

NC-17-038 M20R, S, TN, U & V
Air Conditioning System Installation Manual



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Install manual/Service Letter

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EFFECTIVITY

Mooney Aircraft Types: M20R, M20S, M20TN, M20U & M20V

REVISION HISTORY

REV	DESCRIPTION	DATE
A	Initial Release, See ECN 17-022	4/4/2018
B	Corrections and updates, see ECN 17-022	1/23/2019
C	Install revisions, see ECN 19-037	8/1/2019
D	See ECN 19-043	10/2/2019

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PURPOSE

For installation of Air Conditioning System.

APPROVAL

FAA approval has been obtained on all technical data in this Installation Manual that affects type design.

RESOURCES

100 hours of labor are required to comply with this Installation Manual.

SYSTEM OVERVIEW

The Air Conditioning System consists of an electric hermetically sealed compressor, condenser located in the tail cone; and an evaporator all located behind the baggage compartment in the hat rack. The system is operated through temperature selection and a climate controller located on the instrument panel. There is both a fan mode only and a cooling mode. R-134a is used as a refrigerant for the system.

The power for the Air Conditioning System is tapped off the Main Distribution Bus just downstream of the Battery Master Relays in the tail cone of the aircraft.

MATERIAL INFORMATION

The Kelly Aerospace Thermal Systems (KATS) document NC-17-033 or NC-18-007 lists the materials required for compliance with this Installation Manual. Parts can be obtained from KATS.

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INSTRUCTIONS

1. Preparation

- A. Ensure all documentation is at the appropriate revision based on NC-17-032 or NC-18-006 Drawing List supplied with the kit.
- B. Conduct a parts inventory to ensure all required items are present.
- C. Remove the left and right access door covers to access the batteries per the appropriate M20 Aircraft Maintenance Manual (AMM).
- D. Disconnect all aircraft batteries per the AMM.
- E. Secure external power receptacle to prevent unwanted power on aircraft busses (e.g. tape over receptacle with non-metallic masking tape with label warning of hazard).

2. General Instructions

- A. For all references to wire stripping, crimping and tying procedures refer to AC 43.13-1B chapter 11.
- B. For all references to riveting procedures refer to AC 43.13-1B chapter 4.
- C. Consumables to be procured locally
 - 1) Paint, as required for touch up and re-coloring N numbers
 - 2) Masking tape
 - 3) Assorted sizes of tie wraps
 - 4) M22759/16 wire or equivalent in the sizes of AWG 8, 10, 16 and 18
 - 5) Devcon 14265 Epoxy
 - 6) Black Silicone RTV
- D. Torque Specifications

Unless otherwise specified, use the following torque values.	
6-32 UNC	7 - 9 inch-lbs.
8-32 UNC	17 - 19 inch-lbs.
10-24 UNC	20 - 22 inch-lbs.
10-32 UNF	28 - 31 inch-lbs.
1/4-20 UNC	70 - 75 inch-lbs.
1/4-28 UNF	90 - 94 inch-lbs.
5/16-24 UNF	120 - 145 inch-lbs.
3/8-24 UNF	200 - 250 inch-lbs.
7/16-20 UNF	520 - 630 inch-lbs.
Table 1 – Fastener Torque Specifications	

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Unless otherwise specified, use the following torque values.	
5/8-18 UNF	15 - 20 ft.-lbs.
3/4-16 UNF	21 - 27 ft.-lbs.
7/8-14 UNF	28 - 33 ft.-lbs.
7/8-18 UNS	28 - 33 ft.-lbs.
Table 2 – A/C Hose Fitting Torque Specifications	

3. Remove the following components utilizing the AMM and store securely:

- A. Cover all seats to protect from debris
- B. LH & RH Window Panel Assembly
- C. LH & RH Baggage Headliner Assembly
- D. Baggage Headliner Panel Closeout Assembly
- E. Hat Rack Headliner
- F. Hat Rack Back Assembly
- G. Hat Rack Lip
- H. Hat Rack Floor
- I. Remove both Batteries and the Battery Hold Down Bolt Assemblies on the right side

4. Alternator Upgrade (when required)

- A. Some Mooney M20R and M20S aircraft may need to be upgraded to a 100 amp alternator such as a Hartzell ES-10024; or a 150 amp alternator such as a Plane-Power C28-150. A load analysis of the aircraft will be required.

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5. Sidewall Cutout & Reinforcement

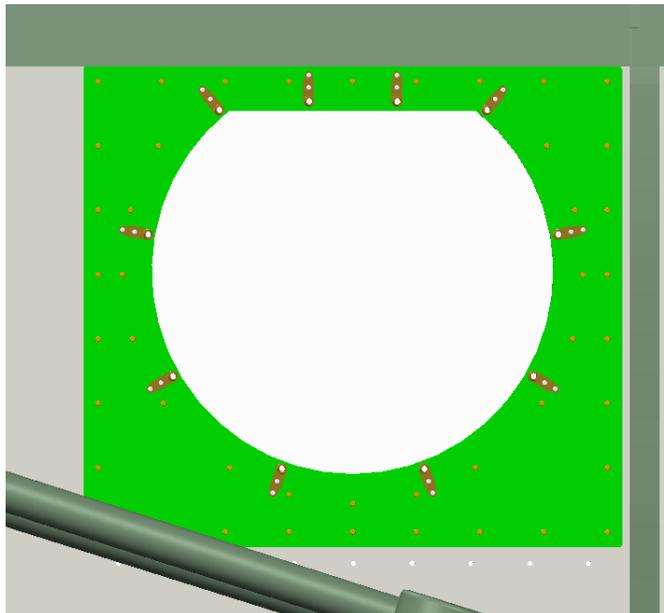
A. Reference AC-01700 M20 Hot Side AC Installation Details (View 2 and 2A).

- 1) Locate AC-01702 cutout template per drawing note 2.1. See Figure 1 for an example of the sidewall cutout process. Match drill the sidewall to the template.



Figure 1 – LH Sidewall Cutout Template

- 2) **WARNING:** Do not cut through any stringers or bulkheads when making the sidewall cutout.
- 3) Rivet Doubler Assembly AC-1704 to the inside of the skin per Note 2.2. See illustration in Figure 2.



**Figure 2 – LH Sidewall Cutout Doubler
Interior View**

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6. Compressor Support Bracket Installation Details

A. Reference AC-01700 M20 Hot Side AC Installation Details (View 1, 1A, Section 1B-1B & 1C)

- 1) Locate and install the compressor support brackets per notes 1.1 through 1.5. See Figure 3 and Figure 4.

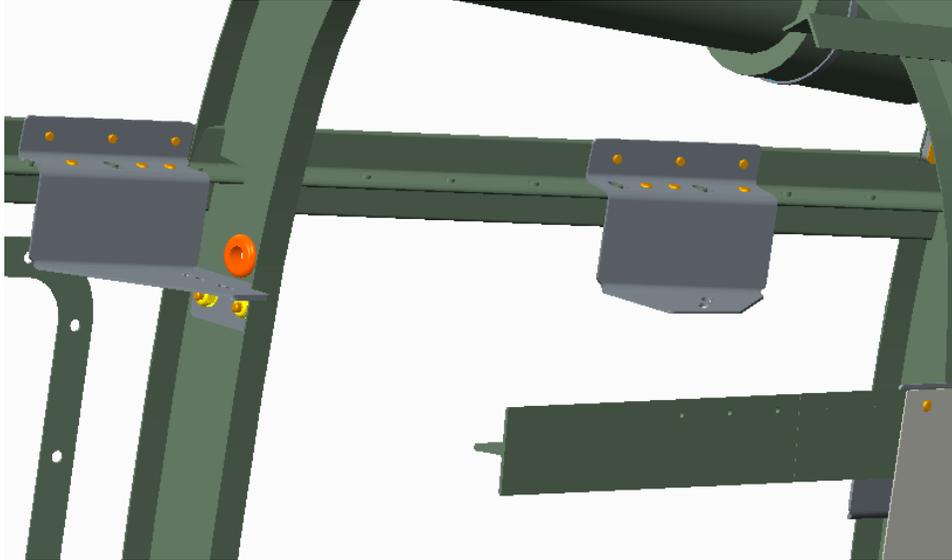


Figure 3 – Compressor Support Bracket Installation

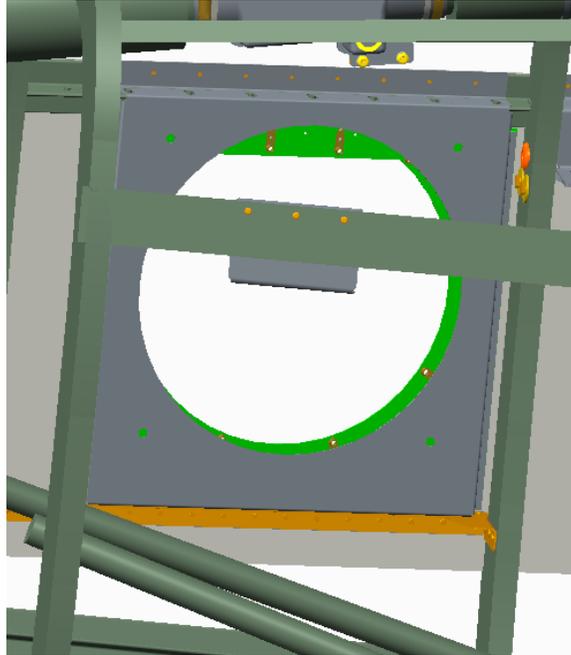


Figure 4 – Compressor Support Bracket Installation

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7. Condenser Hanger Installation

- 1) Install the AC-01706 Condenser Hanger per Notes 2.3 and 2.4. (View 2B, Section 2C-2C & Section 2D-2D) See Figure 5 and Figure 6.



**Figure 5 – LH Sidewall Condenser Hanger
Interior View**



**Figure 6 – LH Sidewall Condenser Hanger
Interior View**

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8. Condenser Inlet Details

A. Reference AC-01700 M20 Hot Side AC Installation Details (View 3 & 3A).

- 1) Install the AC-01736 Water Dam and AC-01740 Screen Assembly per Notes 3.1, 3.2 & 3.3. See Figure 7 & Figure 8.



Figure 7 – Inlet Installation

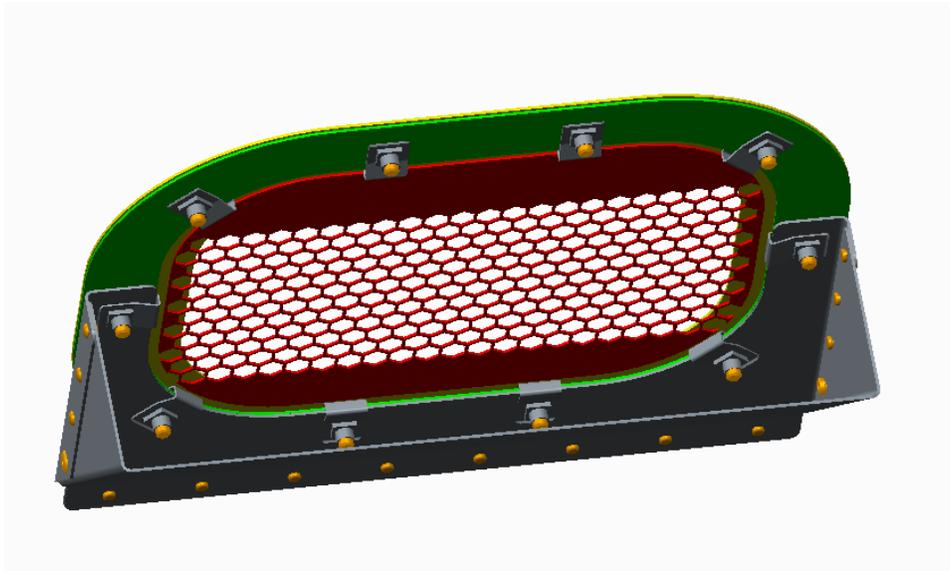


Figure 8 – Inlet & Screen Installation

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9. Air Diverter Installation Details

A. Reference AC-01700 M20 Hot Side AC Installation Details (View 4, 4A & Section 4B-4B).

- 1) Cut the cabin air duct, trim the insulation back and install the Air Diverter as per Notes 4.1 through 4.5. See Figure 9 through Figure 12 below.

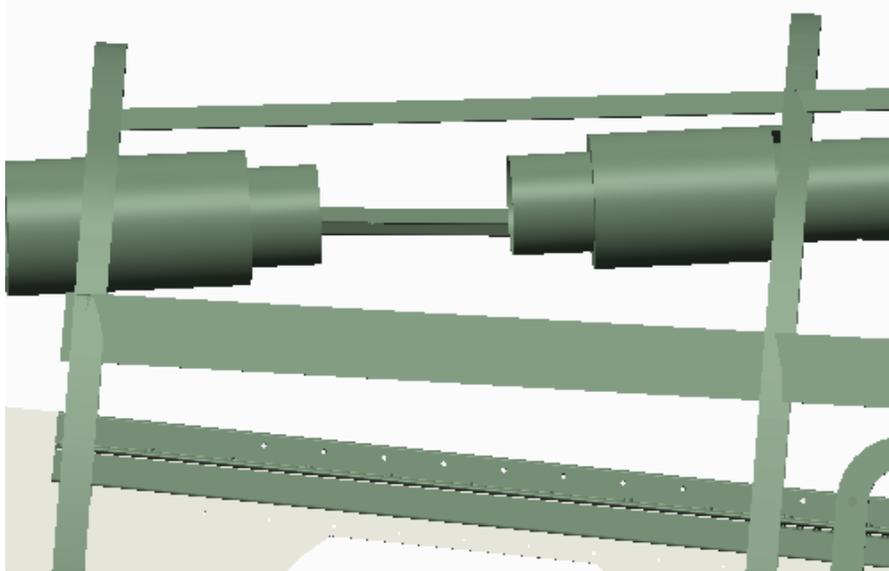


Figure 9 – Trim Insulation & Cut Pipe

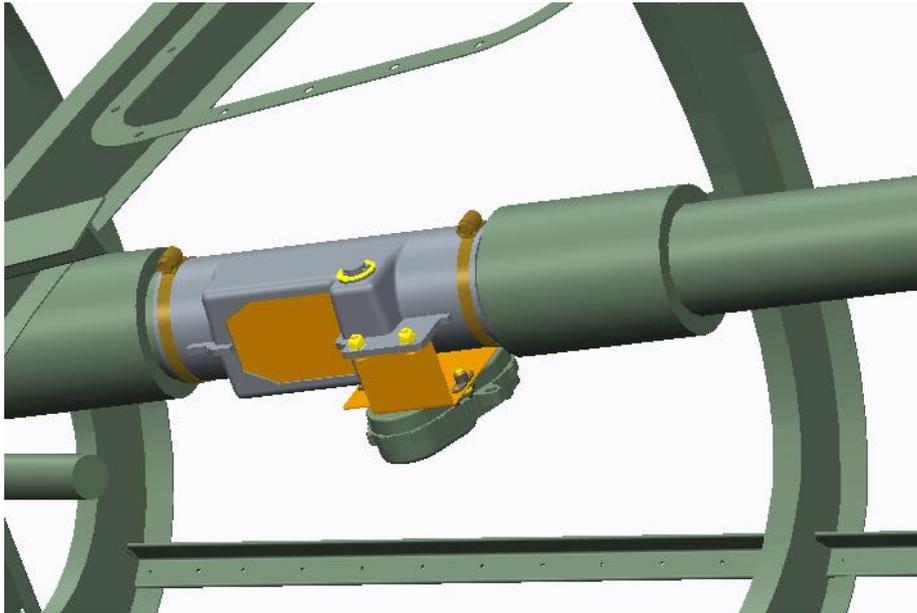


Figure 10 – Install Diverter with Hose Clamps

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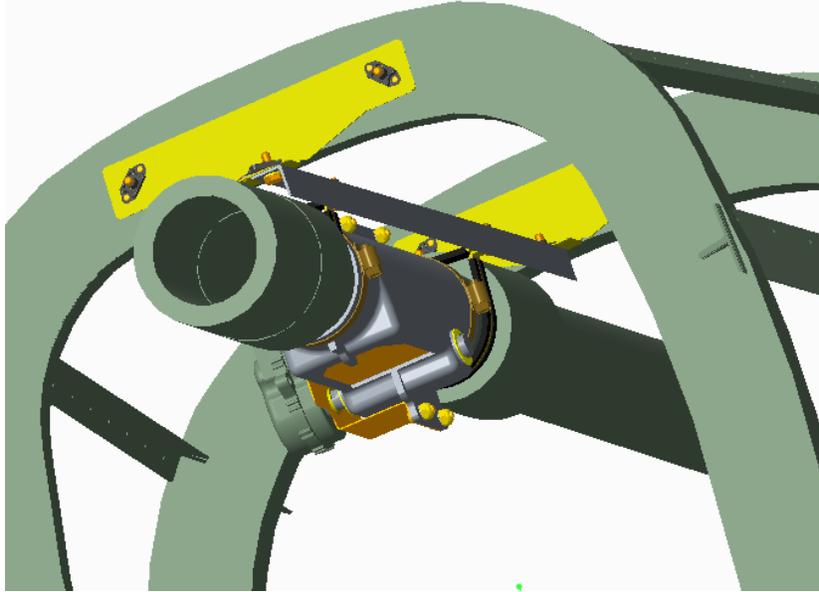


Figure 11 – Secure Diverter & Duct Aft View

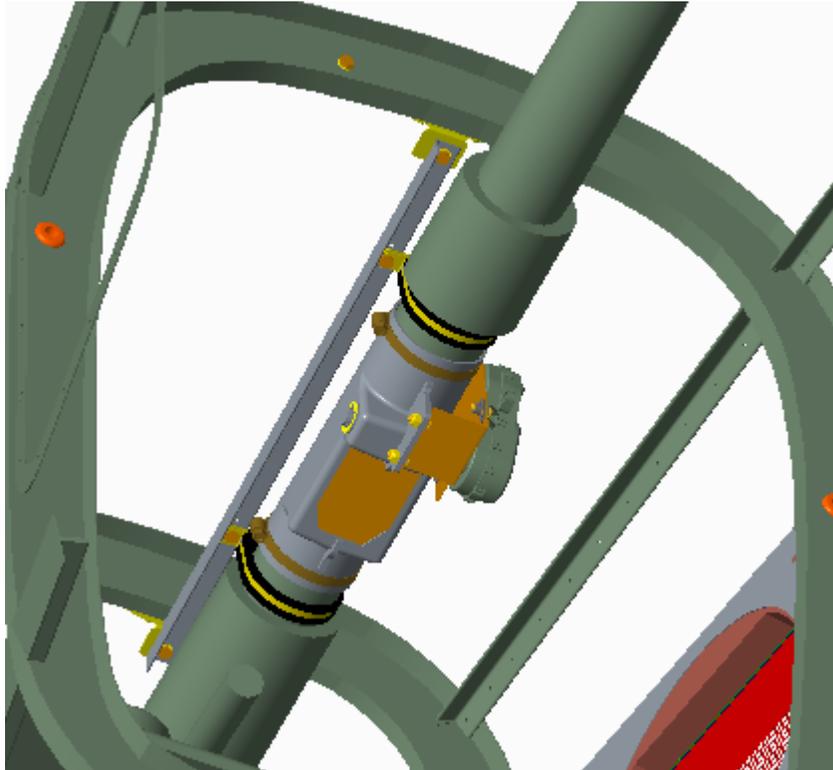


Figure 12 – Secure Diverter & Duct Front View

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10. Condenser Installation Details

A. Reference AC-01700 M20 Hot Side AC Installation Details (View 5, 5A & Section 5B-5B).

- 1) Remove the AN4-11A Bolts and AN960-4 Washers from the Condenser per Note 5.1. Place them in the Condenser Hanger. See Figure 13.
- 2) Connect the #6 and #8 hose assemblies to the condenser assembly and secure to the Condenser Hanger per Notes 5.2 & 5.3 and Figure 14.
- 3) Figure 15 shows the installation of the Outlet Screen Assembly.

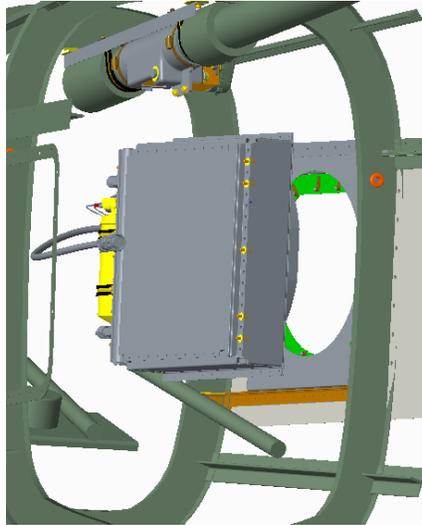


Figure 13 – Condenser to Condenser Hanger Installation



Figure 14 – Condenser Installation

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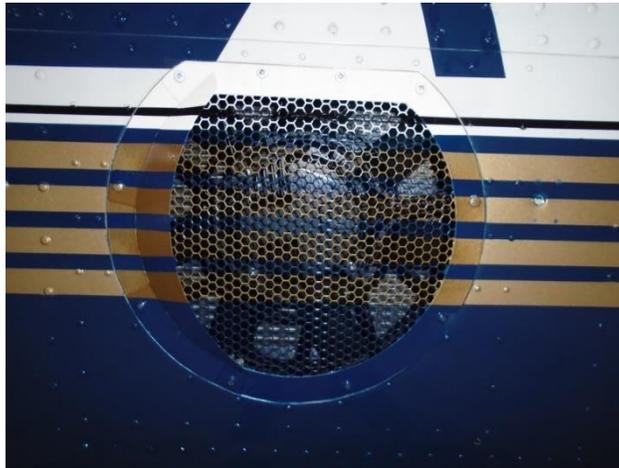


Figure 15 – Outlet Screen Assembly

- 4) During winter months, or when air conditioning will not be used the AC-01710 Outlet Screen Assembly and AC-01864 Outlet Scupper can be removed and replaced with AC-01863 M20 Outlet Cover.

11. Compressor and Controller Installation Details

- A. Reference AC-01700 M20 Hot Side AC Installation Details (View 6, 6A, Section 6A-6A & Section 6B-6B).
 - 1) Install the Compressor Support Structure and Controller per Notes 6.1, see Figure 16. Once the Brackets and the Support Angles are located and tightened in order to ensure the proper fit; some of the following shown in Figure 16 through Figure 19 can be pre-assembled outside the plane, depending on how many obstructions are between the access doors and the installation.

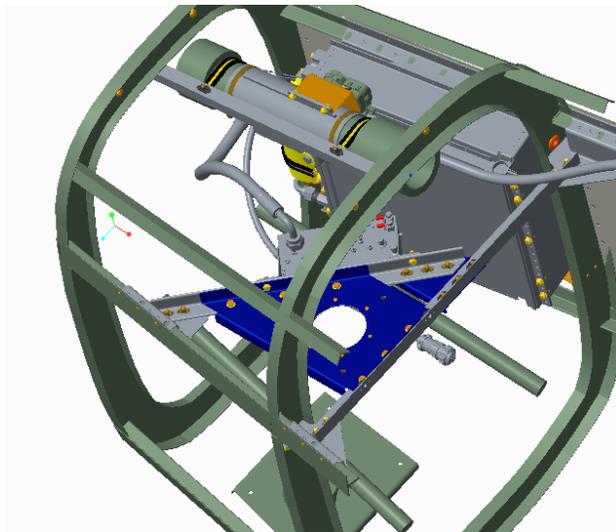


Figure 16 – Compressor Structure & Controller Installation

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- 2) Secure the Compressor to the Structure and make Hose connections per Notes 6.2, 6.3 & 6.4. See Figure 17 & Figure 44 – Hose Layout.

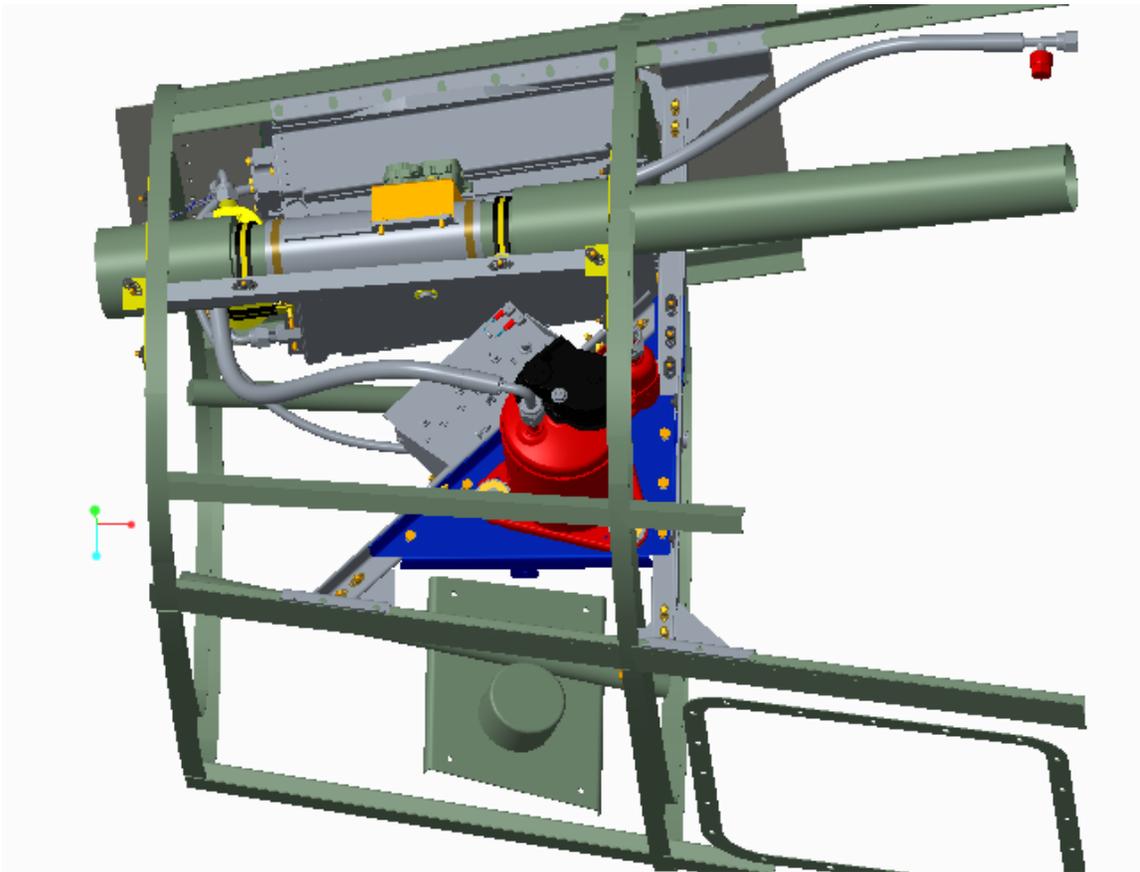


Figure 17 – Compressor Installation

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- 3) Reference Schematic AC-01680 for systems with the A1345 Controller or AC-01681 for the CB-2 controller. Install the Electrical Junction Plate per View 6 and View 6C and Figure 18. Make electrical connections referencing the appropriate schematic. The JAC3 Connector in either AC-01729 (CB-2) or AC-01750 (A1235) will remain loose until Evaporator installation further on. See Figure 19.

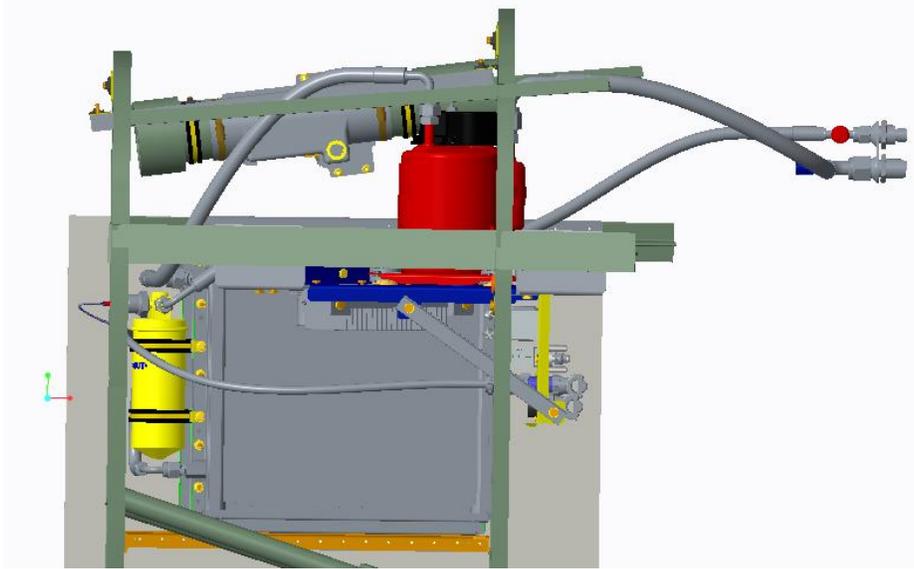


Figure 18 – Electrical Junction Installation

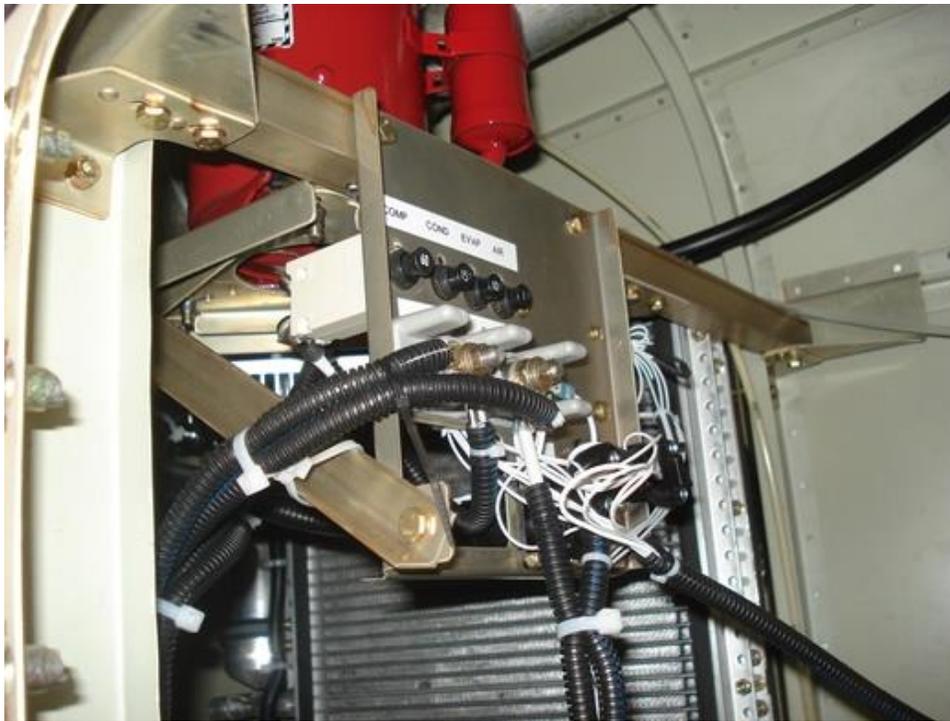


Figure 19 – Electrical Connections

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12. Front Seat Controls

- A. Install Climate Controller in instrument panel where space permits. See Figure 20 for A1235 Controller or Figure 21 for CB-2 Controller below for cutout dimensions.

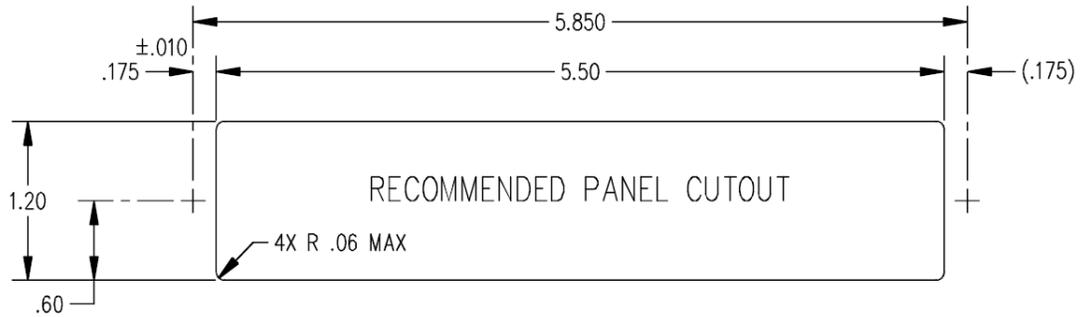


Figure 20 – A1235 Panel Cutout Dimensions

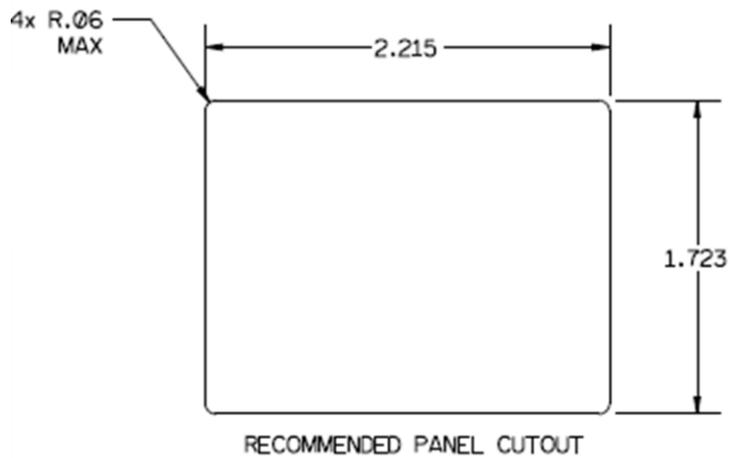


Figure 21 – CB-2 Panel Cutout Dimensions

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13. Route AC-01744 Climate Control Extension Harness

- A. Route the harness behind the instrument panel to the pilot's side, up the front window pillar. See Figure 22.
- B. Then back to the center support along the top front window structure. See Figure 22.
- C. Then follow the center fuselage structure to the baggage compartment. See Figure 23 and Figure 24.

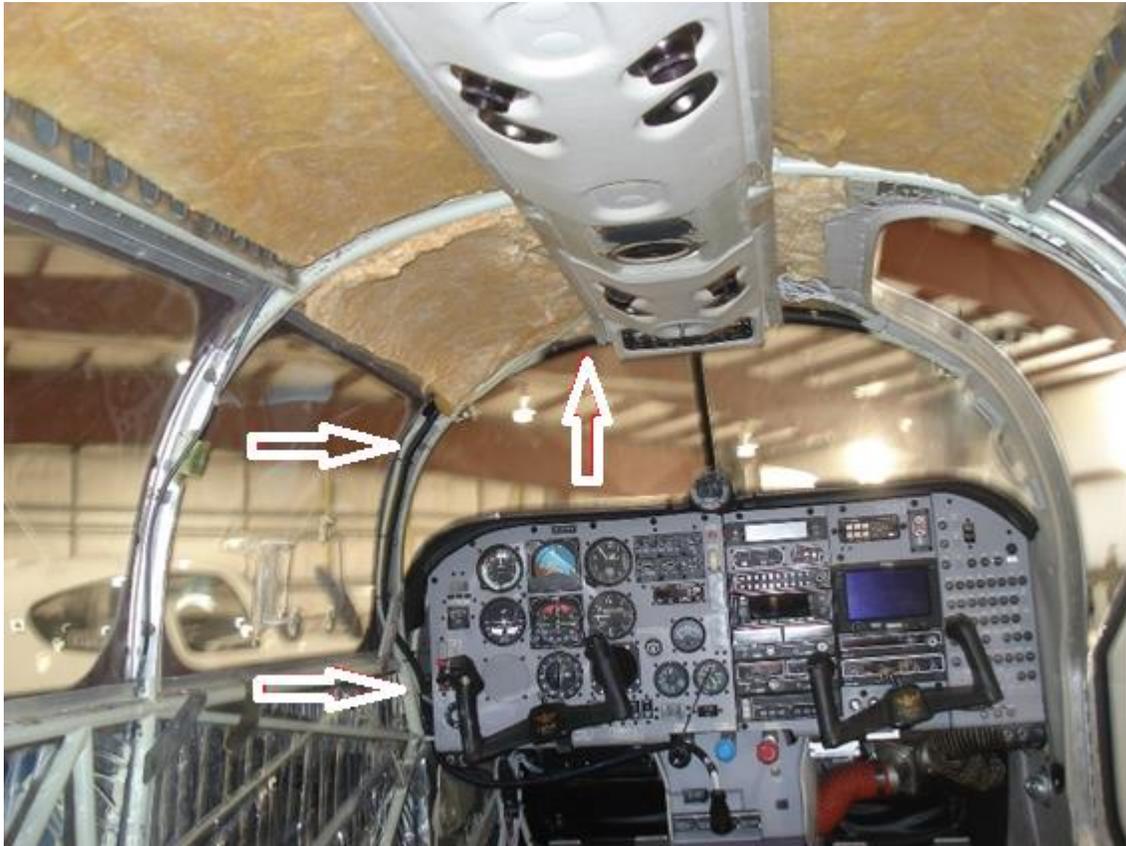


Figure 22 – Climate Control Extension Harness Routing

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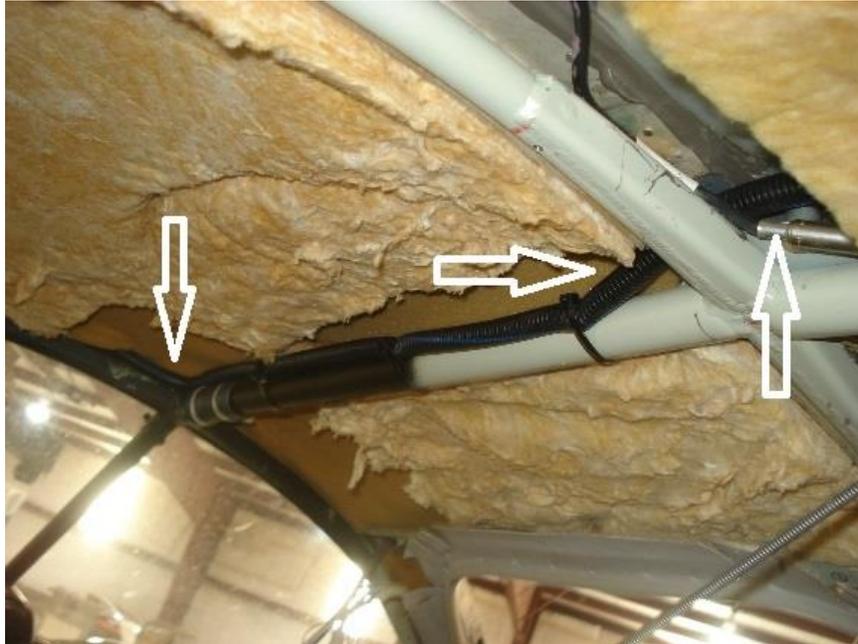


Figure 23 – Climate Control Extension Harness Routing



Figure 24 – Climate Control Extension Harness Routing

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14. Evaporator Installation Details

A. Reference AC-01678 for A1235 Controller or AC-01769 for CB-2 Controller.

- 1) Remove interior Hat Rack trim pieces and set aside for reuse. Remove the Headliner Assembly and set it aside for modification. Carefully mark and note all electrical connections to simplify reassembly. See Figure 25.

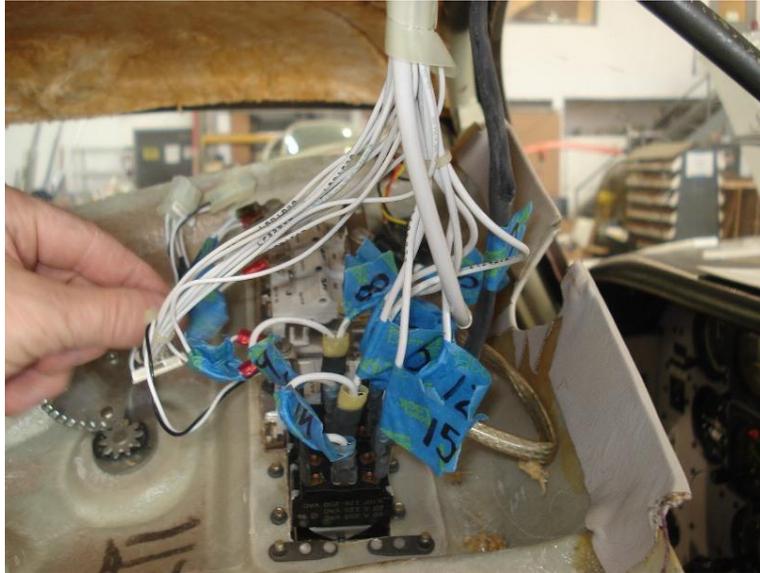


Figure 25 – Headliner Removal

- 2) Remove insulation when necessary and set it aside for reuse.
- 3) Cut the tie wraps holding the fresh air control cable to the overhead duct.
- 4) Carefully remove the three rivets from the overhead bracket and the four rivets connecting the bracket to the bulkhead, remove the bracket. Disconnect the fresh air duct from the flexible joint just behind the Hat Rack. Remove and discard the ducting, taking care not to damage the control cable. See Figure 26 and Figure 27.

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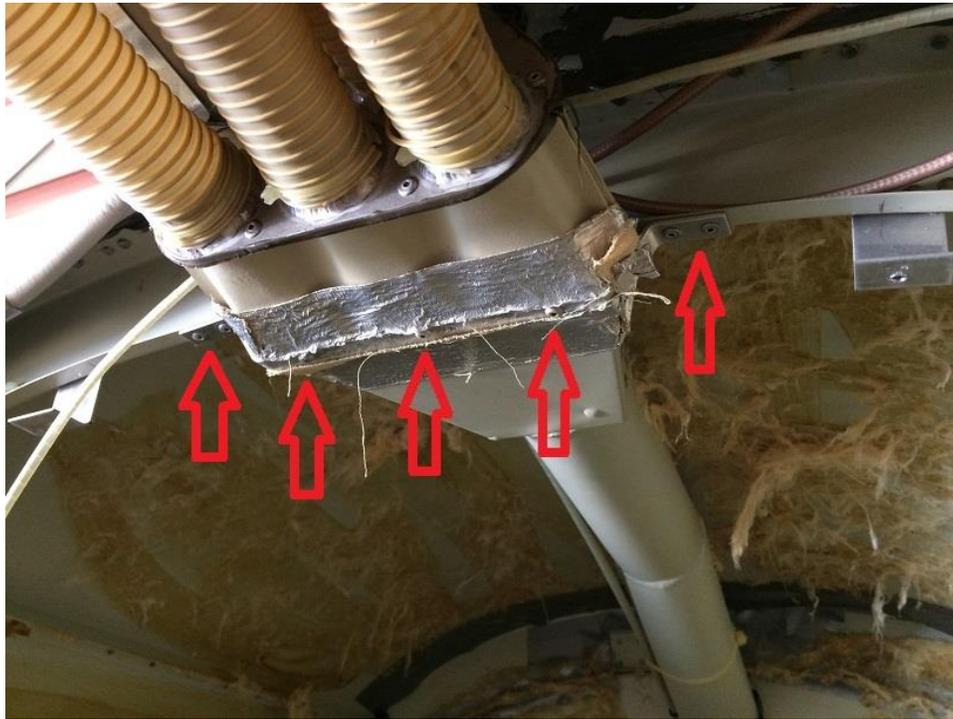


Figure 26 – Air Duct Modification Before



Figure 27 - Air Duct Removal

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- 5) Remove the port side bracket that holds the rear trim piece by drilling out the two rivets that connect it to the back wall of the Hat Rack. Seal the upper rivet hole. Align AC-01694 Cutout Template inside the Hat Rack over the lower rivet hole using the template hole marked with the arrow. Match drill the holes from the template through the back wall with a #40 and a $\text{Ø}1.000$ " drill taking care not to cut into any items on the other side of the wall. Install the 382600-MBA Bulkhead Fitting with the #10 ports on the bottom. Drill holes for the JAC3 Connector from the Electrical Junction Harness (either AC-01729 for CB-2 controller or AC-01750 for A1235 controller) per Figure 28. Attach the JAC3 Connector with (4) MS35206-228 Screws, (4) AN960-6 Washers and (4) AN365-632A Nuts.

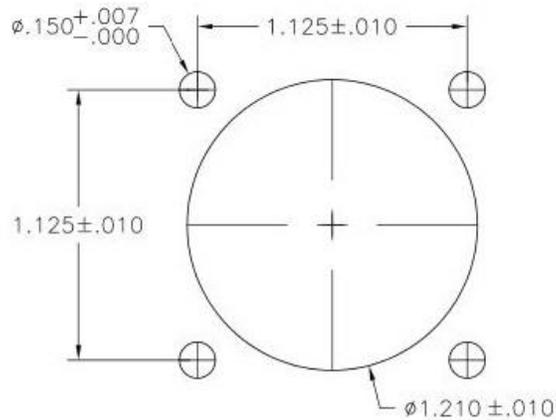


Figure 28 - JAC3 Cutout Dimensions

- 6) Assemble the Evaporator Support Structure per Assembly View 1 and Note 2. If an existing oxygen system hardline interferes with the support structure installation, cut the line to allow installation then use the supplied SS-300-6 Union Fitting to reconnect the line. Test the oxygen system. See Figure 29.



Figure 29 - Evaporator Support Structure

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- 7) Drill the .75" diameter drain hole in the Hat Rack floor per Note 3 and Top View 2.
- 8) Record the aircraft serial number on AC-02207 PMA Label in indelible ink, then affix the label to the starboard side of the Evaporator Assembly. Install the Evaporator Assembly and Hoses per Notes 5, 6 and 7 and Assembly View 4, Partial Top View 5 and Assembly View 6. See Figure 30.

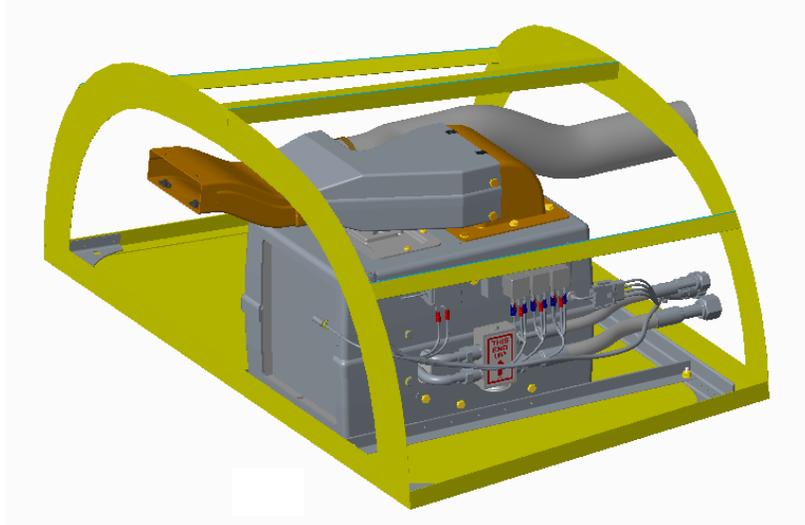


Figure 30 – Evaporator Assembly and Hose Installation

- 9) Connect the rear side of 2 ½" ID 05-29910 Scat Hose to the butterfly valve behind the Hat Rack. Make note of the butterfly valve position for later re-assembly. If the old sleeve behind the butterfly valve is old and brittle, stiffen the connection by replacing it with about 5" of 05-29910 Scat Hose. See Figure 31.

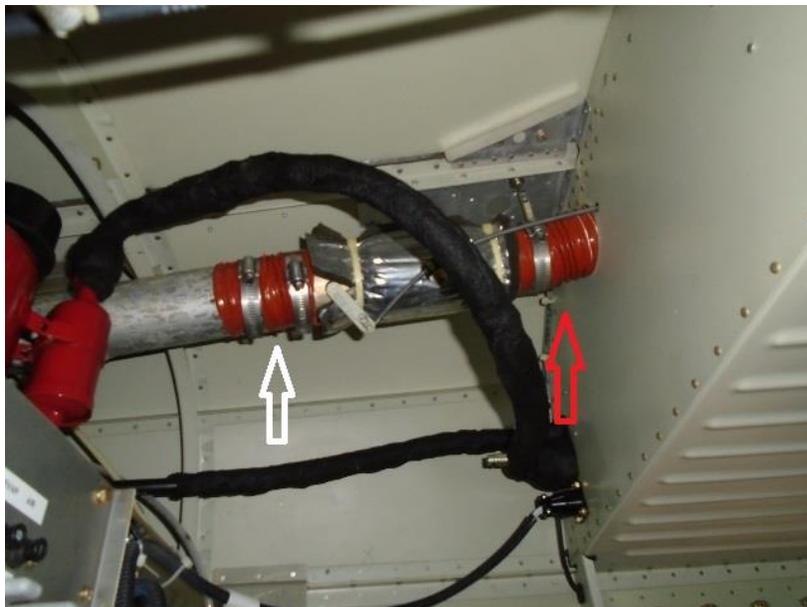


Figure 31 - Air Duct Modification Behind Hat Rack

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- 10) Finish the drain hose connections per Note 8 and Assembly View 4. Ensure Drain Reinforcement is attached with the “bump” orientated aft. Secure the drain hose with tie wraps as needed. See Figure 32 for suggested hose routing.



Figure 32 – Evaporator Drain

- 11) Paint AC-02173 Evaporator Drain Scupper to match the belly of the aircraft where it will be attached to protect the drain nozzle. Trim the protruding section of the nozzle as required to properly seat the drain scupper without impeding water drainage. Attach the Drain Scupper with (4) AN525-832R8 Washerhead Screws and seal the edges with RTV as required. See Figure 33.



Figure 33 - Attached Drain Scupper

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12) Assemble the Evaporator Closeout per Note 9 and Assembly View 6. See Figure 34.

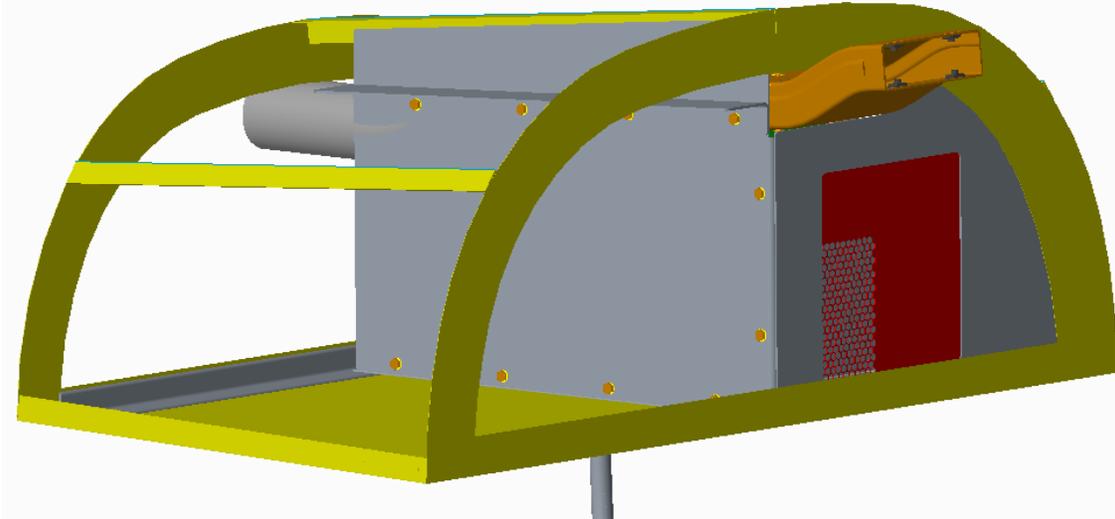


Figure 34 – Evaporator Closeout

- 13) Replace the insulation as applicable.
- 14) Cut the Hat Rack flooring and rear wall trim roughly in half to accommodate the new Hat Rack spacing.
- 15) Cut the Hat Rack headliner to size so that when replaced in the Hat Rack it rests evenly on AC-01891 Hat Rack Divider Trim right up against the AC-1676 Hat Rack Divider Assembly.
- 16) Bond the Hat Rack headliner to AC-01891 with plastic welder or equivalent.
- 17) Re-install remaining Hat Rack items. Install strips of weather resistant adhesive foam underneath the floor trim for support if needed.

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15. Headliner Installation

A. Reference AC-01892 M20 Overhead Duct Modification Details

- 1) Modify the Headliner per AC-01892.
- 2) Install the AC-01873 Outlet Upper Duct to the Lower Duct with (4) AN960-10L flat washers and (4) AN3-3 Bolts while routing the upper duct along the same route the vent hoses traveled. See the photos in Figure 35. Seal any potential air leaks up to this point with Silicone RTV.



Figure 35 – Outlet Upper Duct Installation

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- 3) Reinstall the headliner assembly containing the new duct. Reconnect all the electrical connections in the headliner; (those up front as well as the passenger and speaker lights). Connect the duct in the rear of the headliner by sliding it around the upper outlet duct previously installed. (8) 93406A199 No. 8 x 1" sheet metal screws are provided to replace the existing sheet metal screws, if they are now starting to strip or not quite long enough due to the thicker material. See Figure 36 and Figure 37. During assembly, index the vent knob connected to the butterfly valve aft of the hat rack.



Figure 36 – Headliner Reinstallation



Figure 37 – Headliner Reinstallation

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- 4) See Figure 38 for completed installation of the hat rack and baggage compartment interior trim.



Figure 38 - Completed Evaporator Installation

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16. Electrical Connections

- A. Reference Schematic AC-01680 for systems with the A1345 Controller or AC-01681 for the CB-2 controller.
- B. Connect the wire from AC-01727 Junction Plate labeled Master Relay #2 (A1) to the Battery #2 Master Relay. See Figure 39.



Figure 39 – Mooney Electrical Installation

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- C. Connect the wire from AC-01727 Junction Plate labeled Battery #2 (GND) to the ground location shown on Figure 40. Then route Ground Harness AC-01765 from that same location over to the grounding location for Battery #1. See Figure 41.



Figure 40 – Wire Routing

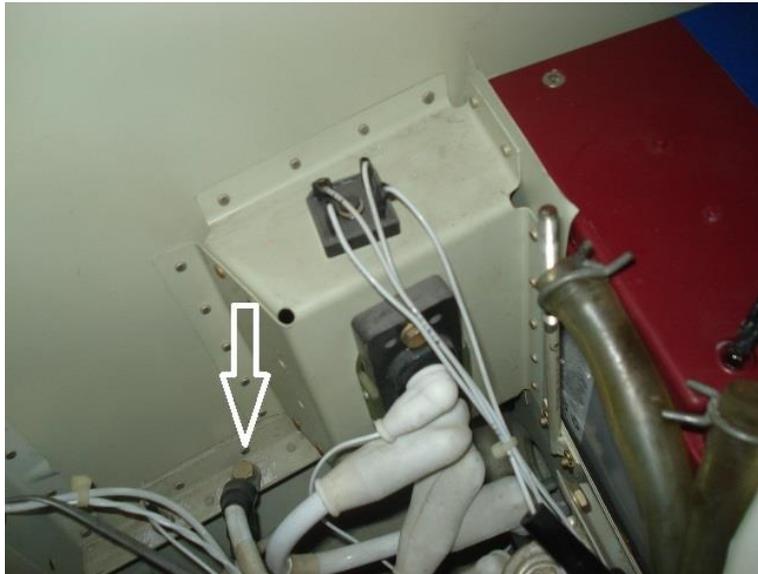


Figure 41 – Wire Routing

17. Firewall Forward

- A. An alternator upgrade may be necessary. An electrical load analysis may be required.

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18. Piezo Installation

- A. Reference Schematic AC-01680 for systems with the A1345 Controller or AC-01681 for the CB-2 controller.
- B. Place the Piezo switch and relay near External Power Receptacle. See Figure 42 and Figure 43.



Figure 42 – Mooney Piezo Switch Installation Interior View



Figure 43 – Mooney Piezo Switch Installation Exterior View

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19. Wiring

- A. Reference Schematic AC-01680 for systems with the A1345 Controller or AC-01681 for the CB-2 controller.
 - 1) ENSURE NO CONTROL CABLE INTERFERENCE
 - 2) Sufficient wire bundle length has been provided to accommodate variations in wire routing.

20. Modification of existing components

- A. Paint reworked areas per AMM as required.

21. Servicing

- A. Only qualified personnel with proper equipment may service this Air Conditioning System.
- B. Connect condenser, evaporator, and compressor hoses per Figure 44 below:

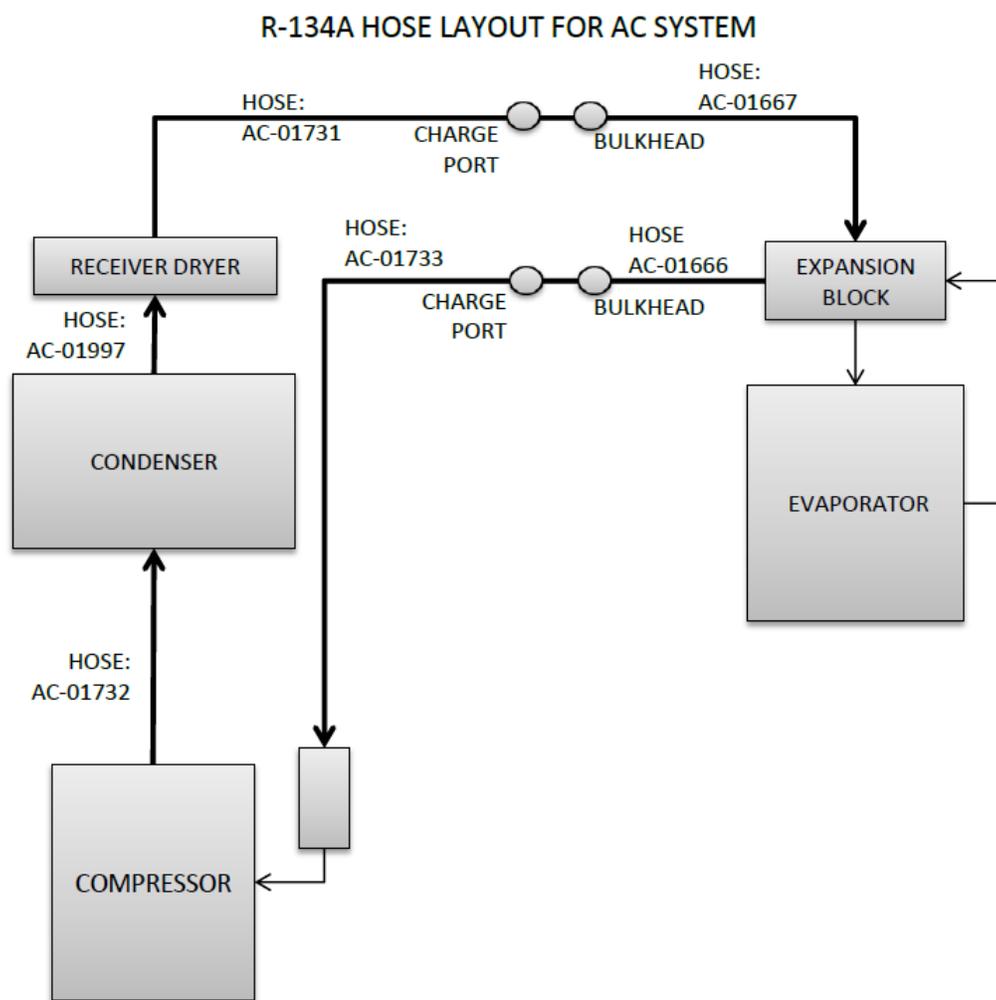


Figure 44 – Hose Layout

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- C. Wrap lines where required (near expansion block) to prevent sweating with cork insulation tape P/N 4217-W3.
- D. Evacuate system and ensure no system leakage prior to charging with R-134a.
- E. Charge system with 34oz. +/- 2 oz. of R-134a.

22. Reassembly of aircraft

- A. Reinstall aircraft battery per the AMM.
- B. Place AC-01774 M20 Load Application Placard in the cockpit, viewable from the pilot's seat.

23. Perform operational tests of air conditioning system

- A. Plug in external power and energize.
- B. Turn Master switch on.
- C. Turn Climate Controller on.
- D. Cabin temperature should be displayed.
- E. Select fans up and fan speed should correspond.
- F. Drive cabin temperature requested below ambient temperature by at least 10 degrees F.
- G. Outlets should flow air 20-30 degrees cooler than ambient.
- H. Check that water is coming from evaporator drain line. Water will not be present only if atmosphere is extremely dry, so if no water is flowing check for hose continuity to evaporator plenum.
- I. If any items do not operate as described, troubleshoot system and correct discrepancies.
- J. Turn Climate Controller off.
- K. Aircraft will need to be located in a run up area to complete this section.
- L. Utilizing qualified personnel operate the aircraft engine per the Pilot Operating Handbook.
- M. If further assistance is needed contact Kelly Aerospace Thermal Systems Technical support at 440-951-4744.

24. Return to service

- A. Update aircraft Weight and Balance records.
- B. Install Approved Flight Manual Supplement.
- C. Complete FAA form 337.
- D. Make aircraft log book entry.