



INSTRUCTION TO SERVICE

ITS: 5161	
SECTION:	260 Battery Compartment and Power Distribution
WRITTEN BY:	Shaun Cardinal
SUBJECT:	UCAP Circuit Board Cover

ITS5161

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PROCEDURE:

1. Turn the main battery disconnect switch to the “OFF” position.

⚠ WARNING: ALWAYS discharge the Ultra Capacitors (UCAP) before performing high voltage system maintenance on this vehicle. Refer to Section 5 of the Service Manual under *2.17 Discharging The Ultra Capacitors* for the discharge procedure.

2. UCAP Identification

- a. Open the clam shell doors on top of the bus to access the UCAP assembly. For Legacy style UCAP's (See Fig 1) proceed to step 3. For Mono style UCAP's (Fig 2) proceed to step 4.

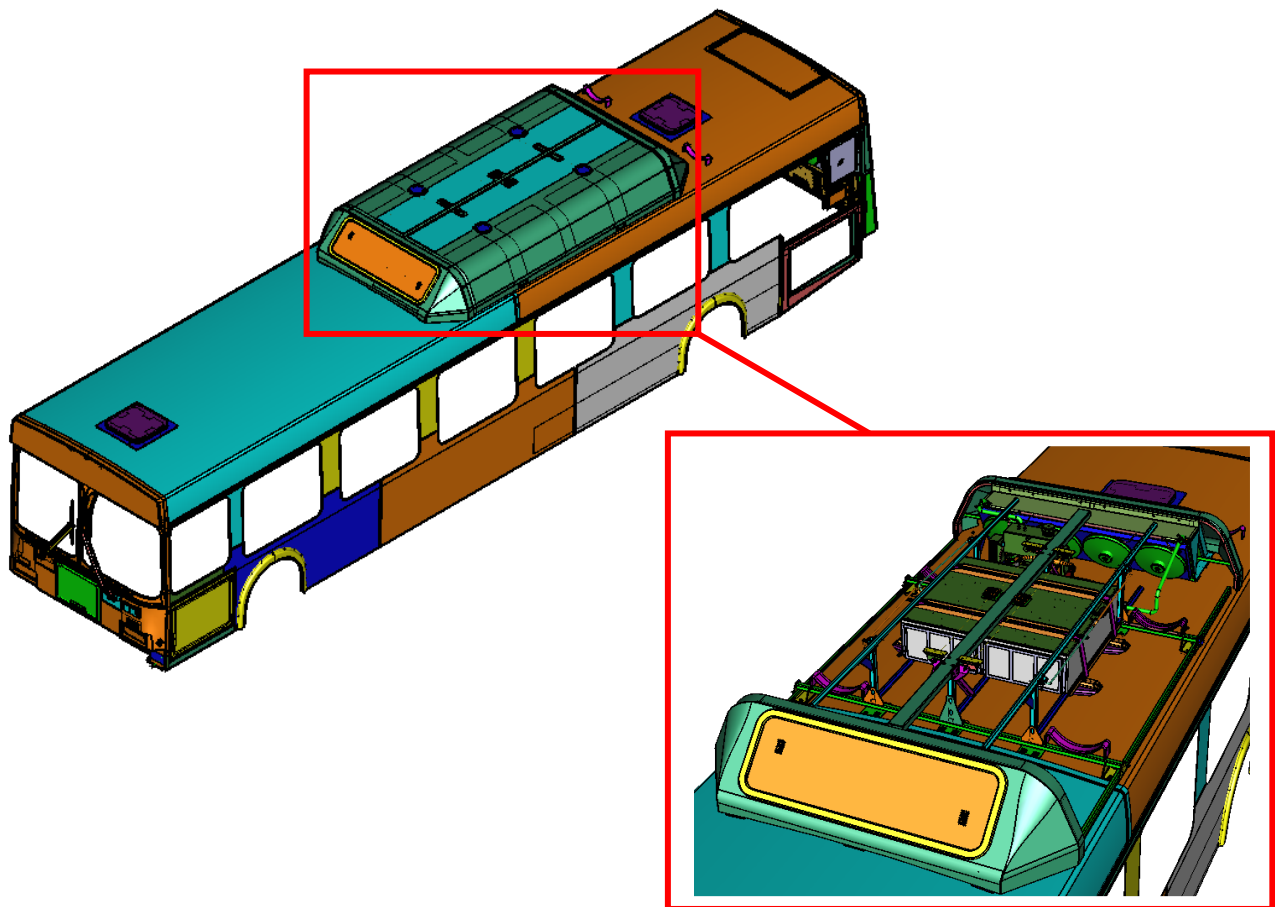


Fig 1 – Legacy UCAP Location (doors removed for clarity)

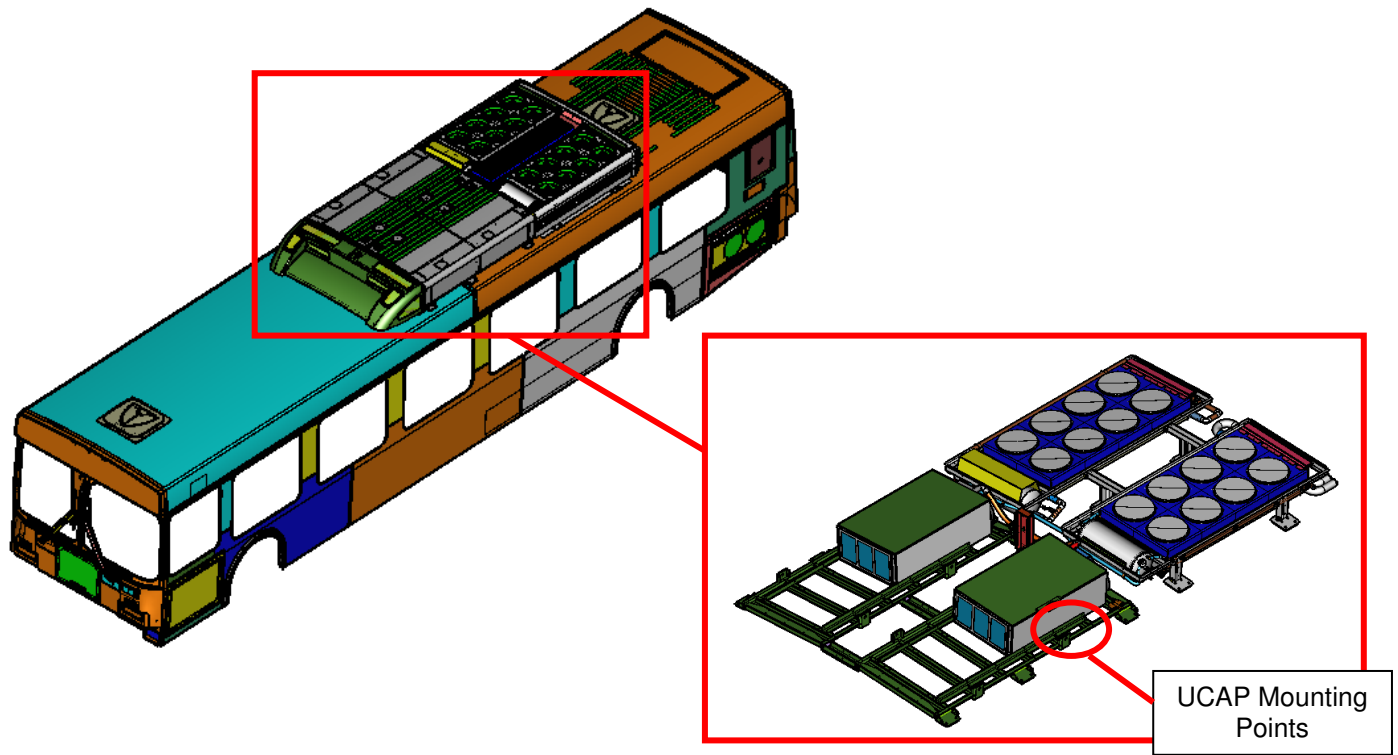


Fig 2 – SPLIT UCAP Location (doors removed for clarity)

3. UCAP Access (Legacy)

- a. Remove the four front and rear hardware securing the center beam to the roof top frame. Trim foam strips on beam to access the hardware if required (See Fig 3 and Fig 4)

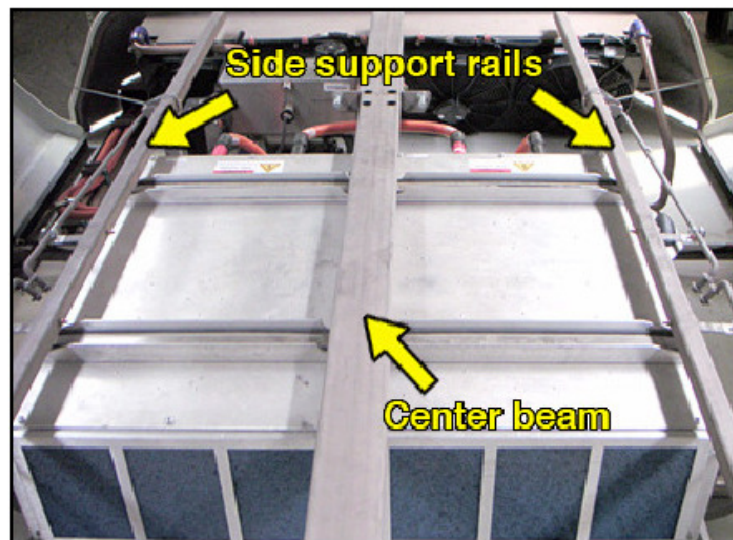


Fig 3 – Legacy UCAP Beams

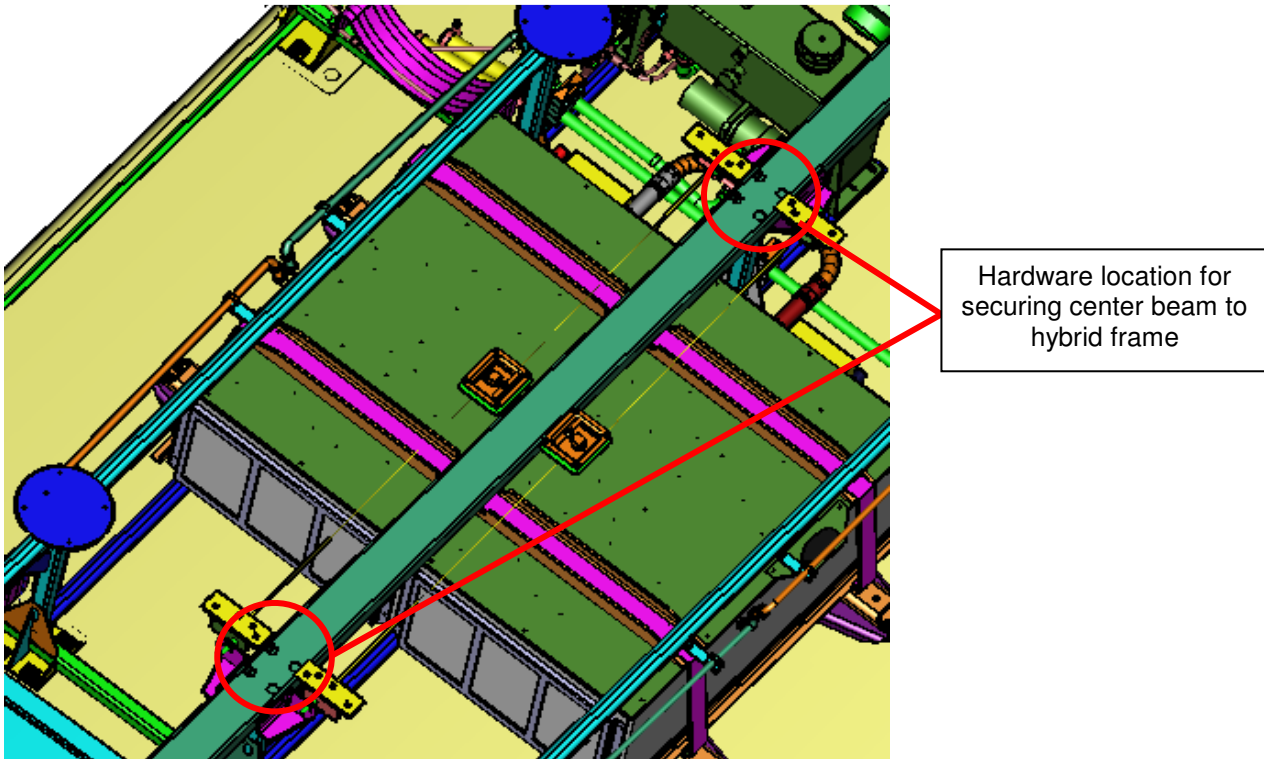


Fig 4 – Legacy UCAP Beams

- b. Remove the hardware securing side support rails (front and rear per side) see Fig 5. Before removal of curb side rail, remove coolant line clamps.

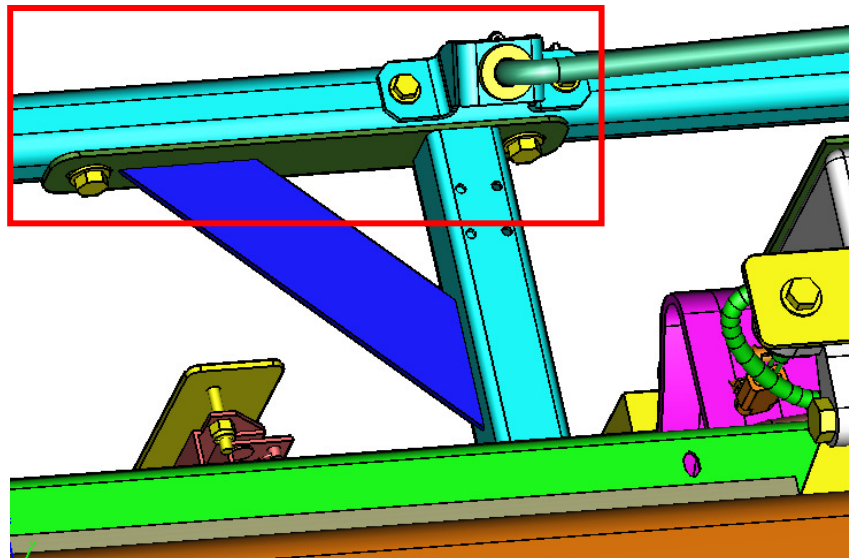


Fig 3 – Legacy UCAP Side Beams



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- c. Remove the nut holding the strap to the base (one side only) of the bus. Remove strap from base and move out of the way to gain access to the UCAP lid. See Fig 6

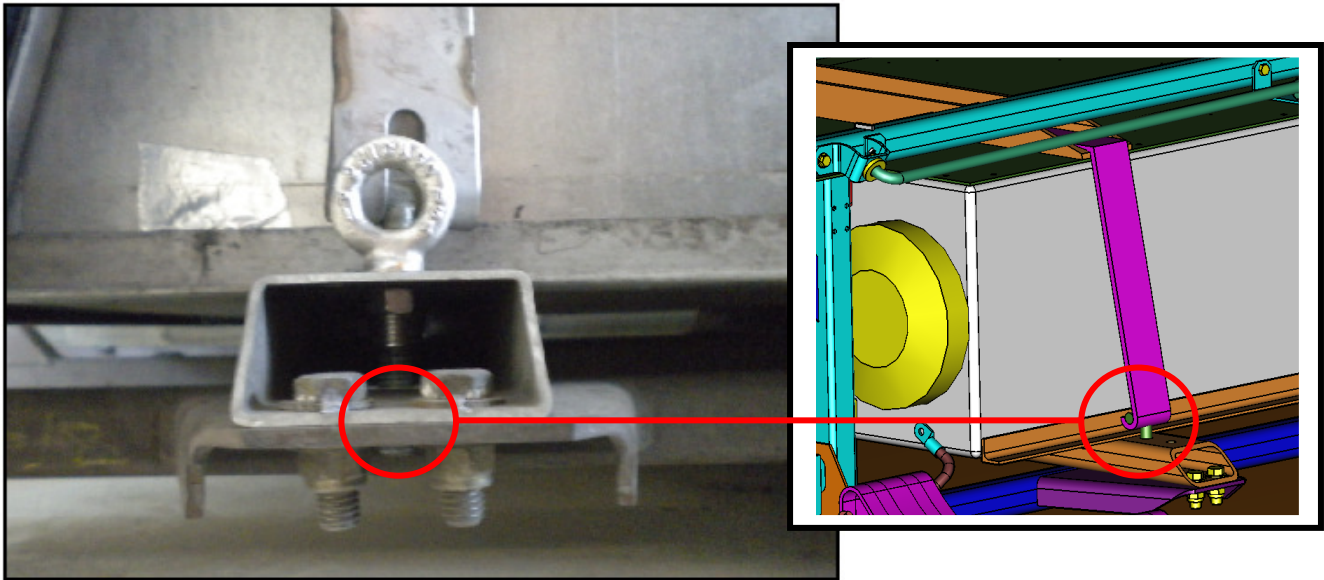


Fig 6 – Legacy UCAP Strapping

4. Circuit Board Cover Installation

- a. Remove any protective covers to access all existing perimeter hardware (16x screws, washers, and lock washers per UCAP) securing the UCAP lid to UCAP box (Fig 7). Remove fire bottle connection.

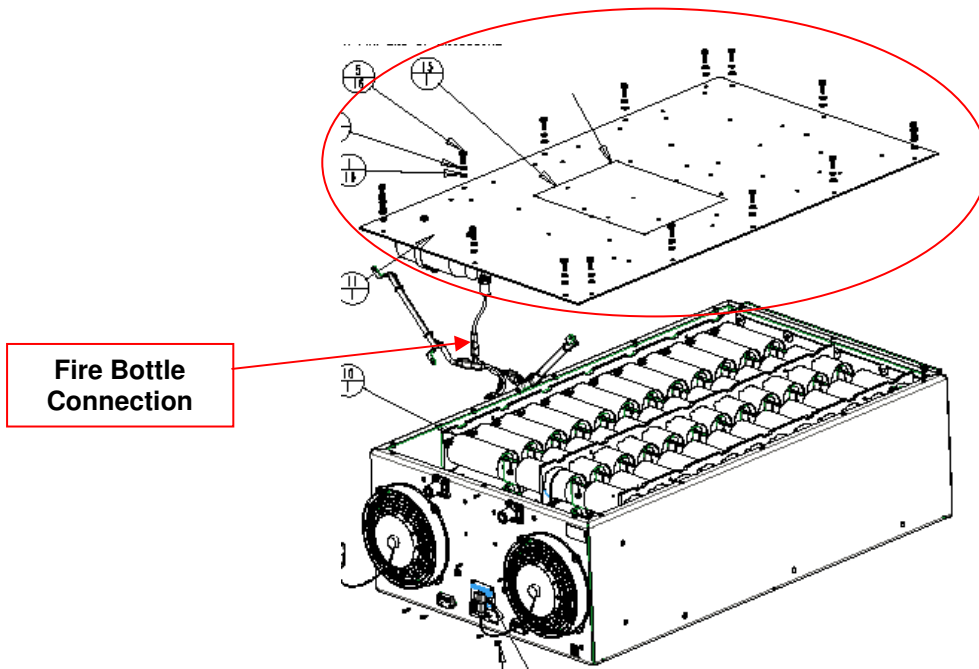


Fig 7 – UCAP Lid



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- b. Identify the harnesses on the circuit board before disconnecting. See Fig 8 and 9. Disconnect wires after identification.

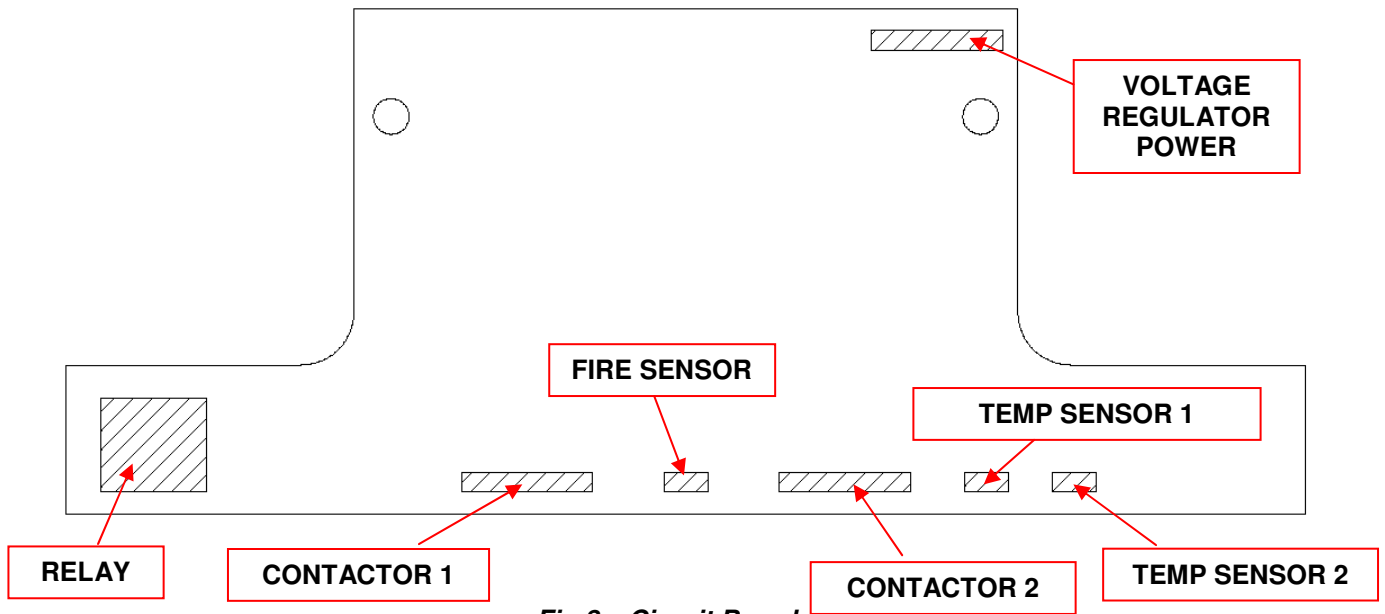


Fig 8 – Circuit Board

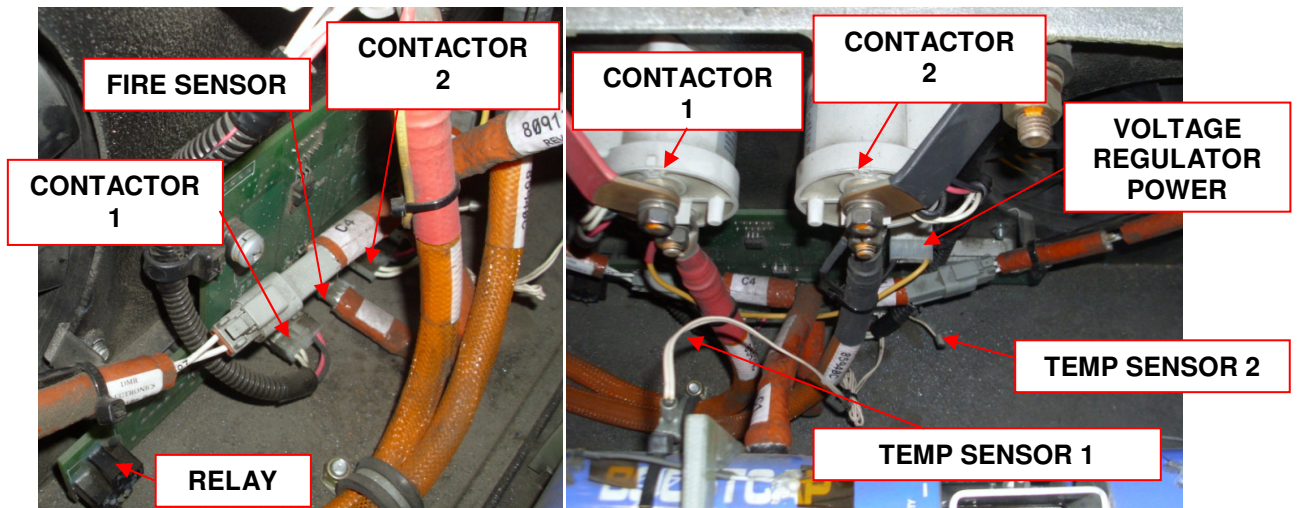


Fig 9 – Circuit Board Harnesses

- c. Remove EVCU/RDU. See Fig 10



Fig 10 – Removed EVCU/RDU

- d. Remove circuit board by unscrewing connections on rear face of UCAP box (both connection sides). See Fig 11.



Fig 11 – Circuit board retaining hardware removed

- e. Remove P-Clamp that holds the high voltage cable to the bottom of the UCAP box, remove the stud by unscrewing it. If stud is seized, cut off flush to the bottom of the box. See Fig 12



Fig 12 – Cable Retaining Stud

- f. Remove the cable tie holding the relay harness to the board by removing the hardware securing it. Refasten the hardware after removing the cable tie. See Fig 13.

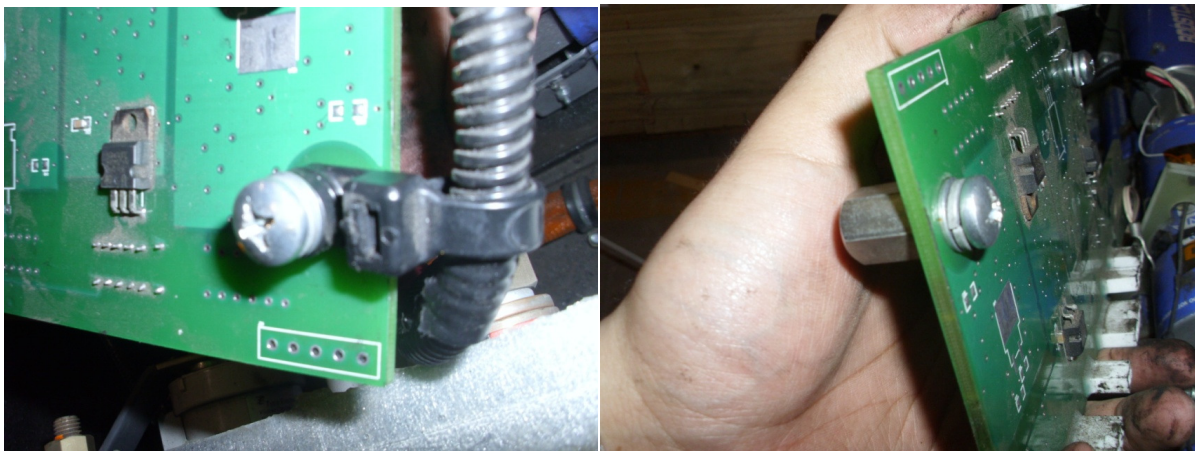


Fig 13 – Removed cable tie



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- g. For Mono Style UCAP's, remove 6x mounting hardware (See Fig 2) to allow the UCAP to tilt up. Use a block of 4x4 wood or equivalent to prop up (allowing jig to sit per Fig 14). Using the LF-MT-2001 drill jig, drill out the holes to secure the circuit board cover. Clean out any debris left inside the box (potential for short circuits/faults). Ensure locating surfaces of the jig are free of silicone/debris. See Fig 14.

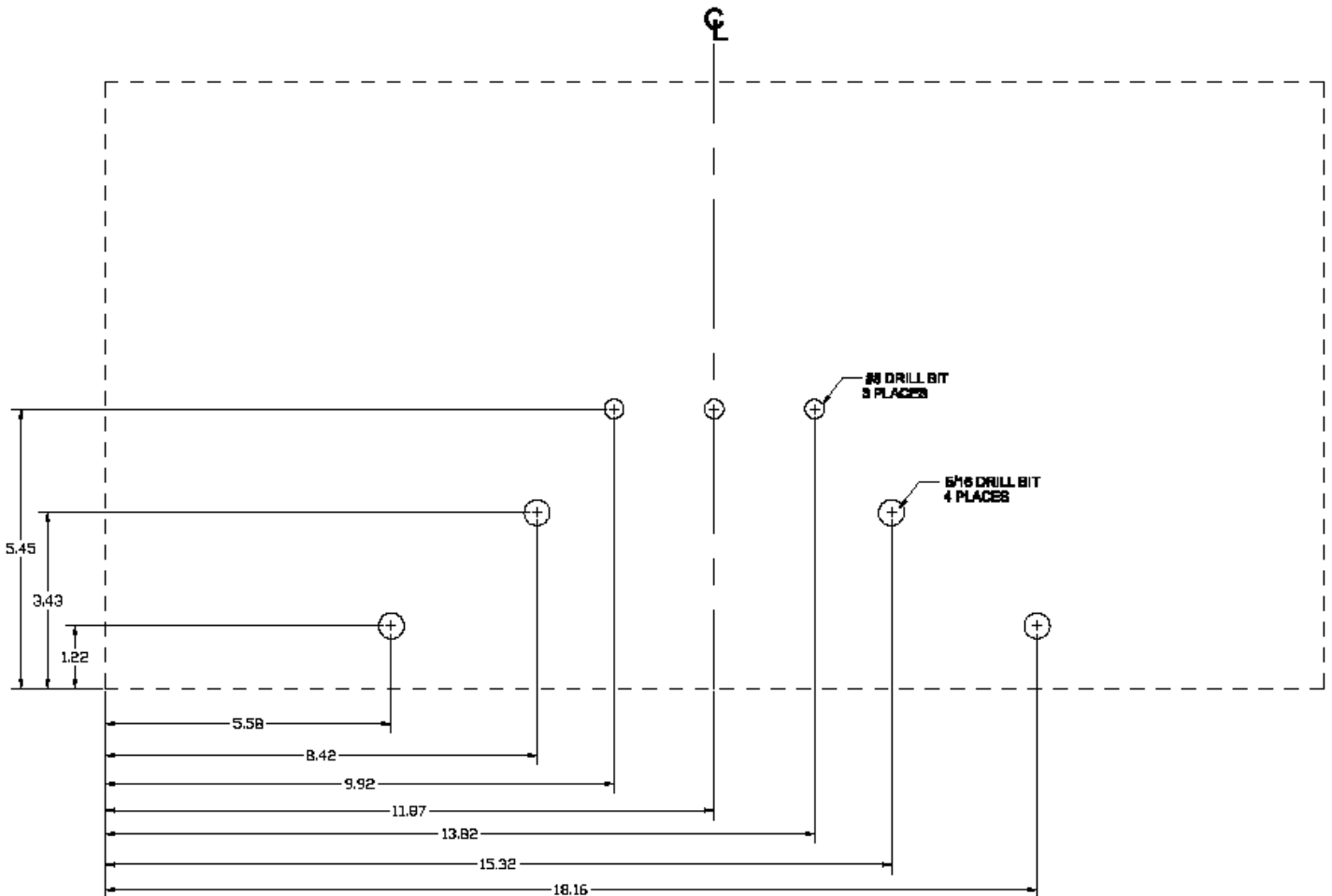
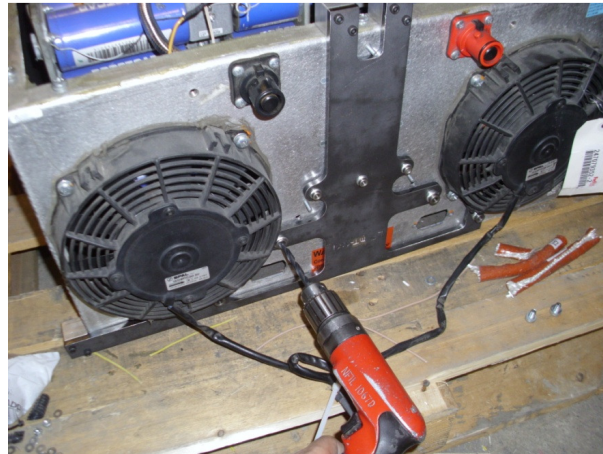


Fig 14 – LF-MT-2001 Drill Jig Location Reference



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- h. For Mono UCAP's, remove the block of wood or equivalent and re-install the UCAP assembly to the mounting frame (see Fig 2). Re install circuit board by fastening connections on the rear face of UCAP box (both connection sides). See Fig 15.



Fig 15 – Re-install circuit board hardware



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- i. Assemble the circuit board enclosure box (**NFI PN 469229**) and door (**NFI PN 468996**) by adding seal **NFI PN 5964906** per Fig 16

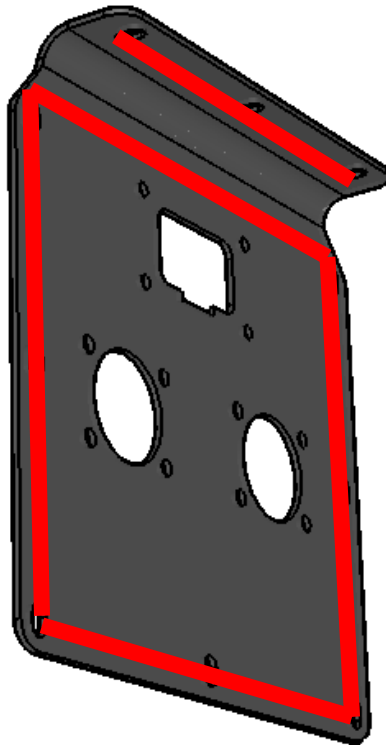
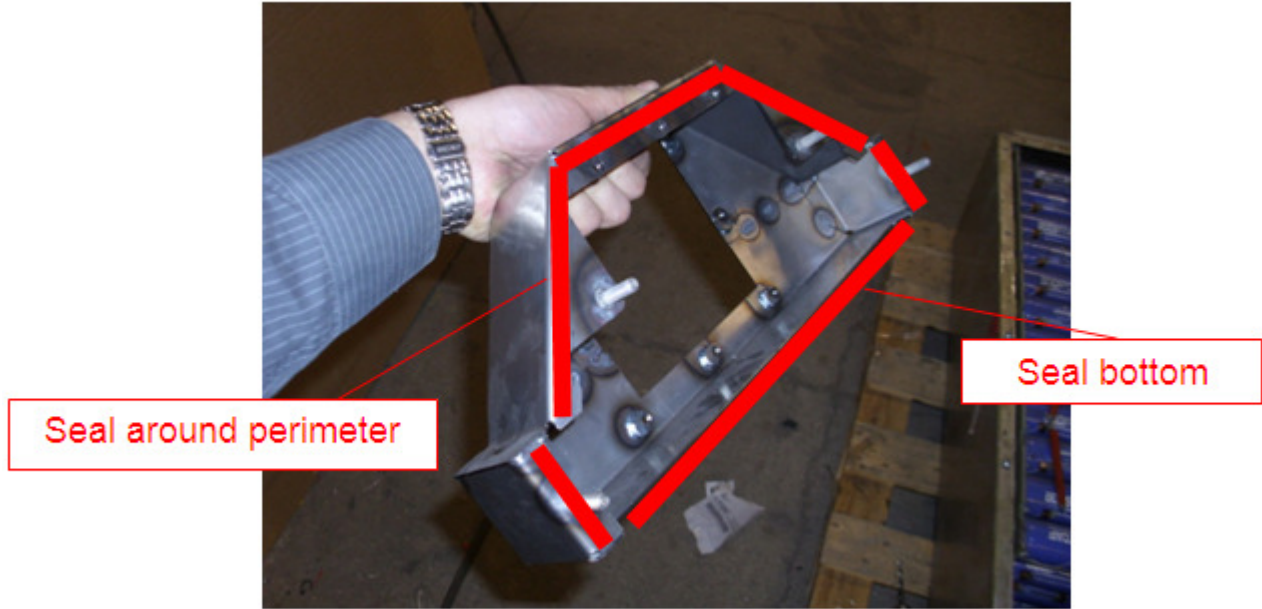


Fig 16 – Sealed circuit board box/door



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- j. Install the cover over top of the circuit board inside the UCAP box and secure with three **NFI PN 10S00008** recess screws, four **NFI PN 40N04000** 1/4-20 lock nuts, and four **NFI PN 50W04000** washers.

See Fig 17

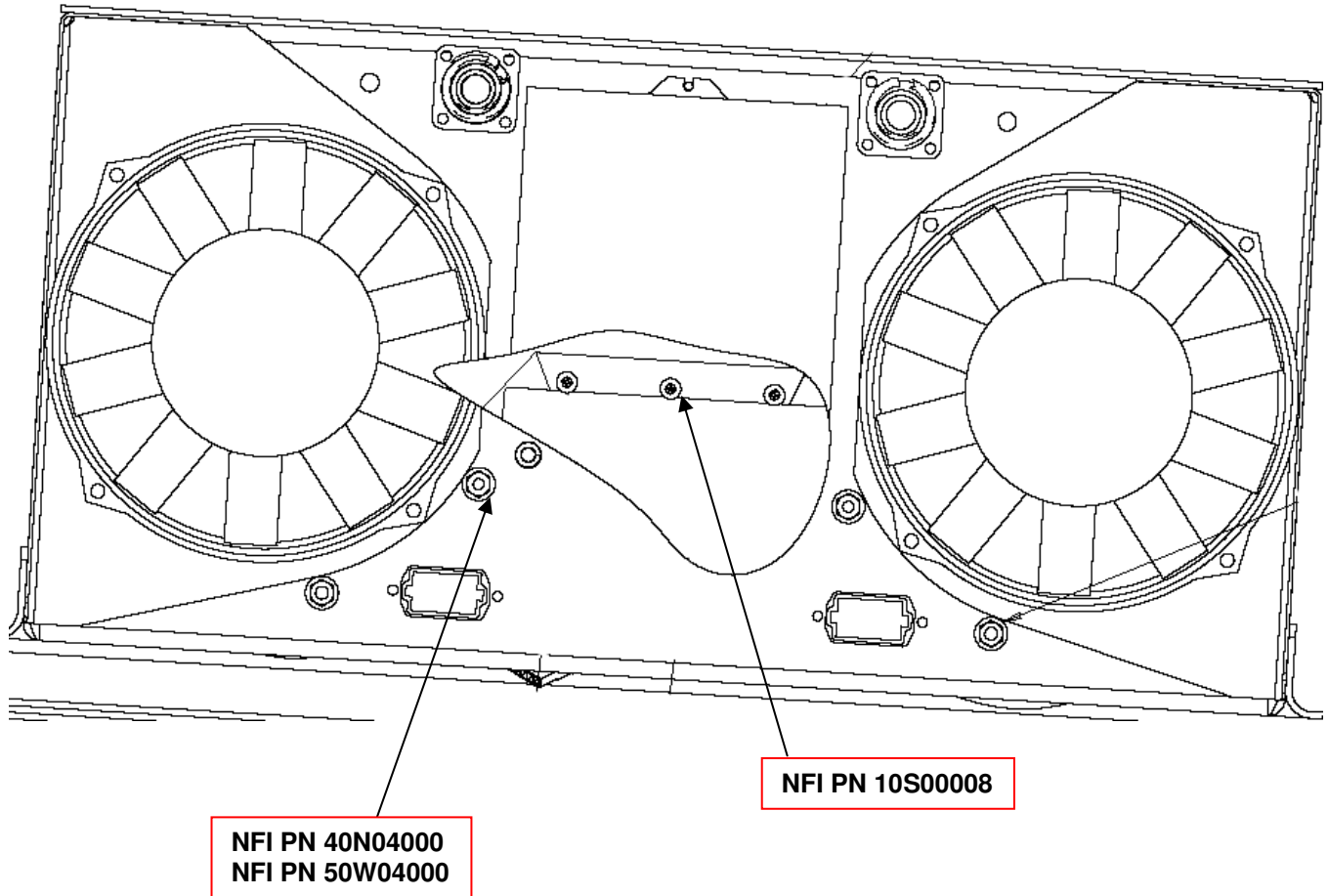


Fig 17 – Installed box



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- k. Assemble door (NFI PN 468996) with harnesses **NFI PN 486521** and **NFI PN 470801** using hardware **NFI PN's 14S98010, 40N96000, and 50W98000** to secure. Install harness **NFI PN 470600** with hardware **NFI PN's 14S96012, 40N96000, and 50W96000**. See Fig 18.

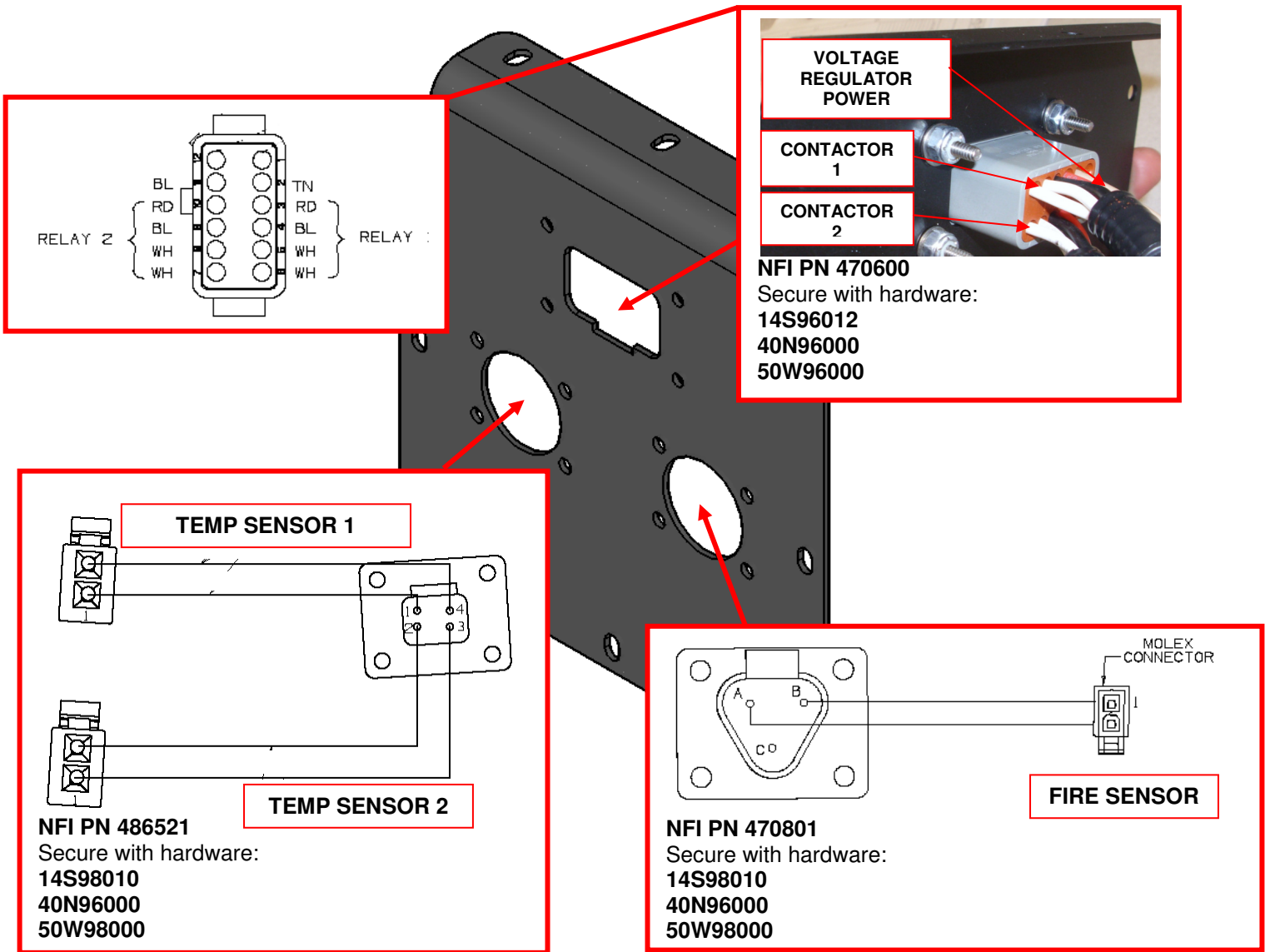


Fig 18 – Door Assembly



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- l. Plug in Temp Sensor 1 and 2 harness **NFI PN 488312** into door assembly. Reconnect Temp Sensors. See Fig 19
- m. Plug in the Fire Sensor adapter harness **NFI PN 489933** into the existing fire bottle/fan cross harness. See Fig 19
- n. Plug in Contactor and Voltage Regulator Power adapter harness **NFI PN 469480** into existing Relays and Voltage Regulator Power harnesses. See Fig 19

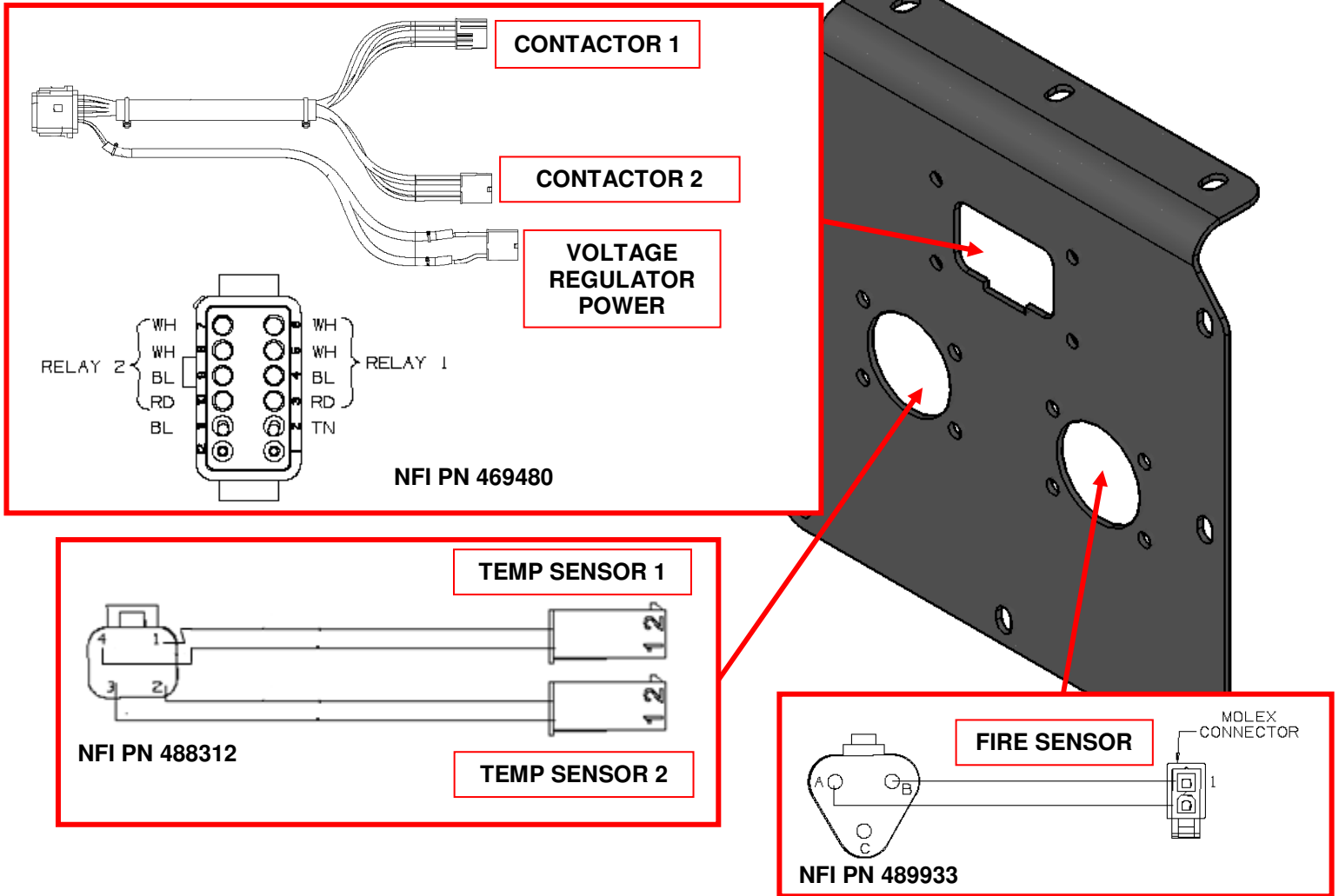


Fig 19 – Adapter harnesses for door assembly



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- o. To allow the UCAP fans to be connected (2x per UCAP), plug the Fan Harness extension harnesses NFI PN 489936 on each side of the Fire Sensor CROSS harness. See Fig 20

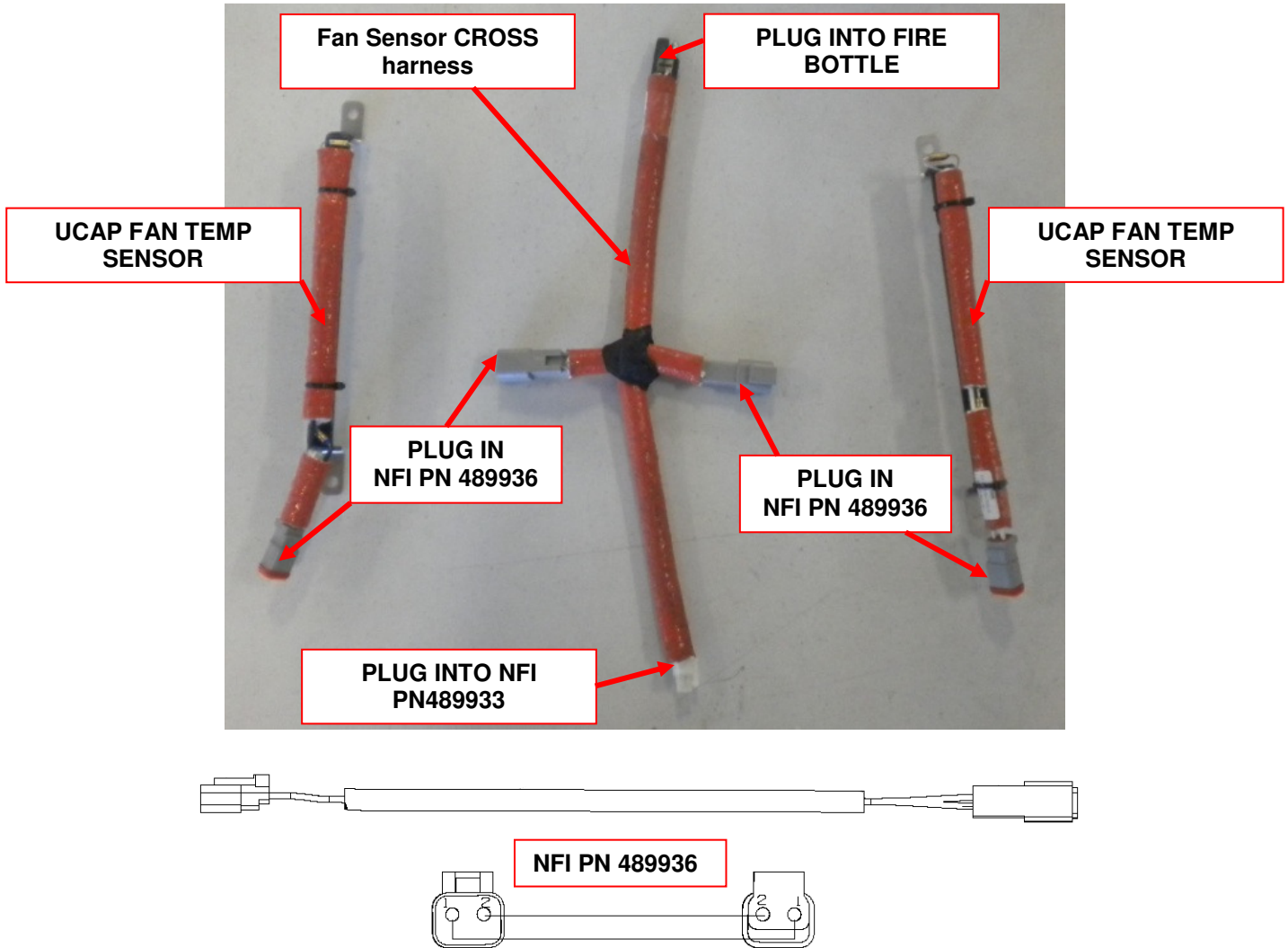


Fig 20 – Fan Harness Extension



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5. Pre Function Check

- a. Have one person on the UCAP place their hand on the contactor (See Fig 9) to physically check for the contactor engaging.
- b. Plug in laptop and Open CRT. See Fig 21
- c. Type out (ls -*io.dout.cont), You will see list of all 4 contactors:
 - p io.dout.cont_nm = 0 (this is negative master pack)
 - p io.dout.cont_ns = 0 (this is negative slave pack)
 - p io.dout.cont_pm = 0 (this is positive master pack)
 - p io.dout.cont_ps = 0 (this is negative master pack)

- d. Change each contactor to equal 1 and this will flip contactor on.

NOTE: Never override contactor with voltage in system.

Sample text: p io.dout.cont_nm = 1

- e. Once complete type (ovr -c) this will clear override enables.
- f. Type out (ls -*io.dout.cont) and confirm equals 0 before finishing.

```
>
>
>
>
>
>
>
>
>
>
>
>ls -*io.dout.cont
p io.dout.cont_nm = 0
p io.dout.cont_ns = 0
p io.dout.cont_pm = 0
p io.dout.cont_ps = 0
>
>
>
>
>
```

Fig 21 – Pre Function Check



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6. Securing UCAP

- a. Ensure old silicone around perimeter of UCAP is cleaned off, add a fresh bead of silicone (**NFI PN 401722**) around perimeter of lid and reinstall lid using all 16 screws, lock washers, and washers. See Fig 22

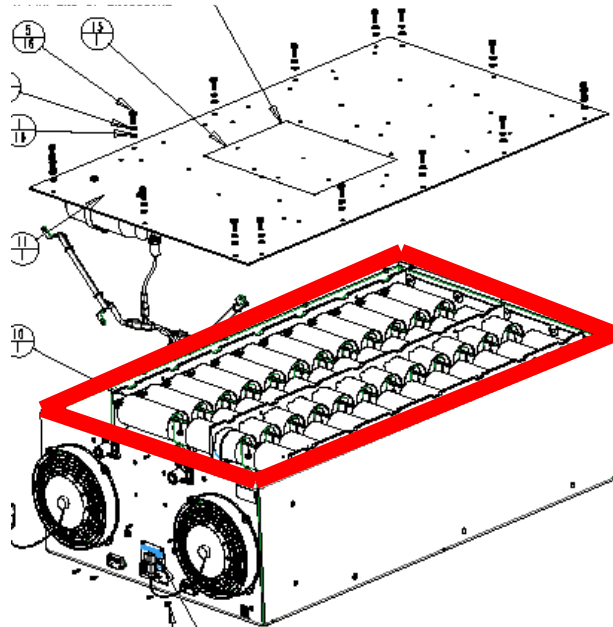


Fig 22 – UCAP Lid Installation

- b. Re install EVCU/RDU. See Fig 23



Fig 23 – EVCU/RDU Installation

- c. If UCAP assembly is a Legacy Style unit, Reverse UCAP removal steps outlined in step 3. Turn knife switch to ON.



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7. ISO Fault Test

- With the UCAP's still discharged, connect the laptop to the ISE Diagnostic Port located on the rear PLC panel (rear of bus)
- Start the CRT software and name the file and location to save the logged file to
- Start the bus and when the contactor test is completed, start the data log by going to "Transfer Selection" at the top of the screen and selecting "Send ASCII". Select file to retrieve from. Click on *desktop*, and then *double-click* on "ISO data logger text folder".
- When the bus goes into hybrid mode, start the A/C System and let it run for 1 min
- After 1 min, type *dl*, followed by the "enter" key. This will stop the data log
- Open the log file as a *text document* and review column 3 (ISO RESULT)
- Ensure that Column 3, *ISO RESULT*, has a value greater than 900 after the bus goes into Hybrid Mode. See Fig 18
- If issues occur, ensure that knife switch is turned off and capacitors are drained before any rework is completed.

```
LBT 2909 EVCU20110221 no power - Notepad
File Edit Format View Help

>
>d1 reset
resetting datalogger list...
>
>d1 -t 100
Setting period to 100 ms
>
>d1 --iso.iso.mode
iso.iso.mode add Successful.
>
>d1 --iso.iso_fin_result
iso.iso_fin_result add Successful.
>
>d1 --iso.iso.chan_hvm
iso.iso.chan_hvm add Successful.
>
>d1 --iso.iso.chan_hvp
iso.iso.chan_hvp add Successful.
>
>d1 --iso.valid
iso.valid add Successful.
>
>d1 --ucap.dat.tot_v
ucap.dat.tot_v add Successful.
>
>d1
time(ms), iso.iso.mode,iso.iso_fin_result,iso.iso.chan_hvm,iso.iso.chan_hvp,iso.valid,ucap.dat.tot_v
Starting data logging
>
200,4 990,18491,18601,1,650
300,4 990,18491,18601,1,652
400,4 990,18491,18601,1,657
500,4 990,18491,18601,1,648
600,4 990,18491,18601,1,647
700,4 990,18491,18601,1,658
800,4 990,18491,18601,1,656
900,4 989,18601,17959,1,652
1000,4 989,18601,17959,1,655
1100,4 989,18601,17959,1,656
1200,4 989,18601,17959,1,651
1300,4 989,18601,17959,1,651
1400,4 989,18601,17959,1,656
time(ms), iso.iso.mode,iso.iso_fin_result,iso.iso.chan_hvm,iso.iso.chan_hvp,iso.valid,ucap.dat.tot_v
Stopping data logging
>
>
>
```

Figure 18: ISO RESULT



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LABOUR ESTIMATE

	Operation	Men	Hours	Labour Time M X HR
1	Install Circuit Board Cover Assembly	2	4.0	8.0

PARTS REQUIRED

Item	Part Number	Description	Qty. per Coach	Units	Notes
1	469229	ASSY WELD BOX UCAP	2	EA	
2	10S00008	SCREW FH RECESS SS #10 24 UNC X 1/2 LG	6	EA	
3	40N04000	LOCKNUT 1/4 20 UNC	8	EA	
4	14S00008	SCREW PH CROSS RECESS SS #10 24 UNC X 1/2 LG	20	EA	
5	50W00000	WASHER FLAT SS #10	20	EA	
6	50W04000	WASHER FLAT SS 1/4 NOM	8	EA	
7	5964906	SEAL RUBTX 187TX 62W	4	FT	
8	489936	HRNS TEMP SENSOR EXTN	2	EA	
9	489933	HRNS TEMP SENSOR EXTN	2	EA	
10	469480	HRNS UCAP CTRL BOARD	2	EA	
11	488312	HRNS TEMP SENSORS	2	EA	
12	486521	HRNS UCAP CTRL BOARD	2	EA	
13	470801	HRNS TEMP SENSORS	2	EA	
14	50W98000	WASHER FLAT SS #8	32	EA	
15	50W96000	WASHER FLAT SS #6	16	EA	
16	470600	HRNS UCAP CTRL BOARD	2	EA	
17	468996	BRACKET UCAP COLAR	2	EA	
18	40N96000	NUT #6	12	EA	
19	14S98010	SCREW PH CROSS RECESS SS #8 32 UNC X 5/8 LG	16	EA	
20	14S96012	SCREW PH CROSS RECESS SS #6 32 UNC X 3/4 LG	8	EA	
21	401722	SEALANT-PROFLEX CLEAR	1	EA	

SPECIAL TOOLS REQUIRED

Item	Part Number	Description	Qty. per Coach	Units	Notes
1	LF-MT-2001	UCAP COVER DRILL JIG	1	EA	