicator above the two mains.

The landing gear indicator lights work through the micro switches you have already installed on the main gear and nose gear. This circuit is as simple as it gets. When the micro switch at each gear location is grounded out, the indicator light on the instrument panel illuminates.

Next to the gear position indicators, mount the hydraulic pump indicator, which is amber in color. This light will now illuminate when the hydraulic pump is running, like when the gear is cycling, or when hydraulic system pressure falls off.



Landing Gear Wiring Diagram
Fig 27:D:1



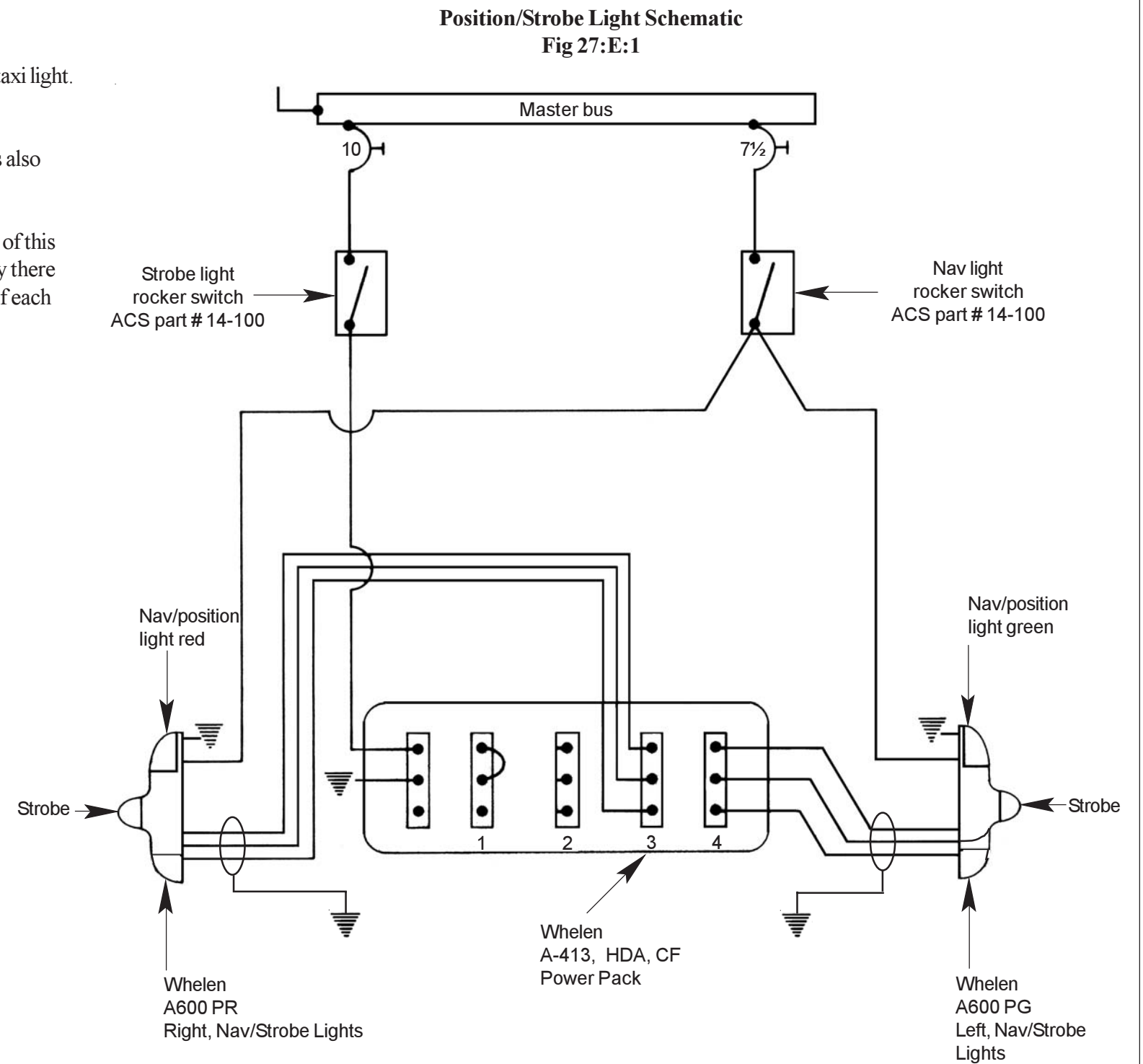
E. Lights Wiring

Exterior lighting on the Lancair Legacy consists of wingtip position/strobe light, a landing light, and a taxi light. There are variations, of course, but this section will stick to the basics.

Inside the cockpit, instrument lights, or post lights, illuminate the panel for night flying. A cabin light is also sometimes installed. A schematic is given for the simple instrument wiring, but not for the cabin light.

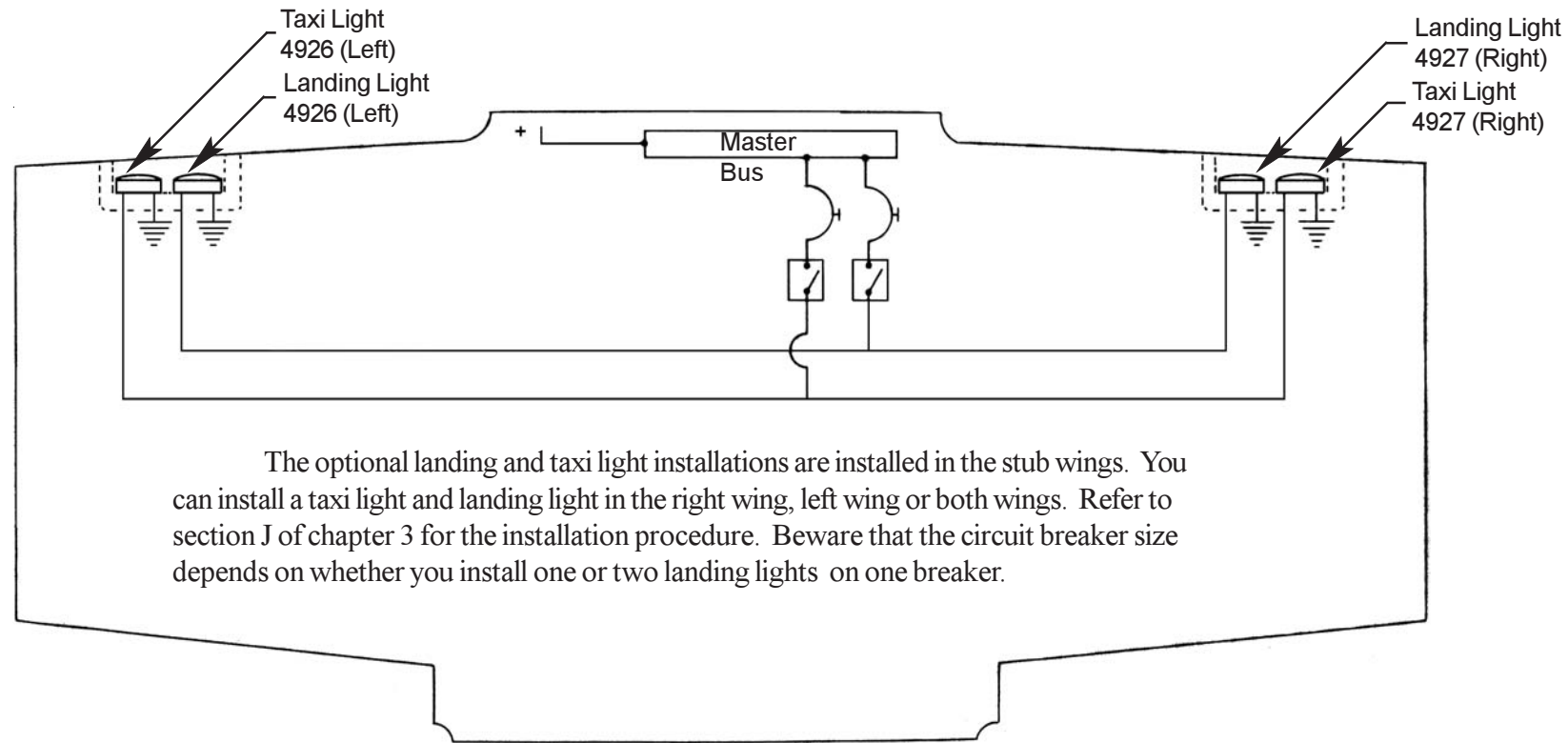
The following schematic shows the wiring of the position/strobe lights. A more complete explanation of this system is provided in the installation kit commonly purchased along with the lights and power pack. Basically there are two wires coming out of each light unit for the red/green/white position lights. The other three wires out of each unit are used for the strobes.

NOTE: Also refer to the installation and service manual supplied by Whelen.



NOTE: Use shielded wire to strobe lights.

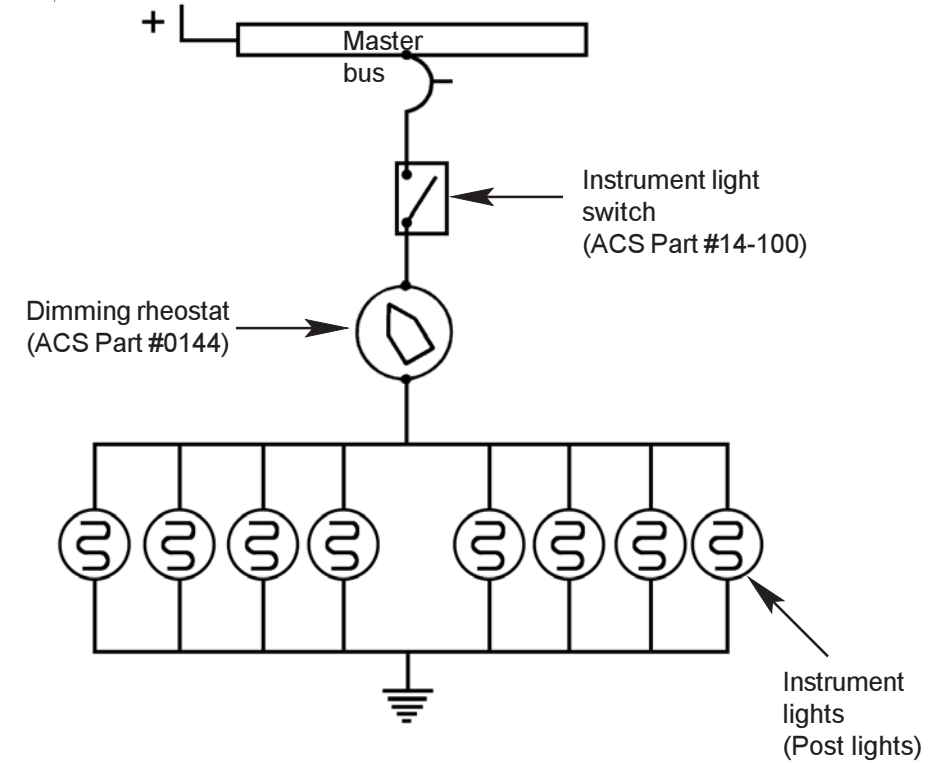
Landing and Taxi Lights
Fig 27:E:2



The optional landing and taxi light installations are installed in the stub wings. You can install a taxi light and landing light in the right wing, left wing or both wings. Refer to section J of chapter 3 for the installation procedure. Beware that the circuit breaker size depends on whether you install one or two landing lights on one breaker.

Instrument Light Schematic
Fig 27:E:3

There are an increasing number of instrument lighting methods. The old standby, postlights mounted adjacent to every instrument are giving way to internally lit instruments and lighted instrument covers. Whichever method you choose, most likely they will be wired similarly to the schematic below.



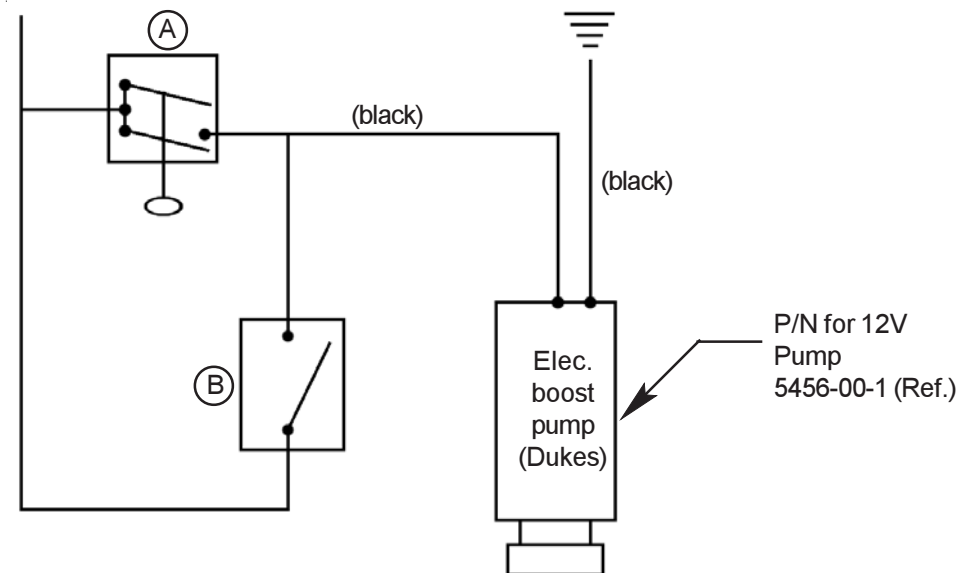
F. Electric Fuel Pump

The electric fuel pump mounts in front of the main spar in the center console. There are two different versions of pumps installed depending, a single stage for the Lycoming installations and a dual stage for the Continental installations (refer to chapter 4, section G).

The Lycoming installations use a single stage pump (high boost). The boost pump is used for priming the engine, takeoff (not landing), and emergency.

The Continental installations use a dual stage. Again the high boost is used for priming the engine and for emergency and the low boost can be used for vapor suppression.

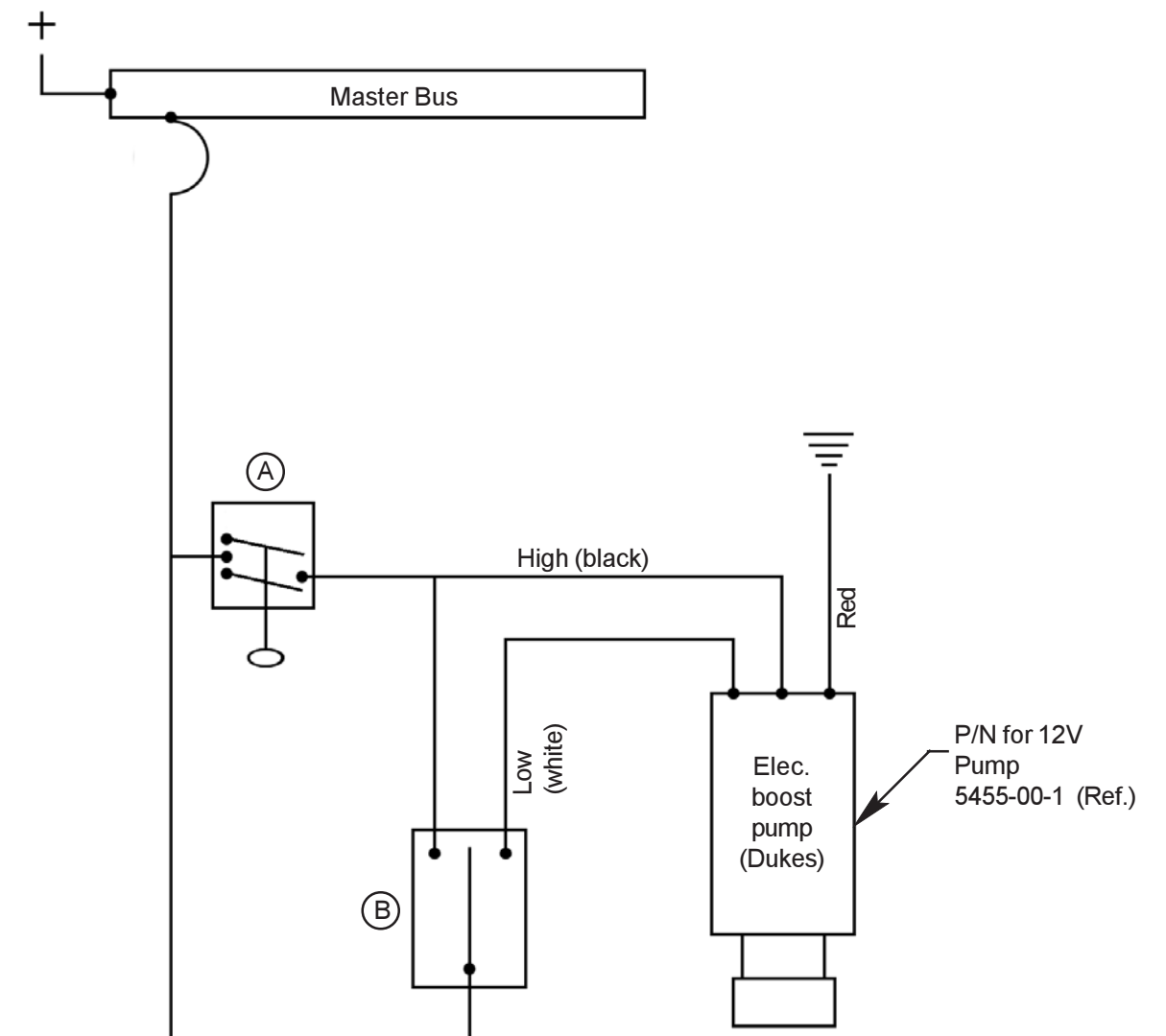
Fuel Pump Wiring, Lycoming Installation
Fig 27:F:1



- (A) - Primer switch , SPDT, MOM On, Push button
- (B) - Boost pump rocker switch, SPDT, Center Off, Hi/Off/Low

NOTE: The pump is not polarity sensitive so either of the two lines can go to ground.

Fuel Pump Wiring, Continental Installation
Fig 27:F:2



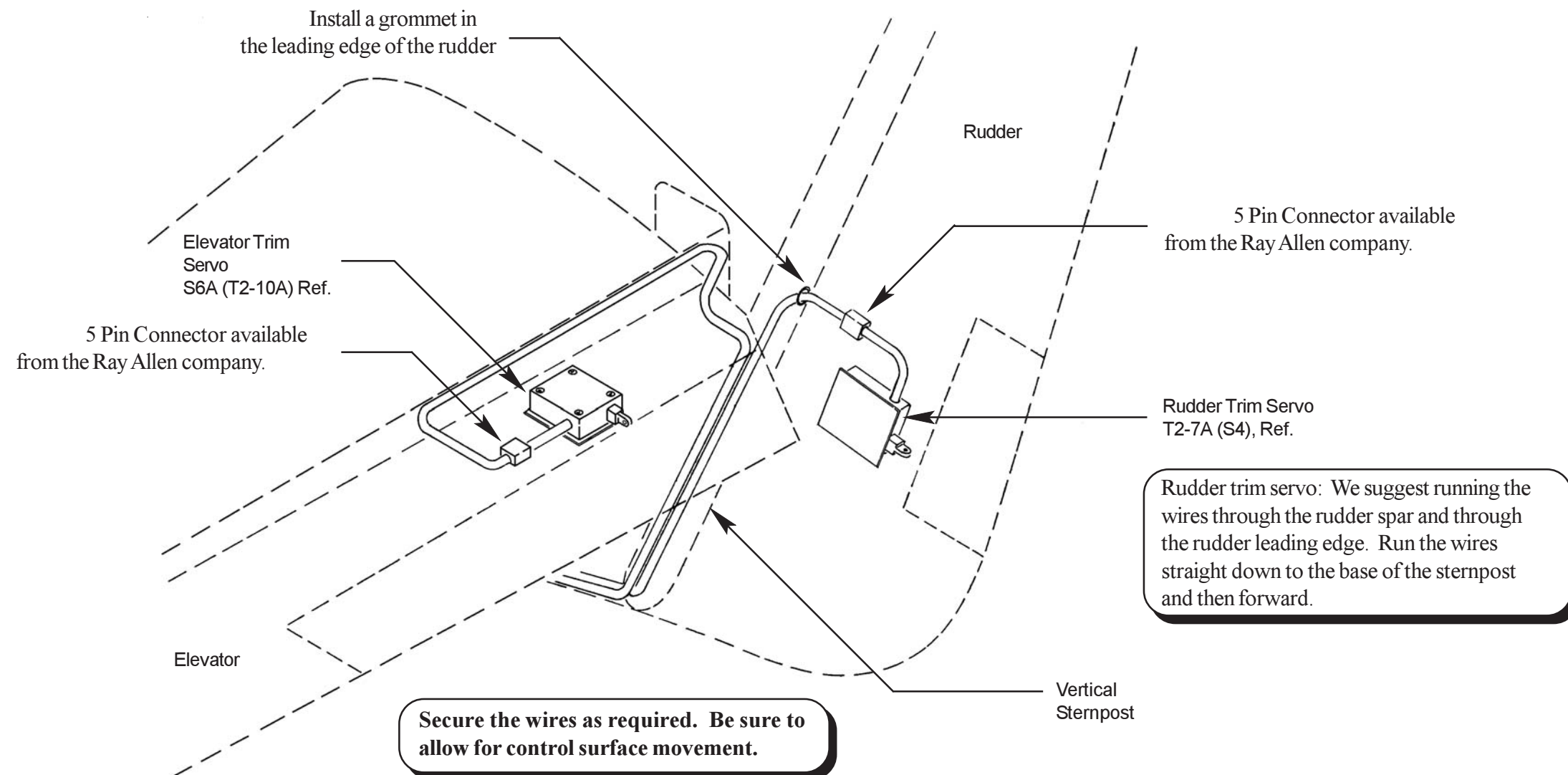
- (A) - Primer switch , SPDT, MOM On, Push button
- (B) - Boost pump rocker switch, SPDT, Center Off, Hi/Off/Low

G Trim System Wiring

Wiring instructions are included with your trim systems. The following diagrams suggest wire routing and plug locations. You should be able to remove one servo alone or a control surface by unplugging the servo. For wiring the T2-10A (elevator trim servo) refer to the wiring diagram that comes with the servo kit.

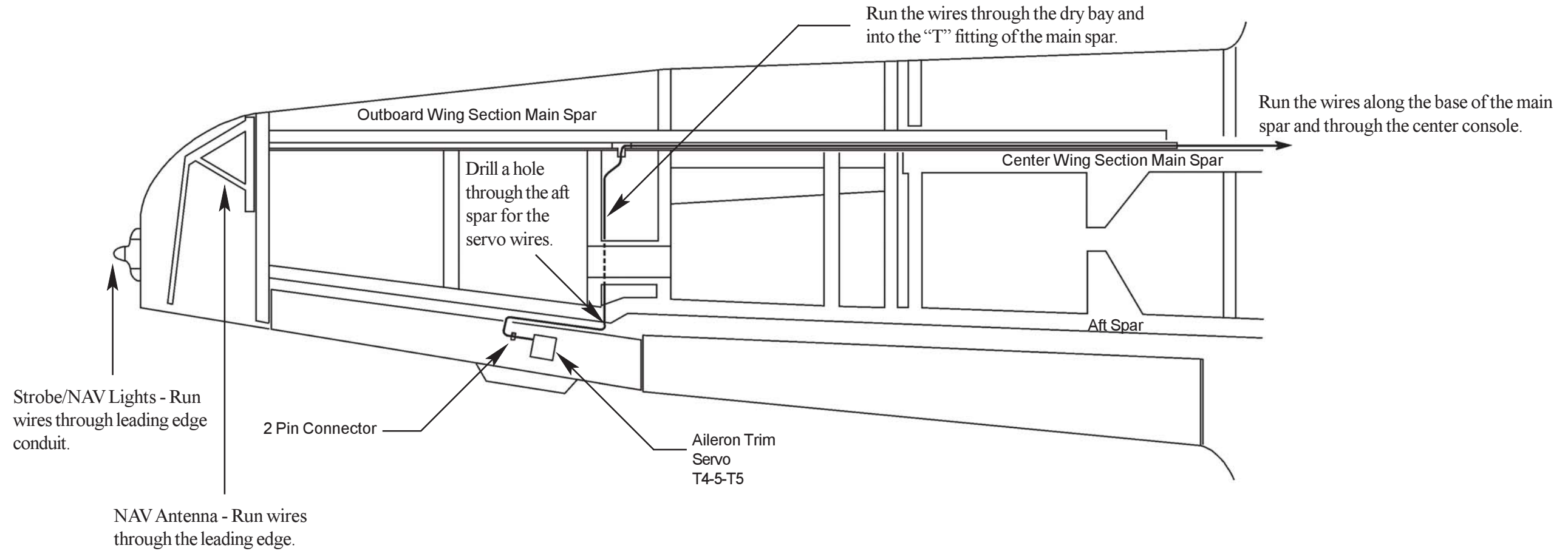
Elevator trim servo wiring: We suggest running the wires through the elevator spar and inboard through the elevator access panel. Then through the vertical sternpost and down to the bottom of the sternpost and forward through the aircraft.

Elevator and Rudder Trim Systems
Fig 27:G:1



Aileron Trim Servo Wiring
Fig 27:G:2

Both wires out of the aileron servo are white. For now you can wire the servo without identifying which is which. When the system is completely wired, check that the trim tab moves the servo the correct direction. If it doesn't switch the wires at one of the plugs.



NOTE: By running the servo wires close to the hinge line, the wires will not have to bend so much when the aileron is deflected, saving wear and tear.

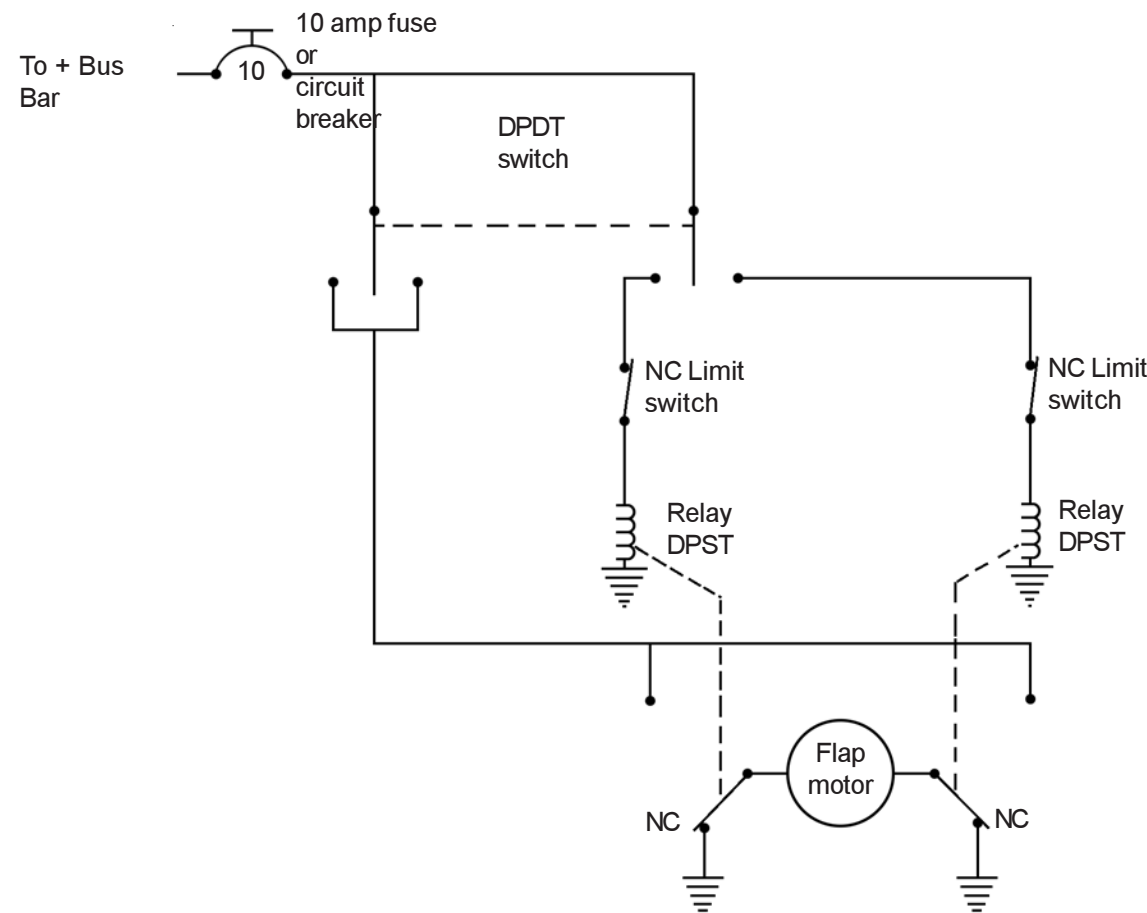
H. Flap Wiring

The Lancair Legacy flaps are driven by the 12V electric linear actuator. Also the limit stops are set by the custom limit stop (micro switch) assembly that mounts directly over the actuator shaft. It is operated by magnetic reed switches.

There are two DPST (double pole, single throw) relays required to connect them. The part number for the 12V system is LY1 and for 24V it is LY1-24V. Also a DPDT Momentary On switch is needed to operate the flaps (Part # MS24658-23D).

See Figure 27:H:1 for the flap wiring. If you have trouble interpreting the schematic, don't worry, the additional drawings will take you through this installation in a simple pictorial manner.

Flap Motor Wiring Schematic
Fig 27:H:1



The relays can be secured to the motor or elsewhere.

- H 1.** Per figure 27:H:2, connect the wiring to these relays and attach the wires to their respective locations. The “spade” connectors on the relays are .187” in width. Use #18 wire.

NOTE: There are 4 wires that will travel forward to the instrument panel:

1. Ground
2. Up limit switch
3. Down limit switch
4. Positive (+) to the relays.

- H 2.** Secure the wires so that they can not possibly get tangled up with any of the flap actuator movements.

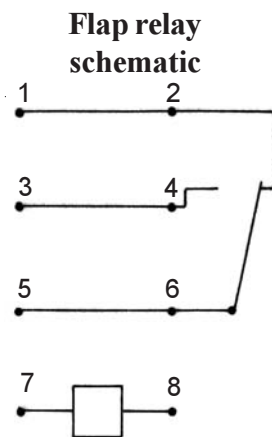
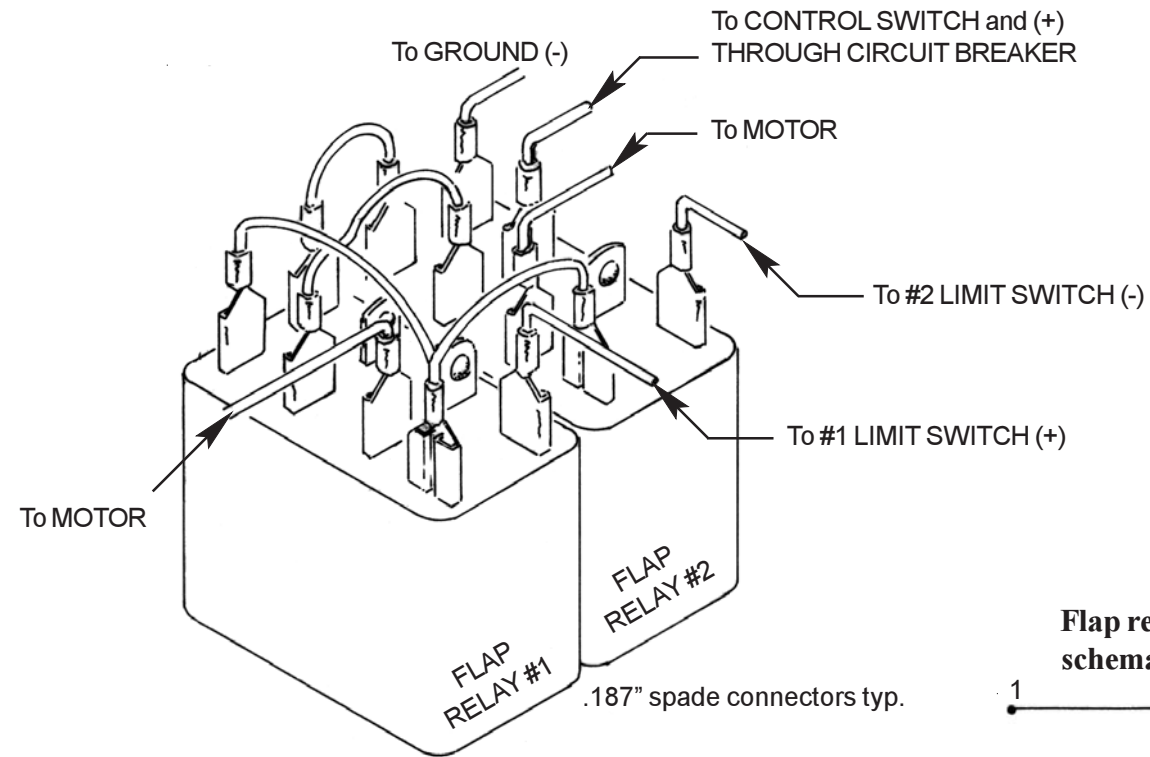
- H 3.** Before wiring the relay / flap motor assembly it is important to first establish the proper polarity of the motor. Or put another way, you must determine which wire on the motor is (+) when the actuator is extending. By placing one of the motor leads on (+) and one on (-) on any handy 12V battery, locate the correct combination that extends the actuator shaft. Mark that appropriate wire (+) for future reference. This extension movement will act to bring the flaps UP.

- H 4.** Attach the limit switch assembly to the actuator shaft. (The final position will be determined later, but for now, just put the magnetic reed switches on opposite ends of the base bracket - not all the way to the ends though.) The limit switch that is at the far end of the shaft (away from the motor) is the one that will limit the flaps UP position.

- H 5.** For the sake of discussion, let's pick relay #2 as the one to be used for flaps UP. The other relay will be used for flaps DOWN. With this established, the wire marked “Limit Switch #2 is connected to that limit switch. See figure 27:H:2. Also, the wire on relay #2 marked “to motor” must be connected to the flap motor wire which was earlier labeled (+). Now we have the motor turning in the correct direction for flaps UP and the motor will be stopped by the correct magnetic reed switch (or limit switch).

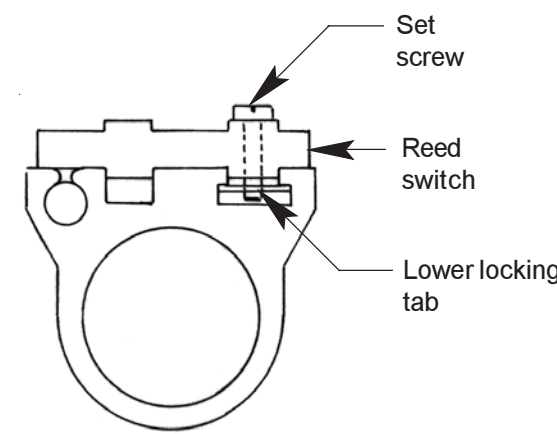
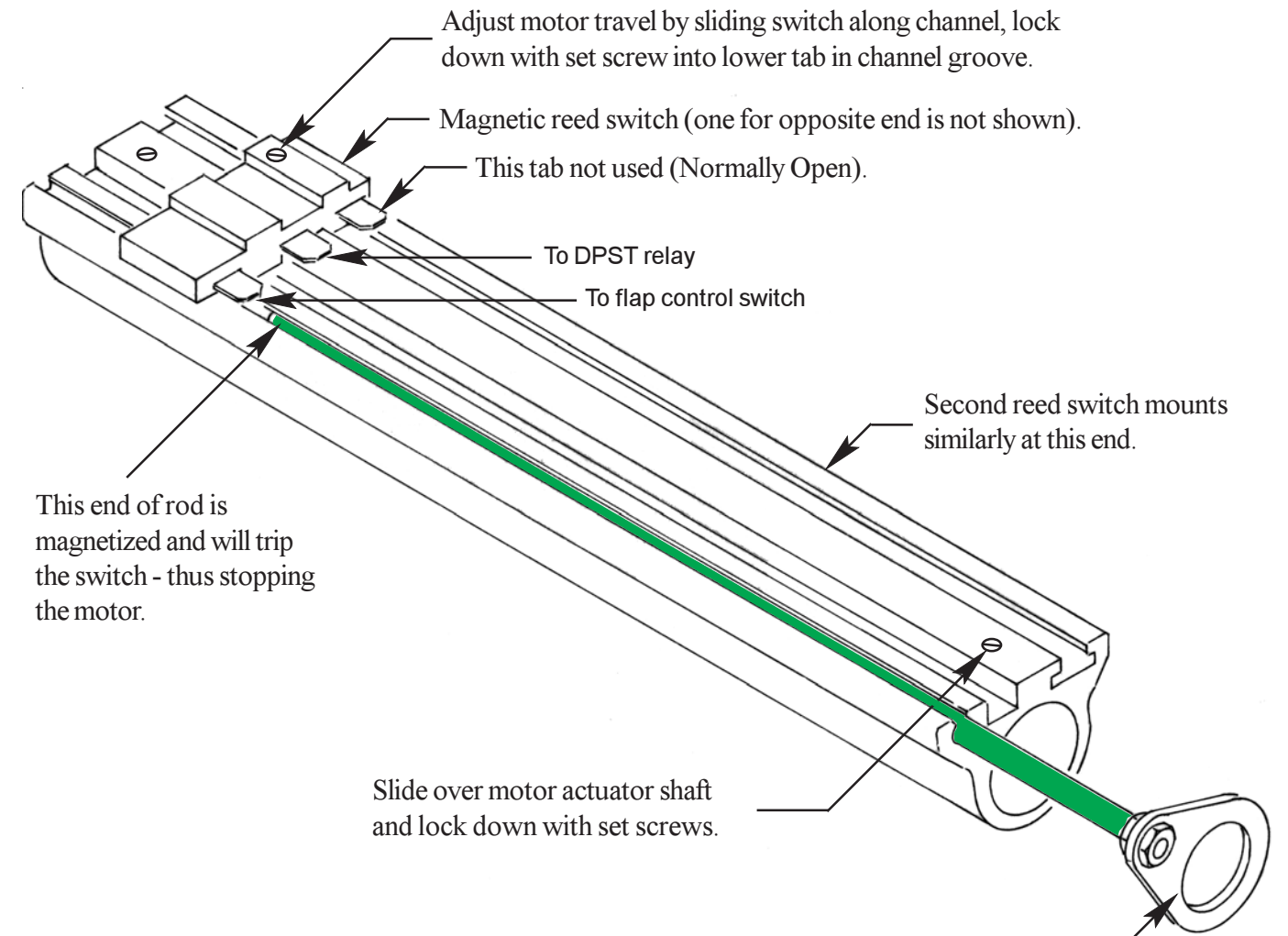
- H 6.** The flap control switch has two possible wires that could connect to the above limit switch #2. See drawing of a typical control switch in figure 27:H:4. Either wire can be used on limit switch #2, this will however determine which way the flap control switch moves to extend the flaps. Naturally, you want the movement on the control switch to be either “downward” or “aft” when dropping flaps. If the direction ends up being opposite, just turn the switch around in its instrument panel mounting hole.

Flap Relays
Fig 27:H:2



.187" spade connectors typ.

Flap Reed Switch
Fig 27:H:3

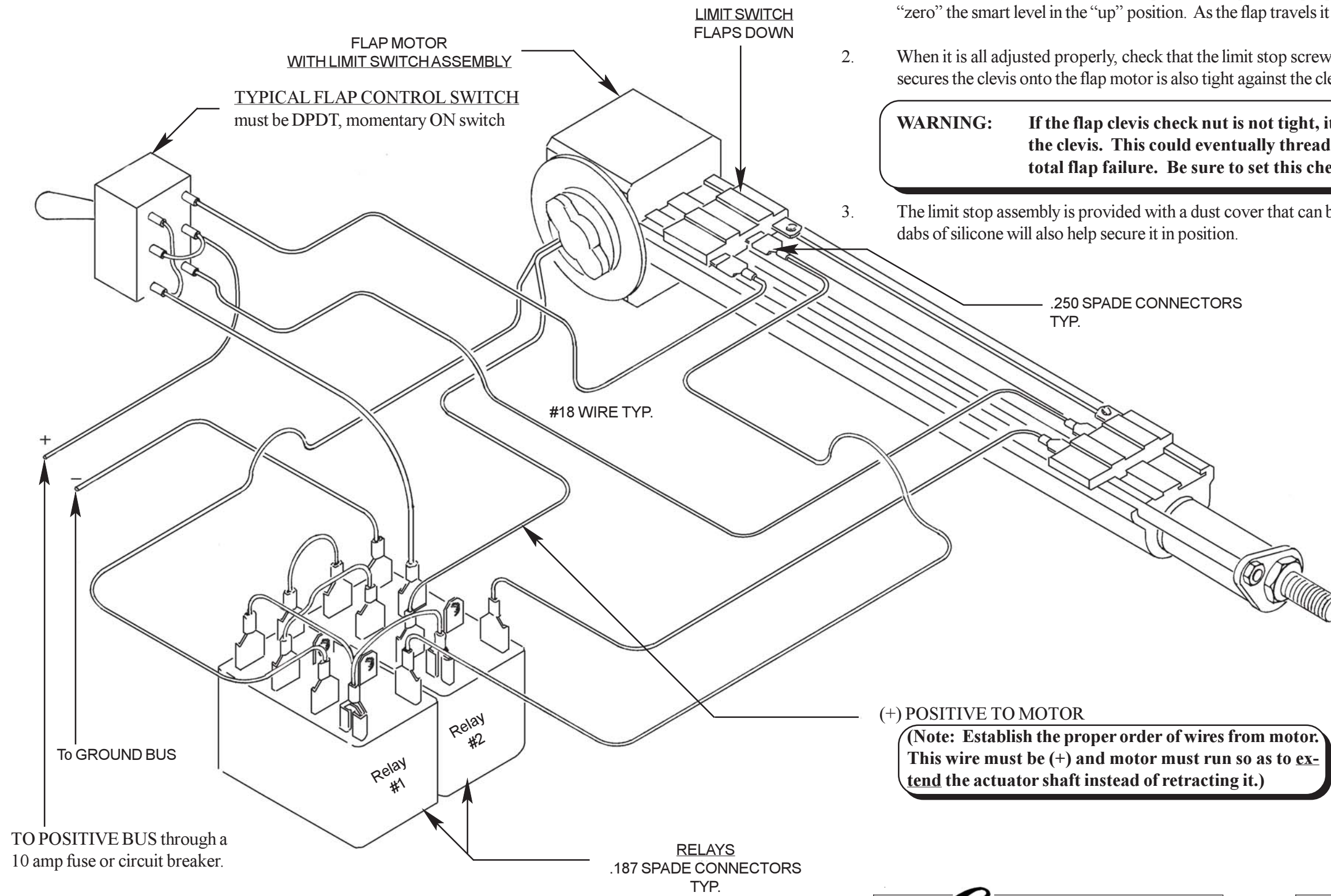


H 7. The magnetic reed switch will have three possible contact points. Use the center contact and ONLY the contact labelled "W".

NOTE: When setting the wiring for the limit stops, calculate extra wire so that you will be able to fit the custom dust cover over this limit switch installation and be able to route all the wires through its exit hole which is on the END.

- H 8.** After completing all the wiring, test run the system and check for two things:
- The limit switches must stop the travel in their respective directions;
 - The motor must be self braking. That is, when you release the control switch, the motor should stop quickly instead of gliding or coasting for two or three seconds. Such coasting is not acceptable and will not occur if everything is wired correctly.

Flap Wiring Diagram
Fig 27:H:4



Setting the Flap Limit Stops

1. When adjusting the DOWN limit stop, run the flaps to the proper down limit position (40 degrees). Simply “zero” the smart level in the “up” position. As the flap travels it will read the actual flap setting.
2. When it is all adjusted properly, check that the limit stop screws are snug and check that the hex nut that secures the clevis onto the flap motor is also tight against the clevis.

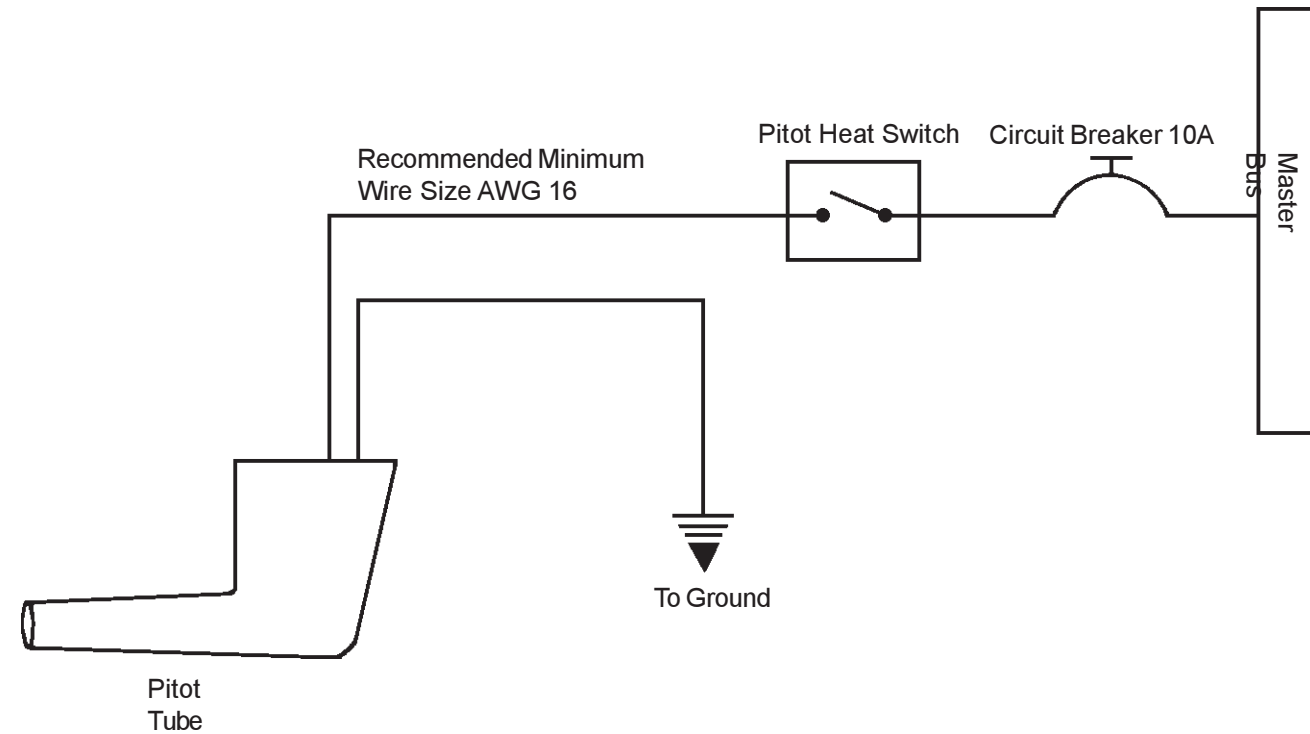
WARNING: If the flap clevis check nut is not tight, it could allow the actuator shaft to turn in the clevis. This could eventually thread the actuator out of the clevis and cause a total flap failure. Be sure to set this check nut.

3. The limit stop assembly is provided with a dust cover that can be wire tied over this installation. A couple of dabs of silicone will also help secure it in position.

(+) POSITIVE TO MOTOR
(Note: Establish the proper order of wires from motor. This wire must be (+) and motor must run so as to extend the actuator shaft instead of retracting it.)

I. Pitot Tube Heat Wiring

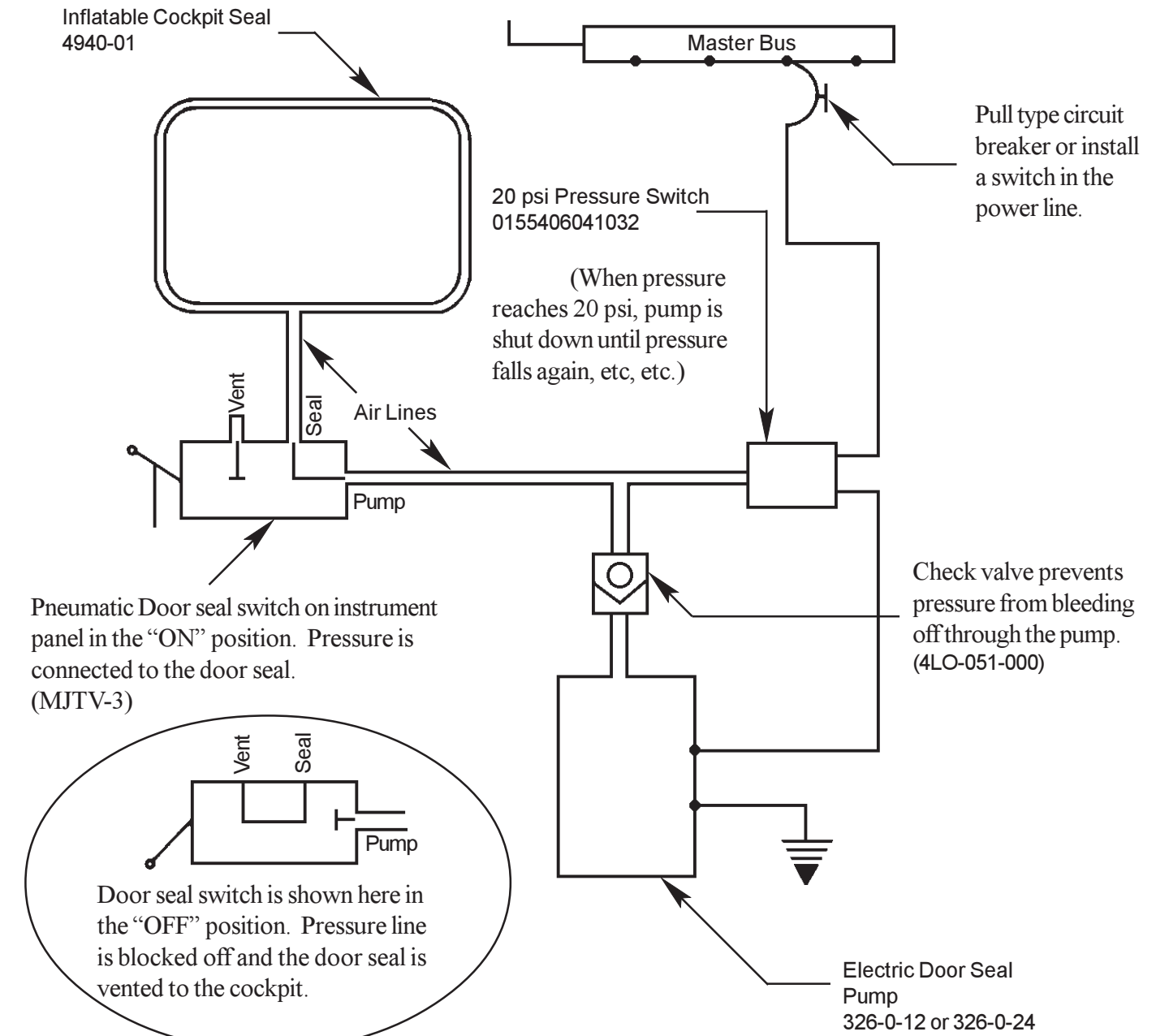
Pitot Tube Heat Wiring
Fig 27:I:1



J. Electric Door Seal Wiring

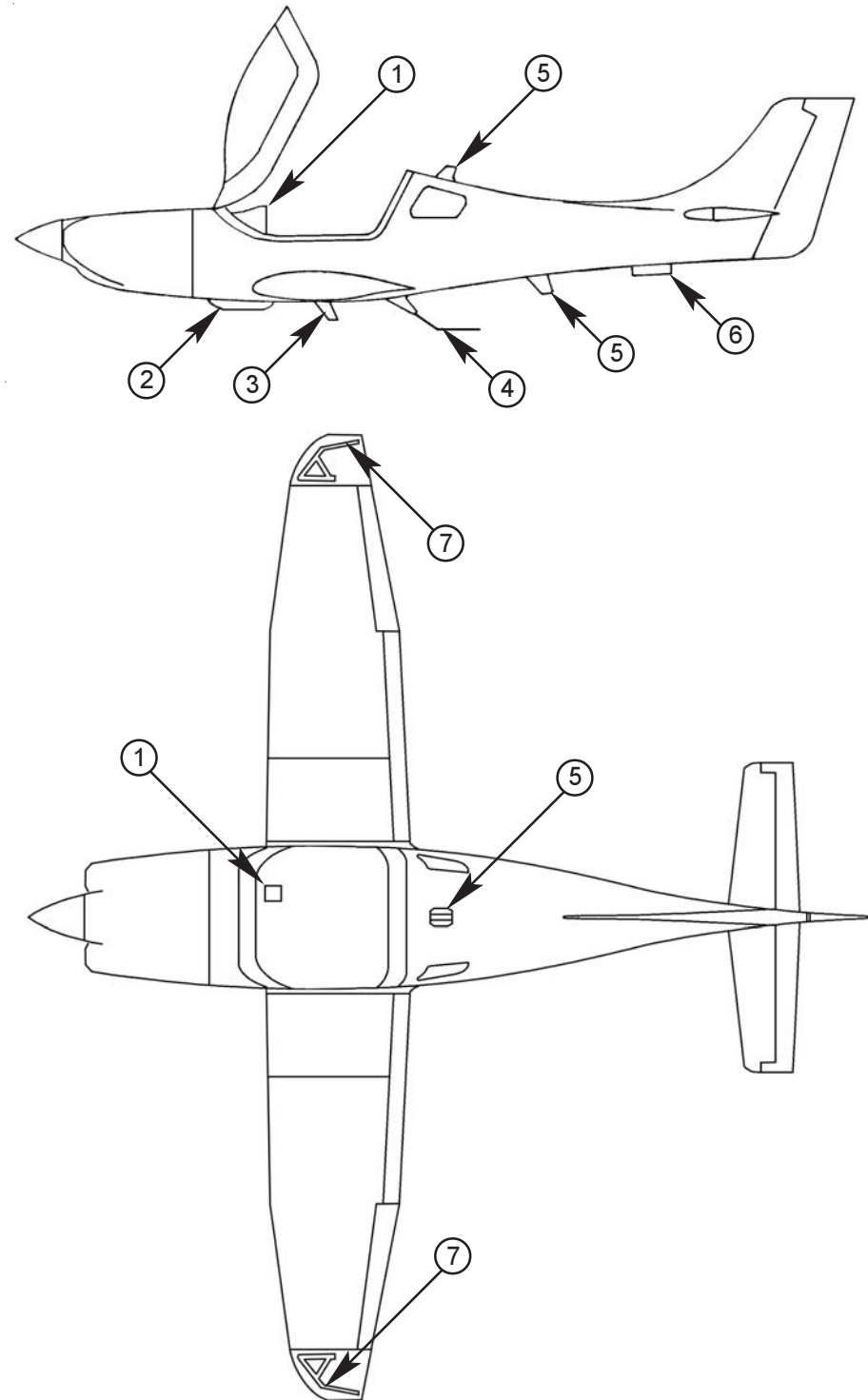
Electric Door Seal Wiring
Fig 27:J:1

The inflatable cockpit seal is kept at 20 psi by a remotely mounted air pump. In this system, a pressure switch activates the pump when the seal pressure falls below 20 psi. When the pump is turned off, the pressure in the door seal will vent out through the panel mounted on/off switch. Refer to Chapter 9 for seal installation.



K. Antenna Placement

Antenna Placement
Fig 27:K:1



In the constantly changing world of avionics, what you read in this section may be outdated in a year. As an example Loran was the hot thing just a few years ago. With the GPS the Loran system is now obsolete. This section outlines recommended placement and location.

1. **GPS.** Recommended placement is under the dust cover. It must be far enough aft so the antenna can “see” through the window. Remember: The GPS signals will not penetrate carbon. The antenna itself is normally supplied with the GPS.
2. **Marker Beacon.** Recommended placement is in the joggle provided in front of the spar. Also see section 3-B. The antenna part number is CL-102.
3. **Transponder Antenna.** Recommended placement is just aft of the main spar in line with the com and marker beacon antennas. Later kits have a premolded joggle for the transponder antenna. Refer to section 24-D.
4. **Com Antenna.** Recommended placement is in the joggle provided just aft of the aft spar. See section 3-C. the antenna part number is [CL122C](#). If you’re installing 2 com radios you can use a splitter or install 2 antennas.
5. **TCAD Antenna.** Call Lancair Avionics.
6. **Stormscope Antenna.** See chapter 25-5. Also call Lancair Avionics.
7. **Nav Antenna.** The NAV antenna may be in either the left or right wing tip. The antennas are pre-installed at the factory.
8. **ELT (not shown).** Refer to section 24:B:1