Technical Service Bulletin 040321
IOX and DCX Motorized Breaker Retrofit

This service bulletin and procedure applies to all Comark IOX and CIOX (Compact IOX) transmitters, and those Comark DCX transmitters manufactured before the introduction of the DCX Millennium series.

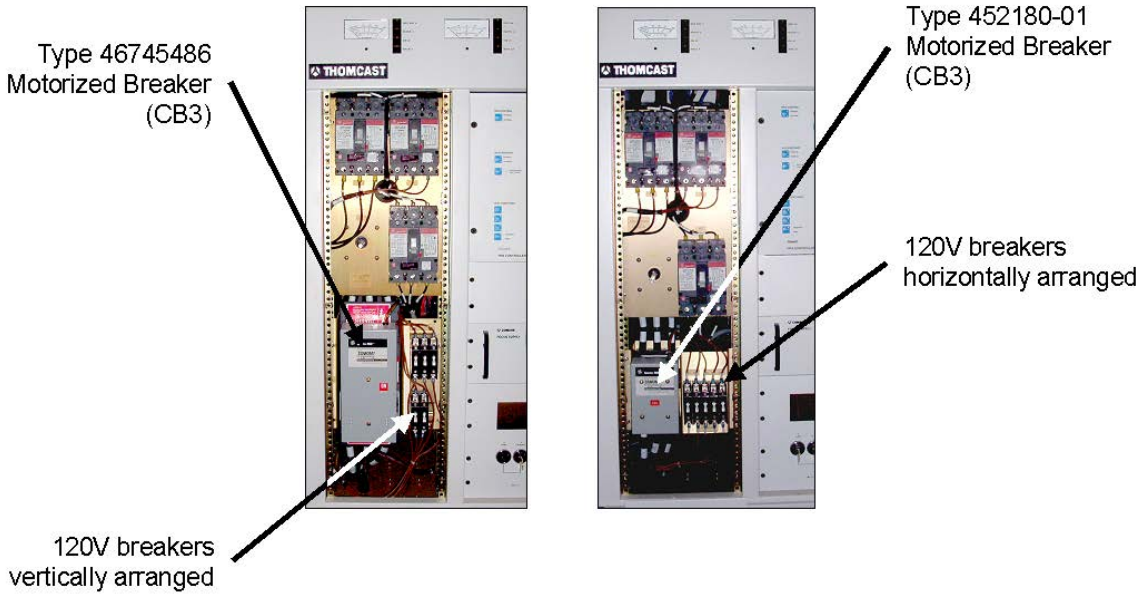
All Comark IOX, CIOX and non-Millennium DCX HPA cabinets feature a three-phase circuit breaker, identified by part number 452180-01 or 451548-01 (and designator CB3), which interrupts the 480V primary feed to the beam supply during a high voltage fault condition. This circuit breaker also features a motorized mechanism, which resets the unit to the ON position once the HPA cabinet is ready for the reapplication of high voltage. Because of the enormous primary current generated during a high voltage fault event, this motorized breaker is subject a great deal of stress and may experience an elevated rate of failure. Symptoms of the failure of this breaker may include: low beam voltage due to a missing phase, “waiting for three phase” alarm messages, breaker mechanism jams and will not reset, or visible burning and damage to the unit.

In response to the elevated rate of failures observed with the type 452180-01/451548-01 circuit breaker, Comark began granting an automatic lifetime warranty on all this part, starting in approximately 1999.

Comark also designed a higher rated breaker into the newer DCX Millennium series of transmitters, identified by part number 46745486. The larger physical size of the type 46745486 breaker dictated a complete redesign of the AC distribution panel and its underlying framework. The determination of motorized breaker type in an IOX/DCX HPA cabinet is easily made by comparison to the photograph on the following page.

Since its introduction in 2001, the type 46745486 motorized breaker has enjoyed an excellent record of reliability. Current fault tracking analyses indicate that the type 46745486 breaker is at least fifty times more reliable than the original type 452180-01.

Despite the lifetime warranty currently being offered on type 452180-01/451548-01 breakers, a number of our customers with these units have expressed a desire to retrofit their HPA cabinets to accept the type 46745486 “Millennium-style” breaker.



The Comark Customer Service Department is proud to announce an upgrade kit to retrofit the type 46745486 breaker into HPA cabinets originally designed for the 452180-01/451548-01 breaker. The upgrade kit comes in two varieties according to the style of HPA cabinet:

453233-01 CB3 UPGRADE KIT FOR COMPACT IOX / DCX
453233-02 CB3 UPGRADE KIT FOR NON-COMPACT IOX

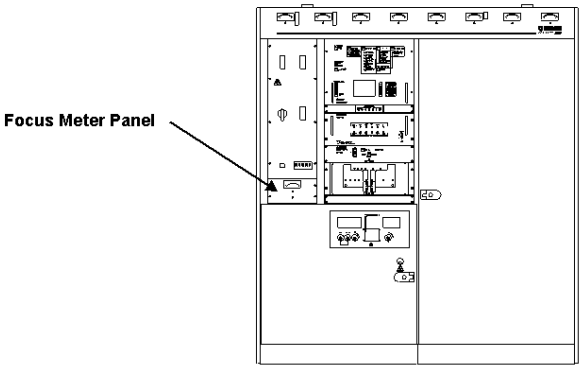
NOTE: The determination of HPA cabinet style is easily made by observing the placement of the IPA driver amplifiers. The "original" style IOX HPA cabinet has an external IPA driver cabinet with a series of IPA driver drawers. The "compact" style IOX/DCX HPA cabinet has a series of IPA driver "plates" mounted directly to air plenum at the rear of the HPA cabinet. Please also see note concerning "Phase II" HPA cabinets at end of this section.

Each kit upgrades one (1) HPA cabinet. There are a large number of major components and sheet metal pieces that must be replaced during the upgrade. A turnkey upgrade may be purchased with field engineer labor provided by Comark. Please contact Customer Service for current pricing on both the upgrade kit and field service installation.

Because an almost complete swap-out of the AC distribution panel is required, the upgrade procedure is mechanically intense. Nevertheless, it should be possible for persons of reasonable mechanical dexterity and equipped with the proper tools. The entire retrofit procedure is included in this bulletin to give interested parties an accurate idea of the scope involved and tools required.

Phase II IOX / DCX Transmitters

NOTE: There are a limited number of single cabinet transmitters known as Phase II IOX or DCX currently operating in the field. These transmitters are easily distinguished by their lack of a separate exciter cabinet (single cabinet configuration) and focus current metering panel mounted in the AC distribution panel area. (See illustration). Comark is not currently offering a standard retrofit kit for these transmitters, due to their limited numbers. Any Phase II customers interested in this retrofit program are invited to contact Comark Customer Service for a possible custom-designed retrofit kit.



Phase II Transmitter

IOX and DCX Motorized Breaker Retrofit Procedure

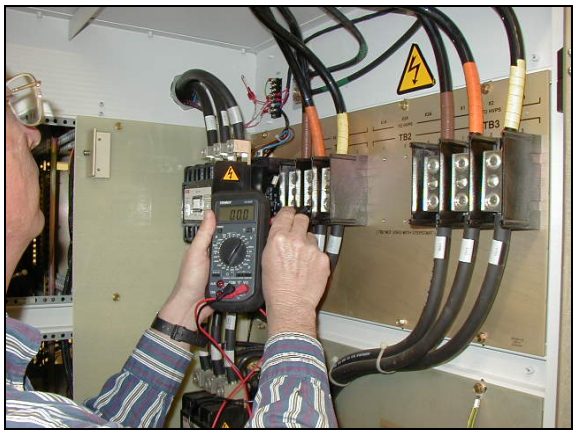
Procedure 040321: IOX and DCX Motorized Breaker Retrofit	
Applicability	IOX and DCX transmitters with old style CB3 breaker (GE SG1MOM).
Prerequisites	Fully read and understand this bulletin before attempting procedure.
Equipment Required	453233-01 or -02 retrofit kit, standard hand tools.
Comments	CIOX/DCX style cabinets (internal IPA drivers): skip steps as noted throughout procedure.

1. Place HPA cabinet in **STOP** mode via HPA controller, allow high voltage to drop off, and place ground switch in ground position using key interlock system.
2. Interrupt main AC input power. Tag and lock out AC disconnect switch.
3. Place all circuit breakers on transmitter front panel in OFF position for added safety.
4. Remove HVPS rotary switch handle and remove front circuit breaker cover panel.

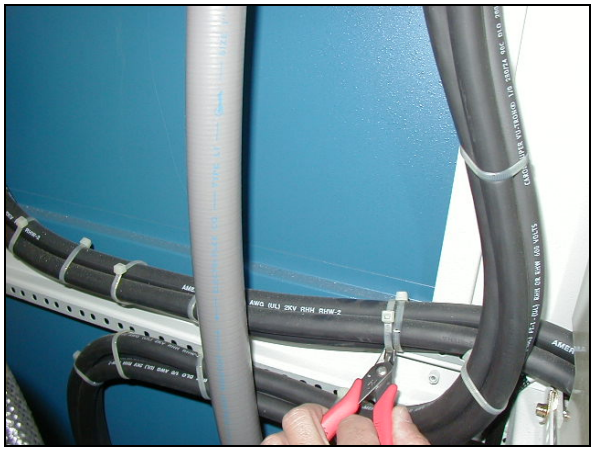


5. Open protective cage at rear of HPA cabinet using #2 Phillips screwdriver. Swing out and prop open cage so that it is not in the way, or simply remove cage by disconnecting ground wire and lifting it off hinges.

6. Using voltmeter, ensure that all exposed circuits are de-energized.



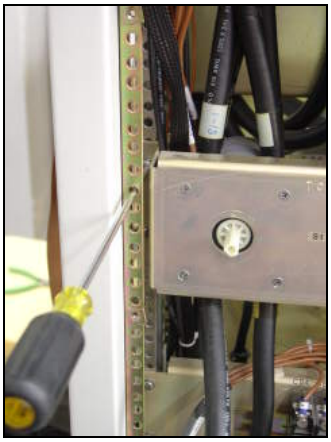
7. Disconnect TB1 1, 2, 3 bottom wires (rear HPA) and cut associated tie wraps.



8. Carefully note circuit connections of all major components and wires in AC distribution subsystem for future reference. Electrical schematic of HPA cabinet will not change with this upgrade, only the mechanical size and location of some components.

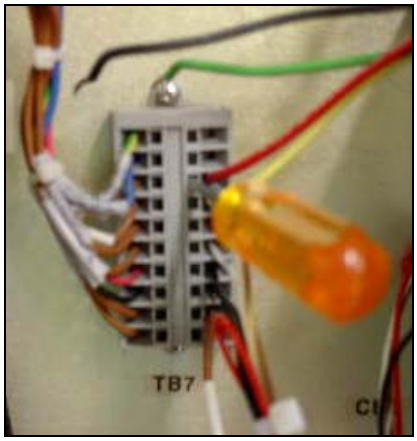
NOTE: Steps 9 through 20 on following pages apply to non-compact IOX (external driver) models only. For compact IOX / DCX models (internal drivers), skip to step 21.

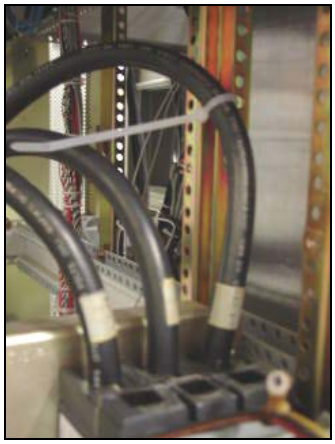
9. **(EXT. DRIVER ONLY)** Remove old S1 mounting assembly using long, narrow flathead screwdriver inserted through mounting bracket holes.

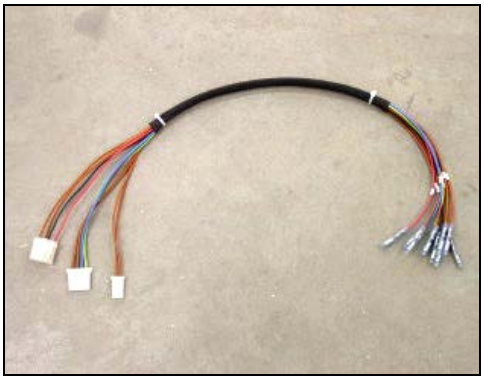

10. **(EXT. DRIVER ONLY)** Remove S1 from mounting assembly by removing four Phillips screws.
11. **(EXT. DRIVER ONLY)** Remove and discard wires S1-2, S1-4, and S1-6 from S1 to CB3 breaker.

12. **(EXT. DRIVER ONLY)** Remove wires S1-7F and S1-8F from switch S1. These will be replaced with a new harness. Discard old S1.
13. **(EXT. DRIVER ONLY)** Use small, flathead screwdriver to remove TB7 wires 1-10 (right side only).



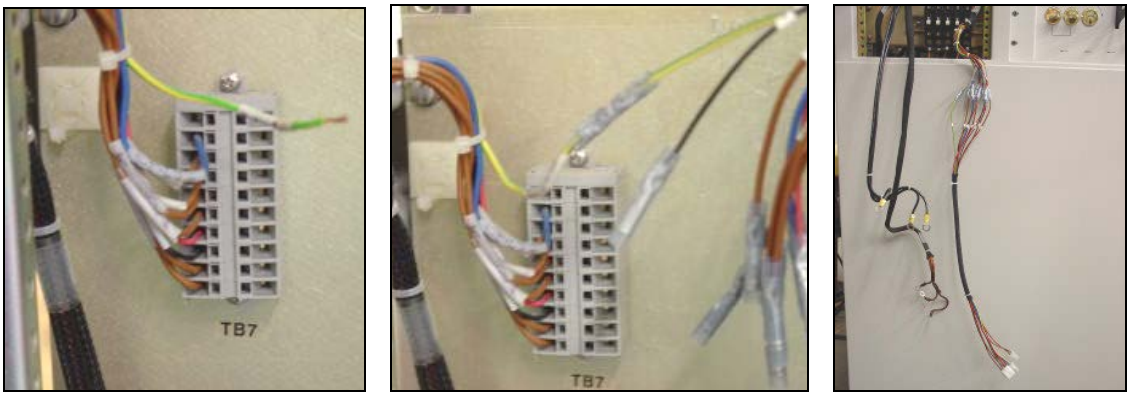


14. **(EXT. DRIVER ONLY)** Tie wrap a line wire just above CB3 to provide mechanical support. (CB3 must be secured because next step will free it from its motor operated mechanism or MOM).
15. **(EXT. DRIVER ONLY)** Remove MOM from CB3 breaker. Lift hinged MOM to reveal four mounting screws. Removing MOM mounting screws will also free CB3 breaker from underlying bracket. (CB3 will hang by tie wrap attached in previous step). Discard MOM assembly.
16. **(EXT. DRIVER ONLY)** While CB3 is supported by tie wrap, use 7/16" Allen wrench to remove load (bottom) wires from CB3.
17. **(EXT. DRIVER ONLY)** Mechanically support CB3, cut tie wrap holding CB3 up, and pull CB3 and its line (top) wires out of cabinet. Discard CB3 and associated wires.
18. **(EXT. DRIVER ONLY)** Cut tie wraps from TB7 wires to facilitate removal of TB7 wires and splicing to adaptor harness P/N 453262-01.



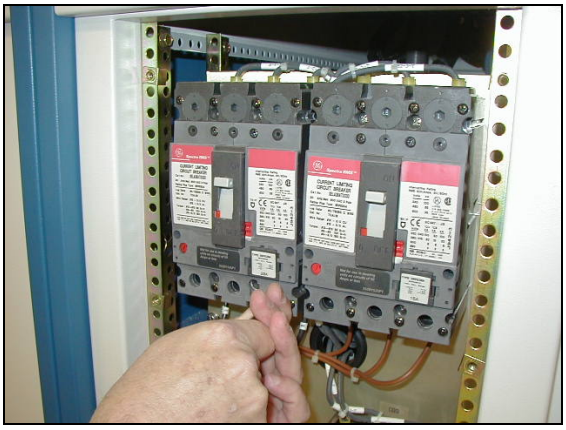
Adaptor Harness Comark PN 453262-01.

19. **(EXT. DRIVER ONLY)** Remove TB7 (left side) wires 1 - 10 one at a time and crimp to appropriate harness wires (also labeled 1 - 10) using supplied butt-splice connectors.



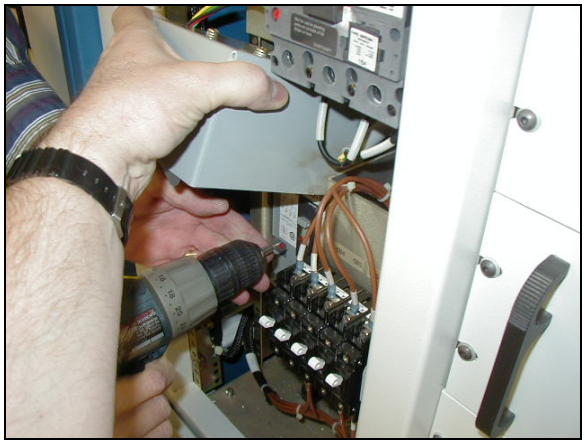
Splicing adaptor harness (EXT. DRIVER ONLY).

20. **(EXT. DRIVER ONLY)** Remove TB7 mounting plate (four flathead screws) and discard.
21. Remove load wires from bottoms of CB1, CB2, and CB9 (where applicable) with 3/16" Allen wrench.

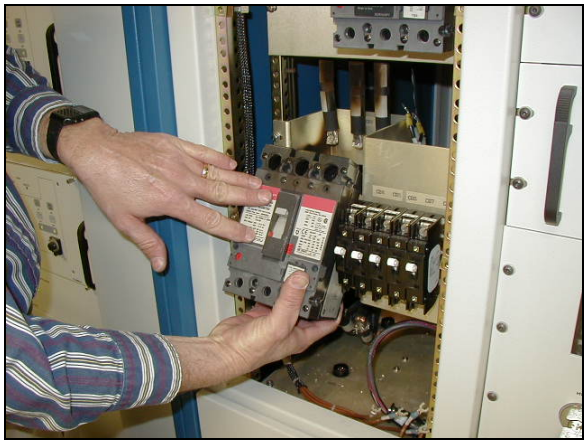


NOTE: Steps 22 through 24 on following page apply to compact IOX & DCX (internal driver) models only. For non-compact IOX models (external drivers), skip to step 25.

22. **(COMPACT ONLY)** Remove motor operated mechanism (or MOM) assembly by removing four mounting screws.



23. **(COMPACT ONLY)** Disconnect Molex connector to MOM assembly. Molex connectors for S1, CB3, and MOM are located directly behind CB3 mounting bracket. Cut MOM wires if not accessible. Discard MOM assembly.
24. **(COMPACT ONLY)** Disconnect 1/0 wires and Molex connectors to CB3. Remove CB3 circuit breaker. Cut CB3 Molex wires if not accessible. Discard CB3 circuit breaker.

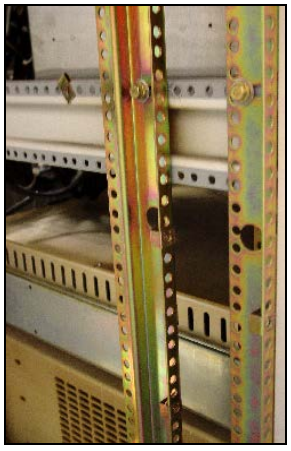


25. Disconnect line and load wires from CB4 - CB8.
26. Remove CB4 - 8 mounting bracket using long, narrow flathead screwdriver inserted through mounting bracket holes. Set breakers aside for spares and discard panel.
27. **(COMPACT ONLY)** Disconnect Molex connector from S1.
28. Remove line wires from CB1.
29. Remove CB1 to facilitate removal of CB1/CB2 mounting plate.

30. Remove CB1/CB2 mounting plate by removing screws with long, narrow flathead screwdriver.
31. Remove breakers CB1, CB2, CB9 (where applicable), and set aside for re-use later in this procedure. Temporarily remove gray cylindrical hole plugs to gain access to screws on line (upper) terminals.

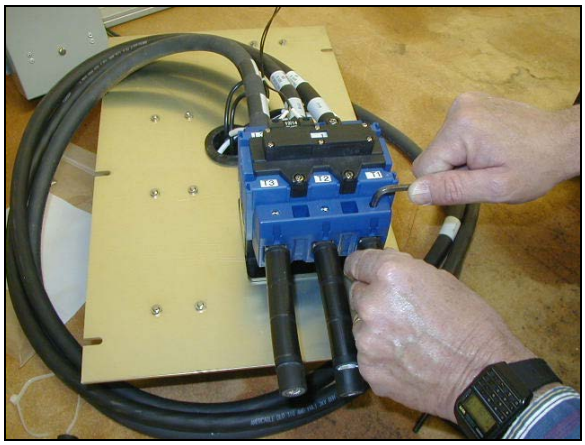
NOTE: The rotary switch S1 from non-compact IOX cabinets in mechanically incompatible and may be discarded. The rotary switch S1 from compact IOX/DCX cabinets is mechanically compatible and may be retained for use as a spare.

32. **(EXT. DRIVER ONLY)** Remove rear set of vertical rails (with 3/8" socket) and any associated tie wraps. Discard rails.
33. **(EXT. DRIVER ONLY)** Remove middle set of vertical rails (with 3/8" socket) and any associated tie wraps.
34. **(EXT. DRIVER ONLY)** Move speednuts (clips) on middle rails to following locations: 2", 9", 16", 21-7/16", and 28-7/16" measured from top of rail.
35. **(EXT. DRIVER ONLY)** Install middle vertical rails in eighth hole back (4-¾" from front of frame). This location is two holes back from original location. Reference: front vertical rail is installed in second hole from front of cabinet frame.



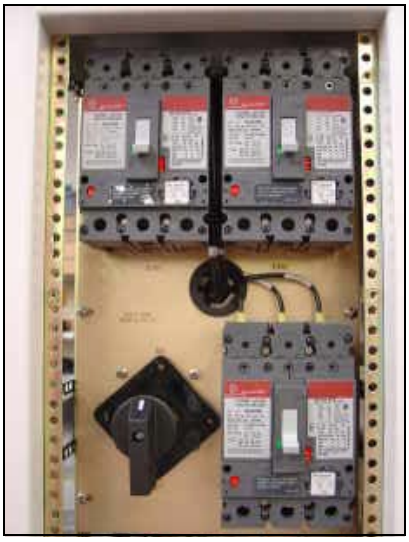
Middle vertical rail installed.

36. Install grommet (supplied in kit) into hole of new CB1/CB2 mounting plate (P/N 46744181).
37. Install new S1 into new CB1/CB2 mounting plate.
38. Simultaneously install 1/0 wires and CB1, CB2, CB9 (where applicable) line wires in top terminals of S1. Note that 1/0 wires are placed toward back of wire clamp connection. Reference drawing 46745485-040 (included in kit) for more details.
39. Route CB1, CB2, CB9 (where applicable) line wires through grommet hole to front of panel.
40. Install J42 wires to 13 and 14 terminals of S1.
41. Install new 1/0 jumper wires in lower terminals of S1.



42. Pre-bundle (tie-wrap together) three 1/0 wires from S1 along their entire length. This will facilitate their routing through to rear of HPA cabinet in next step.
43. Thread pre-bundled 1/0 wires back through hole to rear of HPA cabinet, and install new panel on cabinet mounting rails. Speednut positions should allow top of panel to align with top of mounting rails. Attach panel with 10-32 x 5/8 screws, lock washers, and flat washers.

1/0 wires from newly assembled panel threaded to rear of HPA cabinet.



Line wires connected to CB1, CB2, CB9.

44. Install line wires to top of CB1 and mount CB1 to panel. Re-install cylindrical hole plugs to line terminal access holes when finished.
45. Install line wires to top of CB2 and mount CB2 to panel. Re-install cylindrical hole plugs to line terminal access holes when finished.
46. Run line wires to CB1 and CB2 between bodies of CB1 and CB2. Tie wrap as needed.
47. **(COMPACT ONLY)** Install line wires to top of CB9 and mount CB9 to panel.
48. Install ID labels from label kit to CB1, CB2, CB9 (where applicable), and S1 per ref. 46745485-040.
49. Use 8mm Allen wrench to attach 1/0 wires TB1-1 TB1-2 and TB1-3 as marked to terminal block in rear of HPA cabinet. Be sure to keep phases correct. Comark recommend that a “T” handle or socket adaptor be used, as these 1/0 wires need to be very tight.

NOTE: It is common for stranded wire to deform and become loose in screw terminal connections of this type. For this reason, Comark strongly recommends that all terminal connections be periodically checked and re-tightened, as necessary, during the first few months of service.

50. Connect S1 connector P42 to cabinet harness connector J42.
51. Install CB4 - CB8 on CB3/CB8 bracket (P/N 467454632). Slide CB4 - CB6 temporarily towards left of DIN rail to allow access to mounting screws.
52. Secure CB3/CB8 bracket with supplied screws.

53. Slide CB4 - CB6 back to original positions.

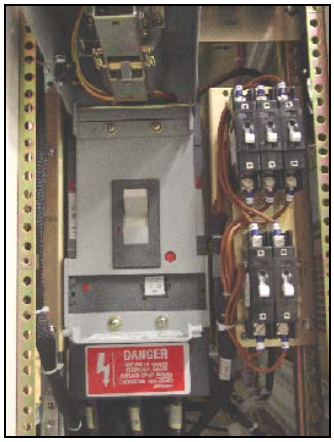
CB3/CB8 bracket installed.

54. Remove plastic terminal covers from CB3, tighten rear (inner) 3/8” Allen terminals on CB3, and loosen front (outer) terminals. The rear terminals will not be used.
55. Feed wire from rear of CB3 back through slot in CB3/CB8 bracket, connect P41 to J41 (double in-line connector), push CB3 up so that three 1/0 jumper wires from S1 fit into line terminals on CB3, and secure CB3 to CB3/CB8 bracket with long hex head screws from MOM kit.
56. Secure three 1/0 gauge wires on line side of CB3 with 5/16” Allen wrench and tighten main lugs (3/8” Allen) that hold terminals onto CB3 breaker.
57. Connect bottom load wires on CB3. Set CB3 trip point to “MIN”.

New CB3 installed.

CB3 terminal covers installed.

58. Replace plastic terminal covers (labeled “Danger” with universal high voltage lightning bolt) on top and bottom of CB3. These covers slide on. (Note: top cover is upside down).
59. Open MOM by pulling release bar on bottom of cover. Hold MOM open, thread wire from MOM through slot in CB3-CB8 bracket, place MOM over CB3, and secure with supplied hardware (flat head screws, washers, and lock washers).
60. Reach under MOM and attach J40 connector from rear of new MOM to P40 on cabinet harness.
61. Tie wrap harnesses P40, P41, and P42 behind CB3 plate as shown below. Tie wrap as needed to provide strain relief. This step may need to be performed from rear of HPA cabinet.

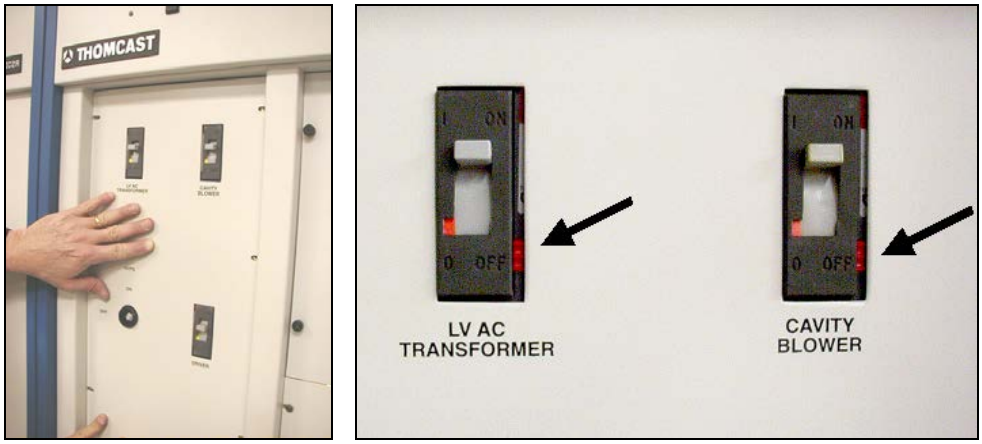


MOM installed with cover held open.

P40, P41, P42. Side panel removed for clarity.

62. Attach CB4 - CB8 line (top) and load (bottom) wires. Tie wrap as needed.
63. Connect CB1 load wires (CB1-2, CB1-4, and CB1-6). The hex bolts must be threaded into washer and ring terminal first, then inserted into CB1, then tightened through front access hole with a 3/16” Allen wrench.
64. Connect CB2 load wires in same manner as CB1.
65. **(COMPACT ONLY)** Connect CB9 load wires in same manner as CB1.
66. **(EXT. DRIVER ONLY)** There will be a blank spot where CB9 would normally be mounted. A filler plate will be installed later in this procedure.
67. Tie wrap wires leading to CB1, CB2, CB9 (where applicable). Avoid securing wires to sharp edges that might wear through insulation.
68. Secure 1/0 harness to rail inside cabinet with cable ties (rear HPA cabinet).

69. Remove four rubber nipples from rear of face panel, place black plastic S1 plate over studs in panel, with “male” part of plastic plate facing forward, and secure with M5 nuts, washers, and lock washers. Care should be taken to avoid stripping embedded studs if any powder coat is present on threads.
70. Temporarily install face panel and ensure that right sides of panel openings for CB1, CB2, CB9 (where applicable) allow sufficient access to trip buttons (colored red and indicated by arrows in photo below). It may be necessary to loosen and move the sub-assemblies to accomplish this goal.



Arrows indicate trip test buttons (colored red)

71. **(EXT. DRIVER ONLY)** Two filler covers are supplied, along with four black button-head screws and Nylock nuts, to plug CB9 opening on non-compact IOX cabinets. Sandwich two covers over CB9 hole: one inside and one outside. The hardware will allow covers to align. Tighten hardware to secure covers.
72. Permanently install face panel and secure with (PN 605141-01) cap screws and (PN 601282-01) nylon washers (10 each). Use 1/8” Allen wrench.

73. Reattach S1 knob and secure with included Phillips screw.

74. Reinstall protective cage in rear of HPA cabinet (if removed earlier). Close cage and install screws.
75. Apply “Modified Per CB3 Mod Kit” label under serial number (S/N) tag in upper left side of the left HPA Cabinet.
76. Retain drawings, parts list, and other documentation from kit for future reference.
77. Procedure complete.

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