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COMM 4120
Assignment #3
13 May 2004

Instructions/Procedures – Option #2

Adaptation Procedure for Environmental System CO_2 Filters in Apollo 13 Lunar Module

INTRODUCTION

This procedure, which takes approximately one hour to complete, will allow the fitting of a square Odyssey Command Module (CM) scrubber filter through the Aquarius Lunar Module's (LM) round mounted filtration hole and will modify the Environmental Systems scrubber unit. The material is for astronauts to use when CO_2 scrubbers fail in the CM, all CM filters are used or in other situations where additional scrubbing of CO_2 is required. Crew Systems Division assembled and tested this information.

REQUIRED EQUIPMENT and MATERIALS

All required equipment is contained onboard within the Apollo 13 CM and LM.

Cover to the Apollo 13 flight plan (to cover and protect the hose entry)
2 lithium-hydroxide canisters
Roll of gray duct tape
2 LCG bags
2 hoses from the red suits
2 socks
1 bungee cord (to secure the modified filtration device to the wall of the LM)

PROCEEDURE - 19 steps

#1) Place the LCG bag over the top of the square lithium-hydroxide canister. The bag must be pulled down to just over the triangular ventilator slots on the side.

⚠ NOTE: Be careful not to rip the bag because there are only three bags onboard.

#2) Tear the duct tape down the middle lengthwise to double the linear length.

#3) Seal the bag to the square canister by wrapping the duct tape around the canister where the bag opening is.

⚠ NOTE: The tape must seal the opening to prevent leakage of air flow.

#4) Poke or cut a hole in the middle of the top of the covering bag approximately the diameter of the hose from the red suit.

#5) Insert the hose into the hole. Secure the hose connection into the LCG bag with duct tape.

⚠ NOTE: The tape must seal the opening to prevent leakage of air flow.

#6) Cover the top of the LCG bag and hose attachment with the flight plan cover in an arch. The hose will stick out of one side of the arch.

#7) Attach the two sides of the cardboard flight plan cover that make contact with the square filter using a six inch long piece of duct tape over the top. This will prevent crushing the hose and air entry on the final mounting in step #19.

#8) Wrap the entire top sides of the filter cube with a three foot (about an arms length) piece of duct tape. Repeat wrapping on the bottom of the sides of the cube.

⚠ NOTE: The tape must seal the opening to prevent leakage of air flow.

#9) Secure the bag with strips of duct tape two per side running from one side, under the bottom and back up the other side. Repeat on the other side. The bottom of the cube will resemble a tic tac toe board when this step is completed. (See Figure 1 to the right)

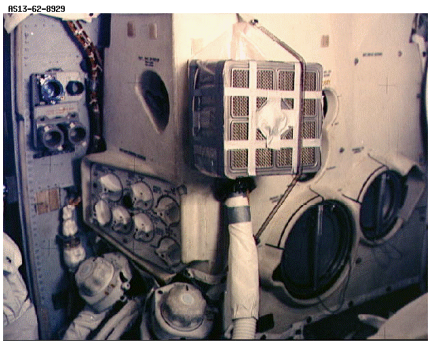

Figure 1

#10) Stuff the sock into the ventration hole in the center of the square scrubber. This will prevent the air from bypassing the filter. Cover the hole with a couple of pieces of tape to keep it from falling out.

#11) Repeat steps #3 through #10 for the second canister. This will be the replacement when the first filter becomes saturated.

#12) Open the sensor relief valve. This will normalize the pressure and allow you to attach the hose to the intake valve.

#13) Attach the free end of the hose to the scrubber intake.

#14) Attach the end of the bungee cord to the hook above the lithium canister mounting location on the bulkhead. (See Figure 1 in step #9 above)

#15) Secure the canister to the bulkhead by hooking the other end of the bungee cord below the mounting location. (See figure 1 in step #9 above)

#16) Attach the crossover hose to the secondary air cleaner.

#17) Close the sensor relief valve opened in step 12.

#18) Set the CO_2 select to secondary using the LM air cleaner selection switch on panel eleven.

#19) Engage the air cleaning scrubber fan by flipping the ACSF switch located on panel eleven.

VERIFICATION

⚠ Check the CO_2 levels on the partial pressure (marked PART PRES C02) meter on panel eleven. The level should begin to fall (**safe level of partial pressure is below eight (8)**). Further verification will be indicated through the amber CO_2 warning light set to illuminate if the level is above ten (10).

⚠ Reminder: **CO_2 levels above 15 can be fatal** and will cause brain asphyxia, impaired judgment and blackouts

TROUBLESHOOTING

⚠ If the canister seals are not correct in steps #3, #5 and #8, CO_2 cleaning may not be adequate. You will recognize this if you hear a whooshing sound when the system starts. Re-tape the seal that is leaking.

⚠ If the LCG bags get ripped air flow may leak out and fail to clean the CO_2. Use the spare bag if this happens.