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**THIS DATA SHEET CONTAINS AN INSTALLATION CHECKLIST THAT MUST BE
COMPLETED AND RETURNED TO INFO@AVIDCONTROLSINC.COM
SEE APPENDIX A**

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Avid Extreme Inverter – Turbine Upgrade Installation Instructions, APU-G, SWP Type 28

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1. Introduction

- The following procedures are specific to the installation of the AVID AEI900L or AEI1000L liquid-cooled inverter module.
- These procedures detail how to upgrade a Siemens Wind Power 2.3MW Type 28 turbine from GE Power Conversion Delta modules to AEI (Avid Extreme Inverter) modules and associated installation kit.
- For reference, see the following AVID documents which are supplied alongside this Installation Instruction:
 - DTS-MID0012 for additional specifications related specifically to the AEI900L and AEI1000L
 - DTS-02175-ASY-A for additional specifications related to the Auxiliary Power Units

2. WARNINGS

- Always refer to the Cautions and Warnings in the associated MV DELTA and MV3000 manuals when installing / commissioning / fault-finding any system containing an AEI900L or AEI1000L module.
- This equipment may be connected to more than one live circuit.
- **Disconnect all power sources before working on the equipment.**
- **Wait at least 8 minutes after isolating all power sources and check that the voltage between DC+ and DC- has reduced to a safe level before working on the equipment.**
- Surfaces on the coolant pipes can reach high temperatures and remain hot for some time after power is switched off.
- Ensure that all coolant has cooled to a safe temperature, and the equipment is suitably drained and isolated before disconnecting the external pipework from the equipment.
- Figures are for reference only.
- It is recommended that all DC fuses are replaced during this upgrade – see section 6 for further details.
- Appendix A contains an installation checklist for the turbine upgrade. This must be completed and returned to info@avidcontrolsinc.com to activate the individual product warranties for the Avid equipment. Each field in the checklist requires either initials, the recording of specific information (such as parameter values) or “N/A” if not applicable.

3. Tools and Supplies Required

MV3000 Keypad with Cable	Diagonal wire cutters	8mm crescent wrench
Torx T25 Driver	Phillips #2 x 4" Screwdriver	3/16" x 4" Slotted Screwdriver
#3 Pozi-drive Screwdriver	Socket Wrench, 3/8" Drive	Torque Wrench, 3/8" Drive
5mm Socket, 3/8" Drive	8mm Socket, 3/8" Drive	10mm Socket, 3/8" Drive
17mm Socket, 3/8" Drive	Socket Extension 10" Long, 3/8" Drive	Adjustable Crescent Wrench, 1" Jaw Capacity
Laptop with Drive Coach and RS232	10" 1/4" Drive Extension [*1]	1/4" Hex to 1/4" Drive Socket Adapter [*1]
8mm 1/4" Drive Socket [*1]	Digital Voltmeter (DVM)	4 NM Torque Key [*1]
Hydrometer Kit	AEI/Delta Installation Dolly (if available)	Torque Seal [*1]
AEI/Delta Lift Hoist (if available)		

***1: Provided as part of the upgrade kit. Used to secure and torque coolant hose clamps.**

4. Necessary Avid Supplied Bill of Materials

AVID Model Number	Qty.	Description
AEI900L-422100-00-[N]/[S]/[R]*2	6	Avid Extreme Inverter, 900A 690V, Plumbing Option B, without capacitor fans, [N]=New, [S]=Enhanced Reman., [R]=Reman.
OR		
AEI1000L-422100-00-[N]/[S]/[R]*2	6	Avid Extreme Inverter, 1000A 690V, Plumbing Option B, without capacitor fans, [N]=New, [S]=Enhanced Reman., [R]=Reman.
AEI-UPGR-KIT-03	1	AEI Upgrade Kit. APU-G for SWP 2.3MW Type 28 Class Turbines

***2: Depending on the rating of the upgraded turbine, AEI900L or AEI1000L modules may be used**

5. Upgrade Kit Parts List

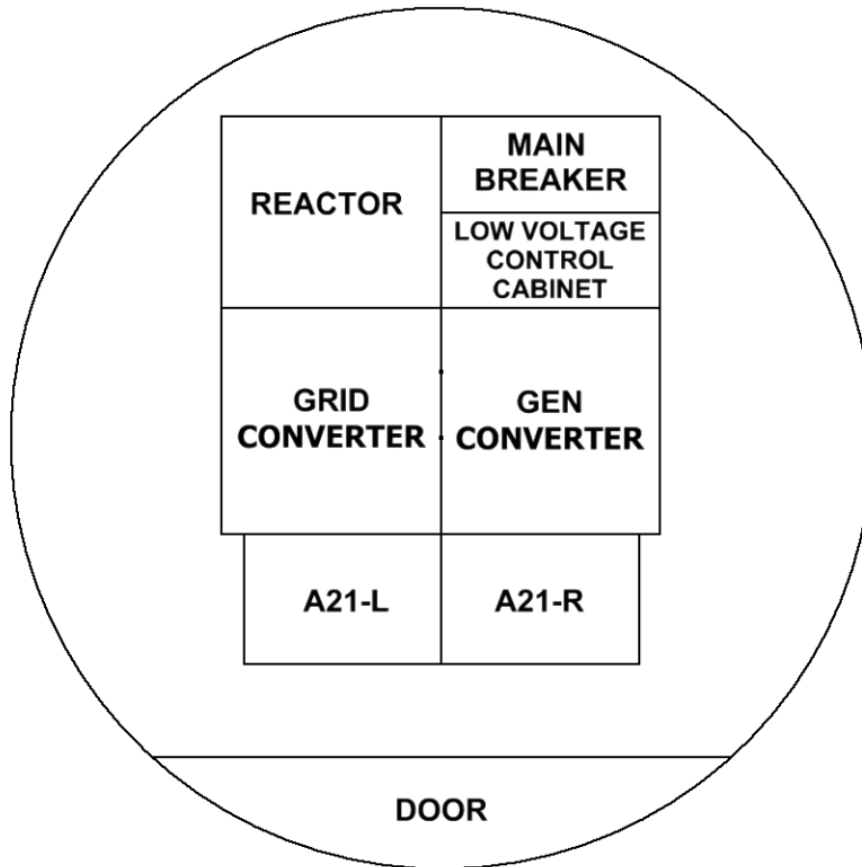
Item Reference	Qty.	Description
1	6	DC/DC Auxiliary Power Unit, Avid Model Number AEI-APU-G-00
2	1	Magnetically Attached Document Envelope
3	2	Identification Label for Upgraded Turbine
4	1	Pack of surface-prep wipes for labels & shrouds
5	8	Warning Label for CDC
6	1	Ribbon cable ground bracket, Grid side
7	1	Ribbon cable ground bracket, Generator side
8	3	Hose, Bottom barb of DELTA/AEI to inlet manifold, Gen. side: 90°, 231mm +206mm
9	6	Hose, Top barb of DELTA/AEI to outlet manifold: 90°, 172mm +103mm
10	3	Hose, Bottom barb of DELTA/AEI to inlet manifold, Grid side: S-bend, 440mm +164mm
11	24	Hose clamps
35	100	11-in black cable ties, 50lb
36	100	5-in black cable ties, 30lb

6. DC Fuses for Inter-Module Connection

- All Siemens Wind Power (and Siemens Gamesa Renewable Energy) 2.3MW and 3.6MW turbines configure the Delta/AEI modules in hard-paralleled “sister” units, with relatively small rating DC fuses to interconnect the “sisters”.
- Experience has shown that these fuses age with time, and that faults in the Delta modules can accelerate this aging – often leading to premature failure.
- It is therefore strongly recommended that these fuses always be replaced when this upgrade is performed.
- Failure to do so may result in failure of the fuses shortly after re-starting the turbine.
- These fuses are standard spares for all wind sites, so are not provided as part of the upgrade kit.

7. Overview of SWP Type 28 Cabinet Layout

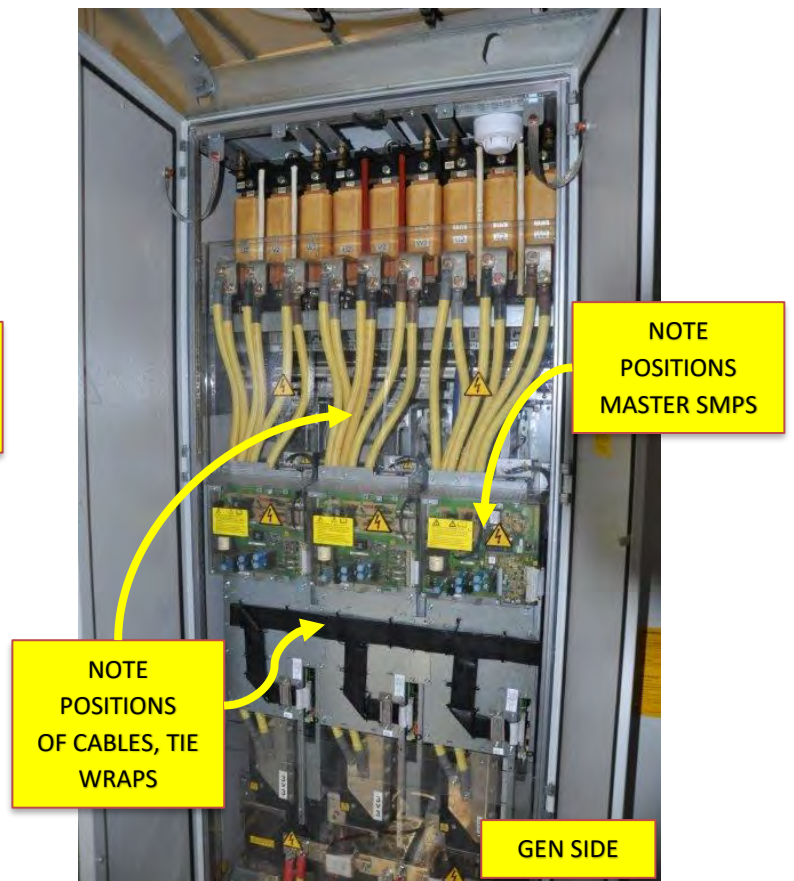
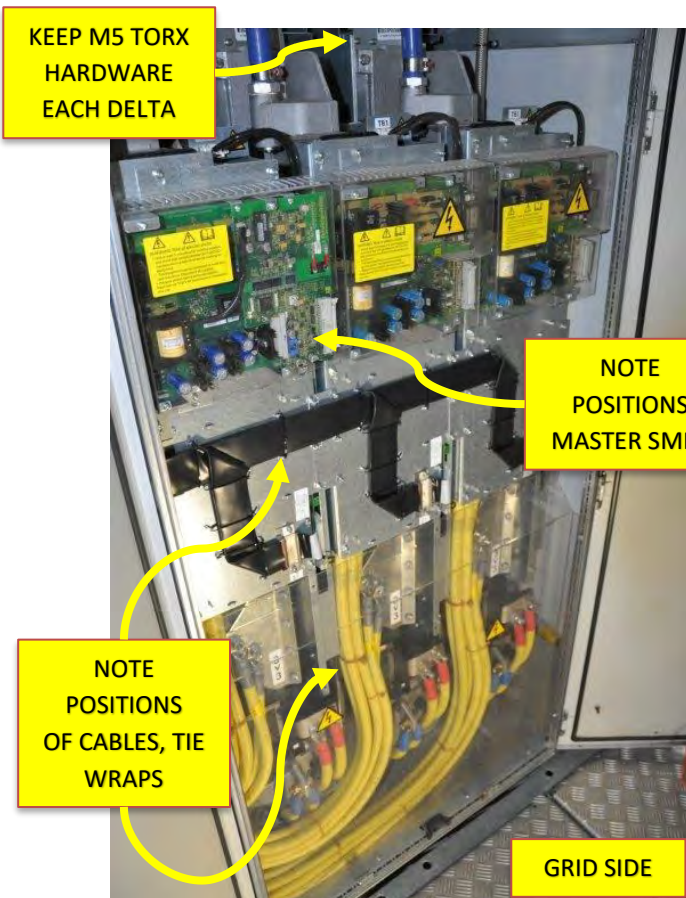
Cabinet Section (See Fig 1)	Contains
REACTOR	Main Grid Reactor
GRID CONVERTER	Grid Deltas and SMPS's
GEN CONVERTER	Generator Deltas and SMPS's
A21-L	Incoming Power for Low Voltage, Large Circuit Breakers & Transformers
A21-R	Fuses, Circuit Breakers, Ethernet & Fiber Optic
MAIN BREAKER	Siemens Control
LOW VOLTAGE CONTROL CABINET	CDC, I/O'S, Power Supply Breakers



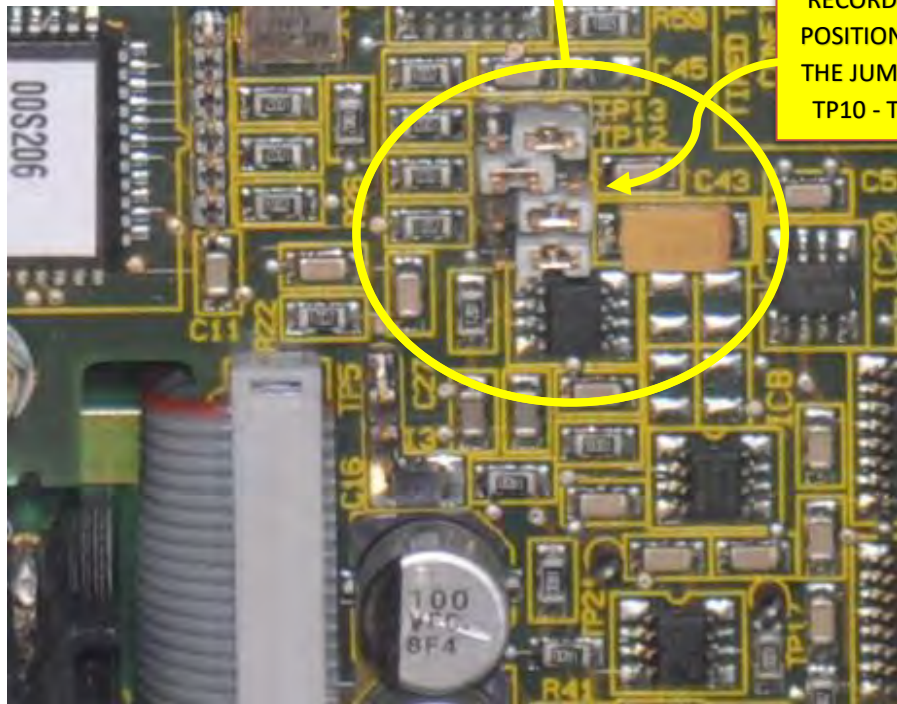
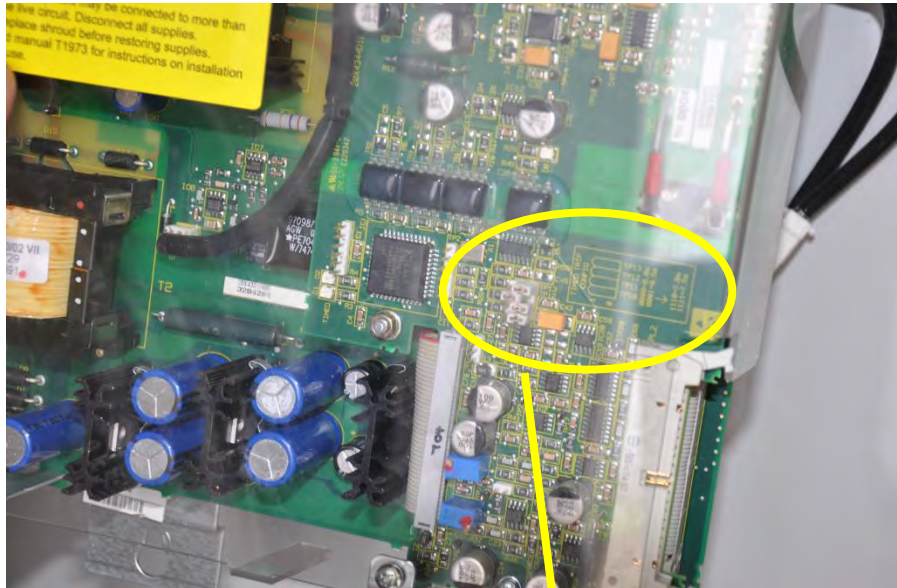
Plan View

8. Prior to Removal of MVDL800 DELTA Modules

- The removal process of the GE Power Conversion MVDL800 Delta modules should follow standard on-site procedures, including:
 - Power shutdown
 - Disconnecting of all electrical power sources
 - Removal of the MVDL800 Deltas
 - Draining of liquid coolant
 - Removal of SMPS
- Before removal of any connections or components, record the positions of the following.
 - All existing cables
 - Note the position of any relevant tie-wraps.
 - Identify the master SMPS for the grid and generator system. The master SMPS is mounted on the Delta module connected to PL2 of the associated CDC.
 - Keep all hardware, nuts, bolts, washers, thread protectors etc.



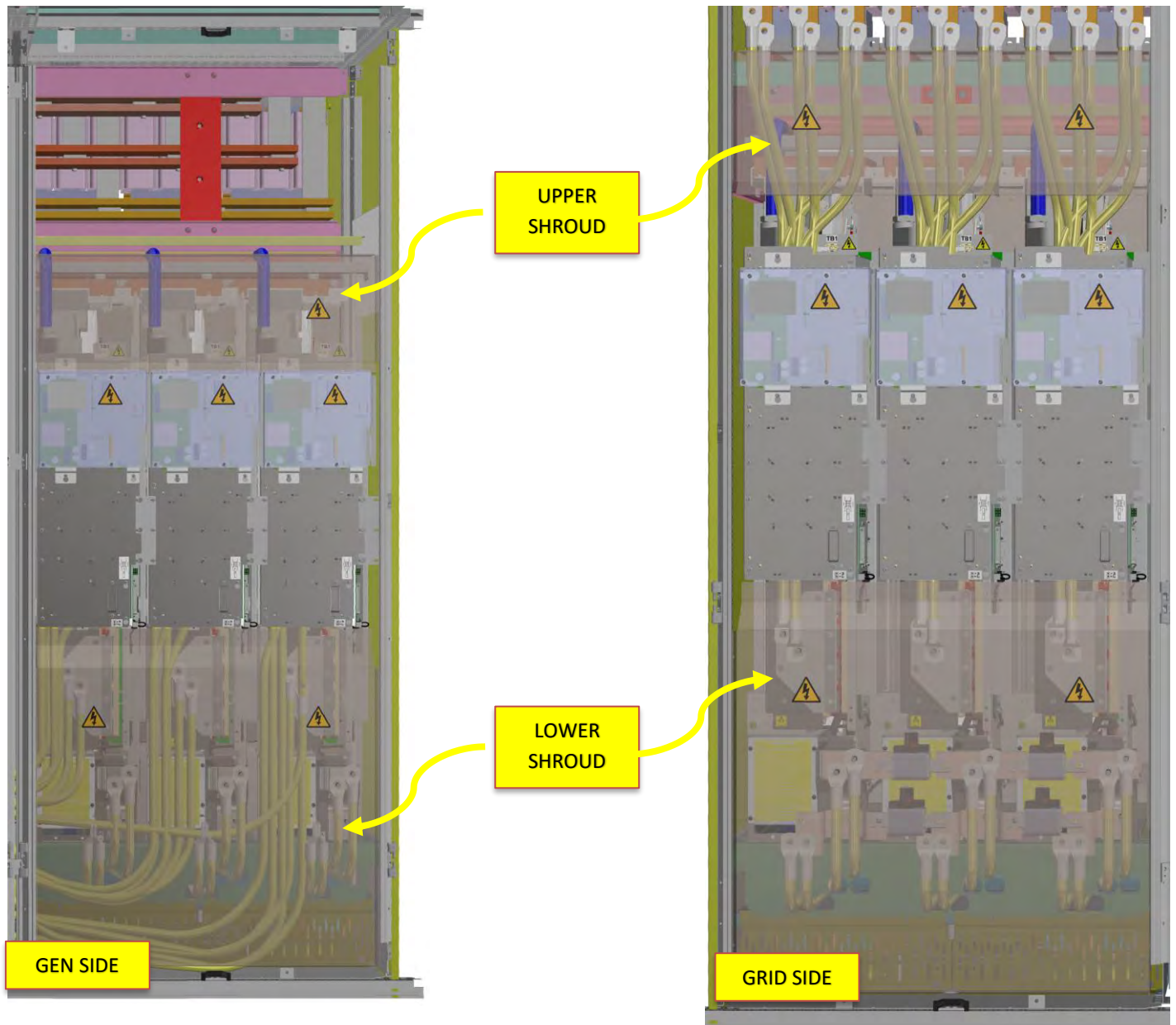
- When removing the Master SMPS(s) record the positions of jumpers TP10 to TP13. These jumpers configure the over-voltage trip behavior. The AEI900L/AEI1000L modules use this information for proper setup.



**RECORD THE
POSITIONS OF
THE JUMPERS
TP10 - TP13**

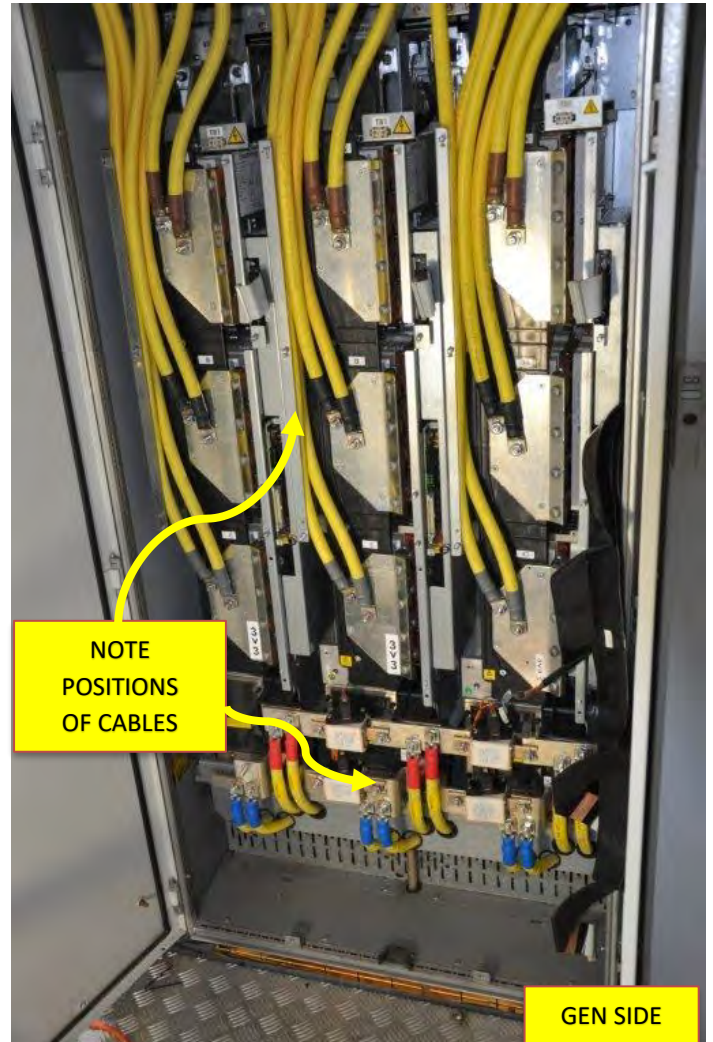
9. Remove, Clean and Retain Cabinet Shrouds

- Remove the upper and lower polycarbonate shrouds from the front of the GEN and GRID cabinets.
- Retain the shrouds for re-fitting after AEI installation.
- Retain the fixing screws.
- **It is highly recommended to clean these shrouds thoroughly before re-installation. A pack of cleaning wipes is included in the upgrade kit.**



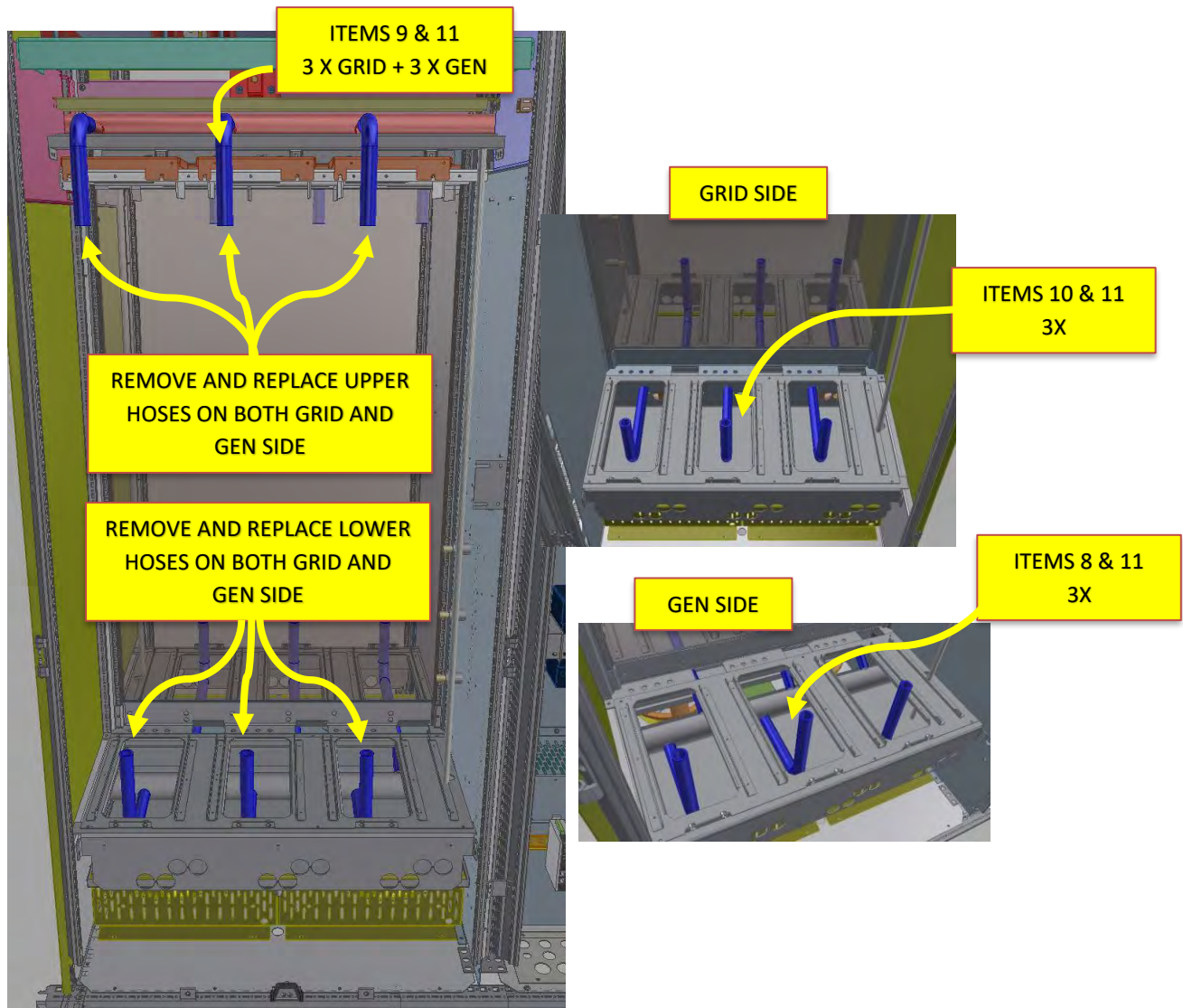
10. Disconnect MVDL800 DELTA Modules

- Disconnect and remove all ribbon cables, carefully retain these for installation of AEI units.
- Remove all SMPS Modules and SMPS mounting plates.
- Carefully note all power cable positions then remove them:



11. Remove MVDL800 DELTA Modules, Replace Hoses

- Remove all DELTA modules as shown, this will allow access to the upper and lower hoses, as shown below.
- Replace all 12 hoses using hoses and clamps provided in the AEI upgrade kit.



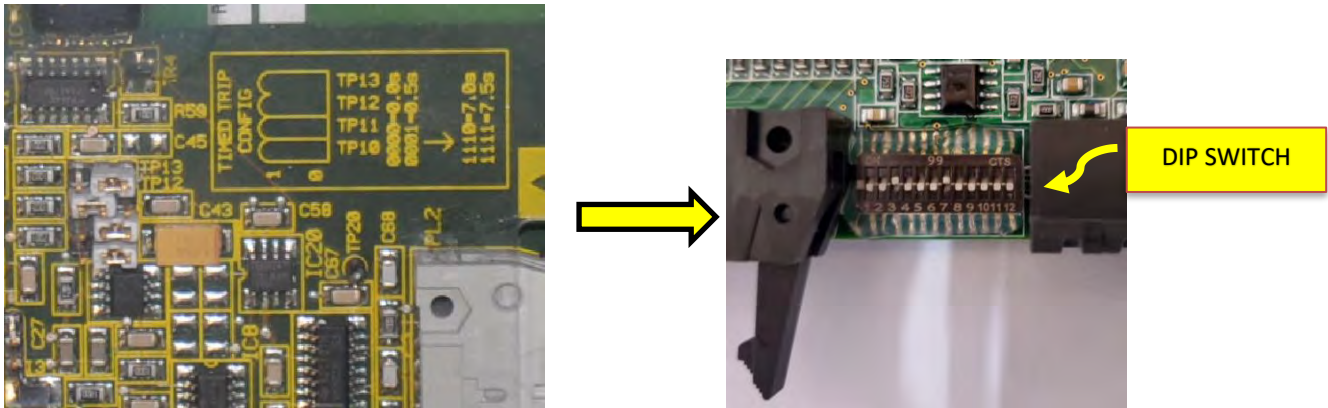
- Ensure that the hose sections that will connect to the barb connections on the AEIs are correctly oriented straight up-and-down as shown above
- Tighten all hose clamps to 4Nm torque. A pre-set torque handle is provided in the upgrade kit for this purpose.

IT IS CRITICAL THAT THE HOSES ARE SECURELY INSTALLED AND THE CLAMPS TIGHTENED CORRECTLY. COOLANT LEAKAGE WILL IRREPARABLY DAMAGE THE INVERTER UNITS.

12. Install AEI 900L/AEI 1000L Modules

- Before the Installation of *each* AEI verify that DIP switches 1-4 (which configure the overvoltage behavior) on each AEI are set to the equivalent time setting as recorded in Step 9 - Master SMPS Jumpers TP10 to TP13

SMPS Jumpers	AEI Switch
TP10	SW1
TP11	SW2
TP12	SW3
TP13	SW4



- Correctly set SW7 for the Compatibility Rating Mode required:

AEI Module Used	Upgraded Turbine Converter Current Rating	Position of SW7
AEI900L	2400 A (as before upgrade)	ON
AEI900L	2700 A	OFF
AEI1000L	3000 A	OFF

- Refer to AVID Document DTS-MID0012 section on User Selectable Options for complete information about these settings.

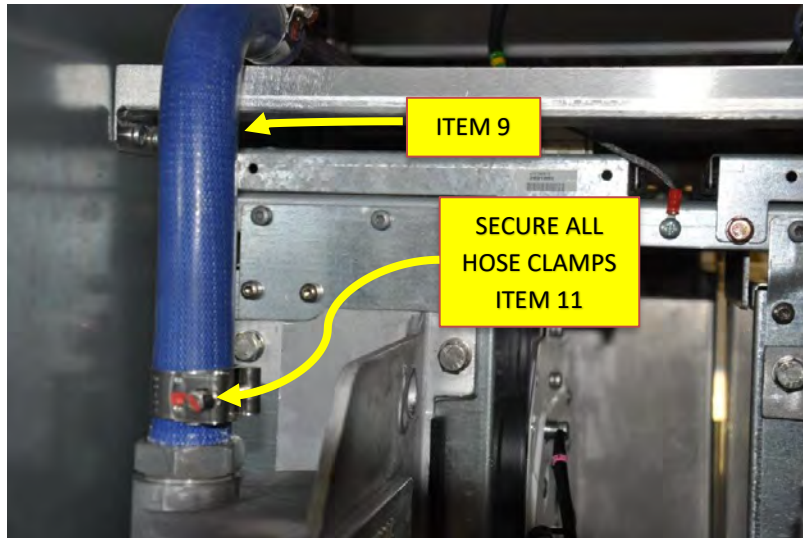
THESE SETTINGS ARE IMPORTANT, THE TURBINE WILL NOT RUN CORRECTLY UNLESS THEY ARE MADE.

- Install the 6 AEIs into the GRID and GEN sides of the cabinet.
- Align with the M5 and M6 mounting locations used by the DELTA modules, firmly secure the AEI units with the M5 Torx screws and M6 bolts/washers retained when the DELTA modules were removed.

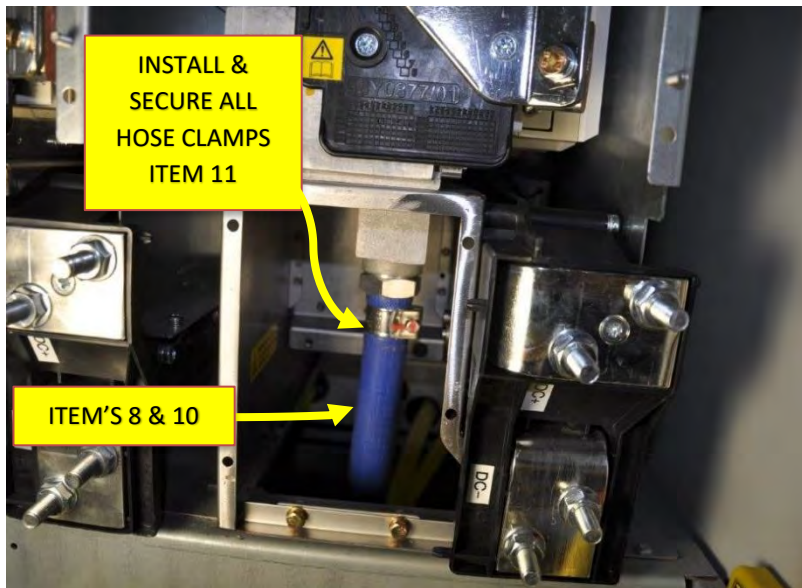


13. Connect Coolant Hoses

- Connect and secure each hose from the outlet manifold to the top barb on all the AEI units

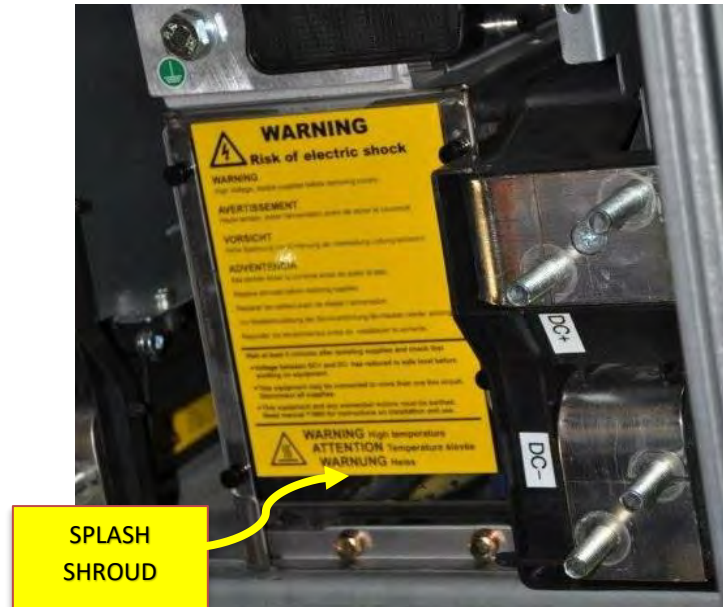


- Connect and secure each hose from the inlet manifold to the bottom barb on all the AEI units



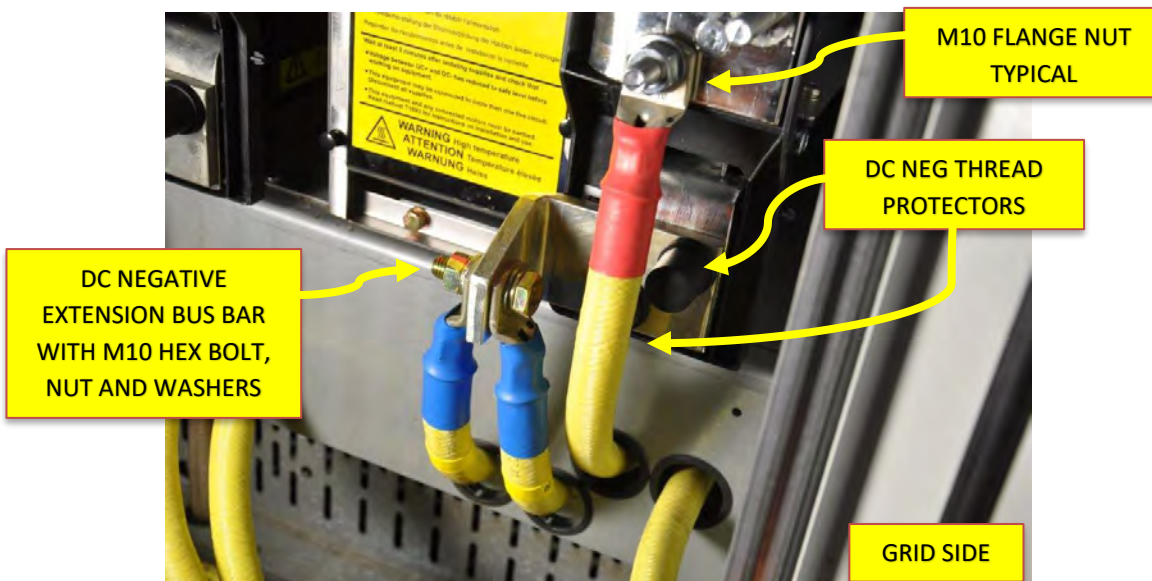
- **Tighten all hose clamps to 4Nm torque. A pre-set torque handle is provided in the upgrade kit for this purpose.**
- **IT IS CRITICAL THAT THE HOSES ARE SECURELY INSTALLED AND THE CLAMPS TIGHTENED CORRECTLY. COOLANT LEAKAGE WILL IRREPARABLY DAMAGE THE INVERTER UNITS.**

- Replace the splash shroud on each AEI

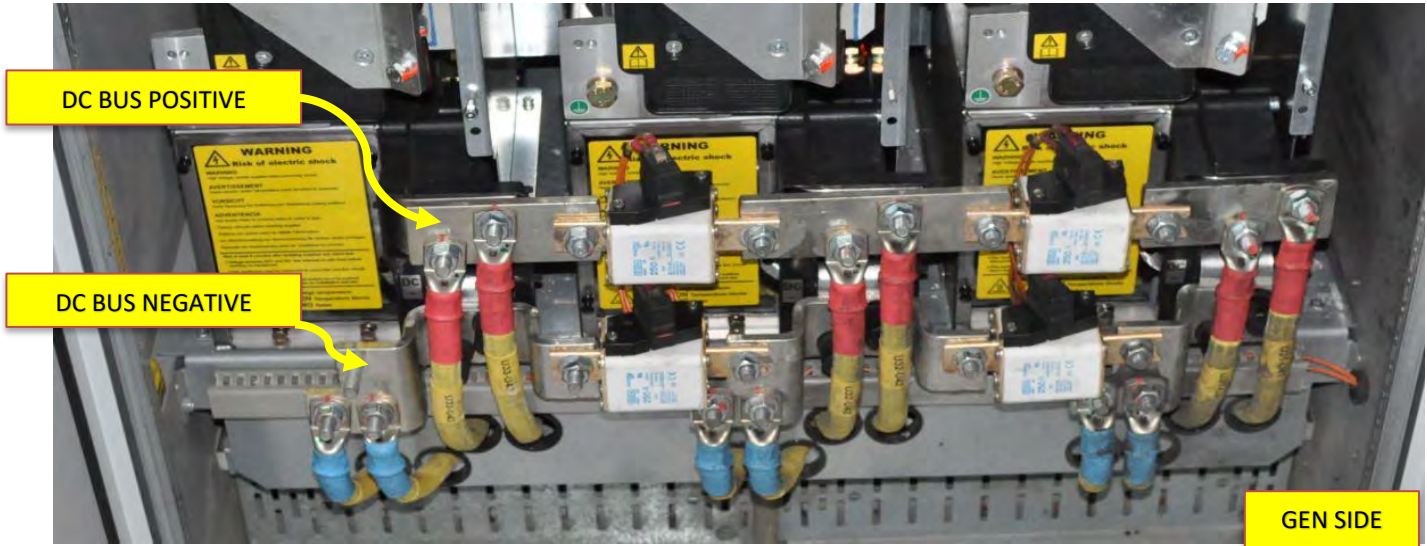


14. Reinstall DC Cables, Busbars and Fuse Links

- On the GRID side: reconnect all the DC negative and DC positive cables to each AEI using the supplied M10 flange nuts and reusing the M10 hex bolt, Hex Nut and Washers on the DC negative extension busbar. Install the thread protectors on exposed DC negative threads to protect the cable from damage or contact. Torque down all connections to 35Nm.

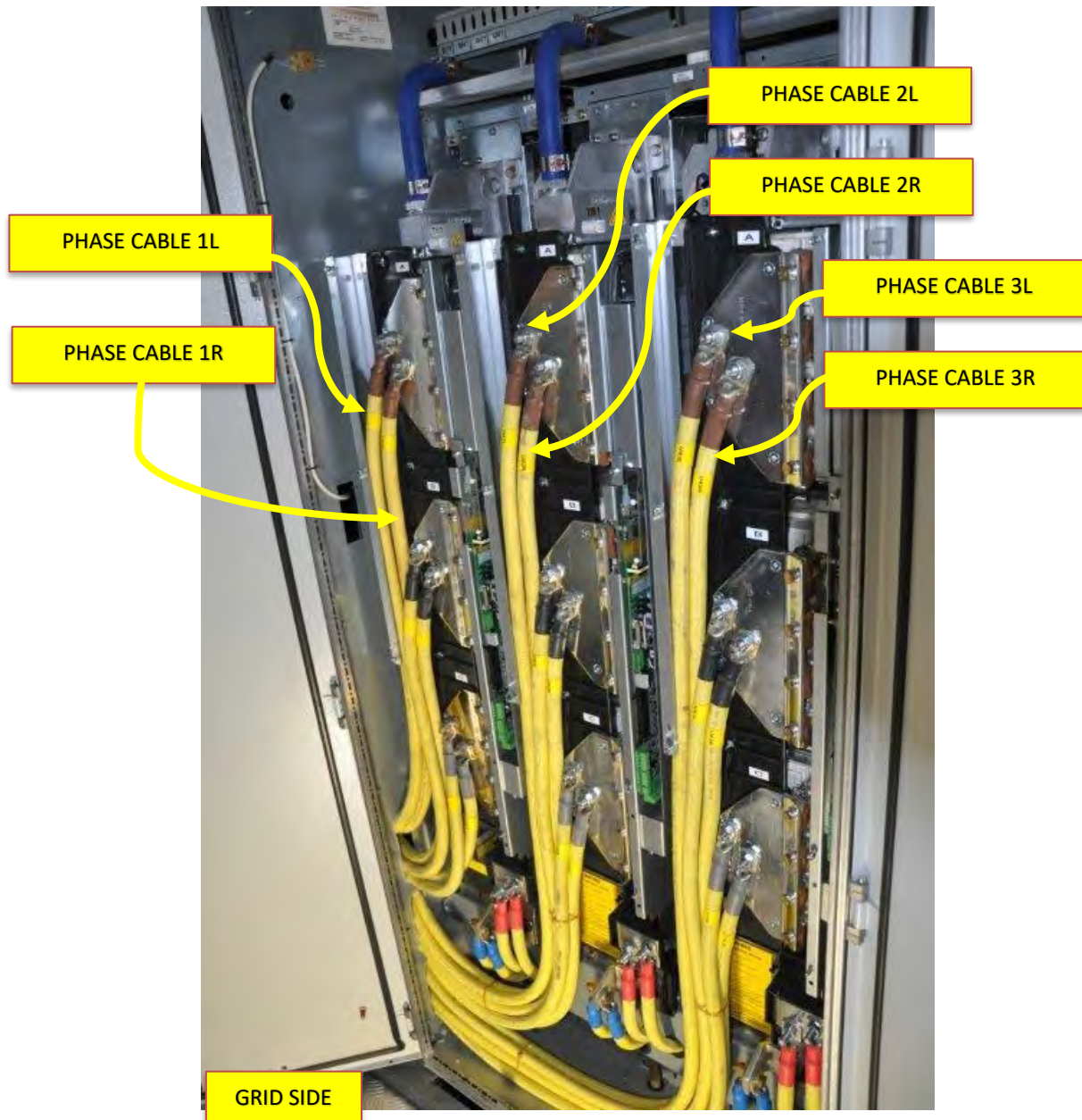


- On the GENERATOR side: reconnect all the DC negative and DC positive cables on each AEI using the supplied M10 flange nuts. Install the DC Link fuse busbar as shown to the DC negative bus and install thread protectors on exposed DC negative threads to protect the cable from damage or contact. Install the DC Link fuse busbar to the DC positive bus as shown. Torque all connections to 35Nm.



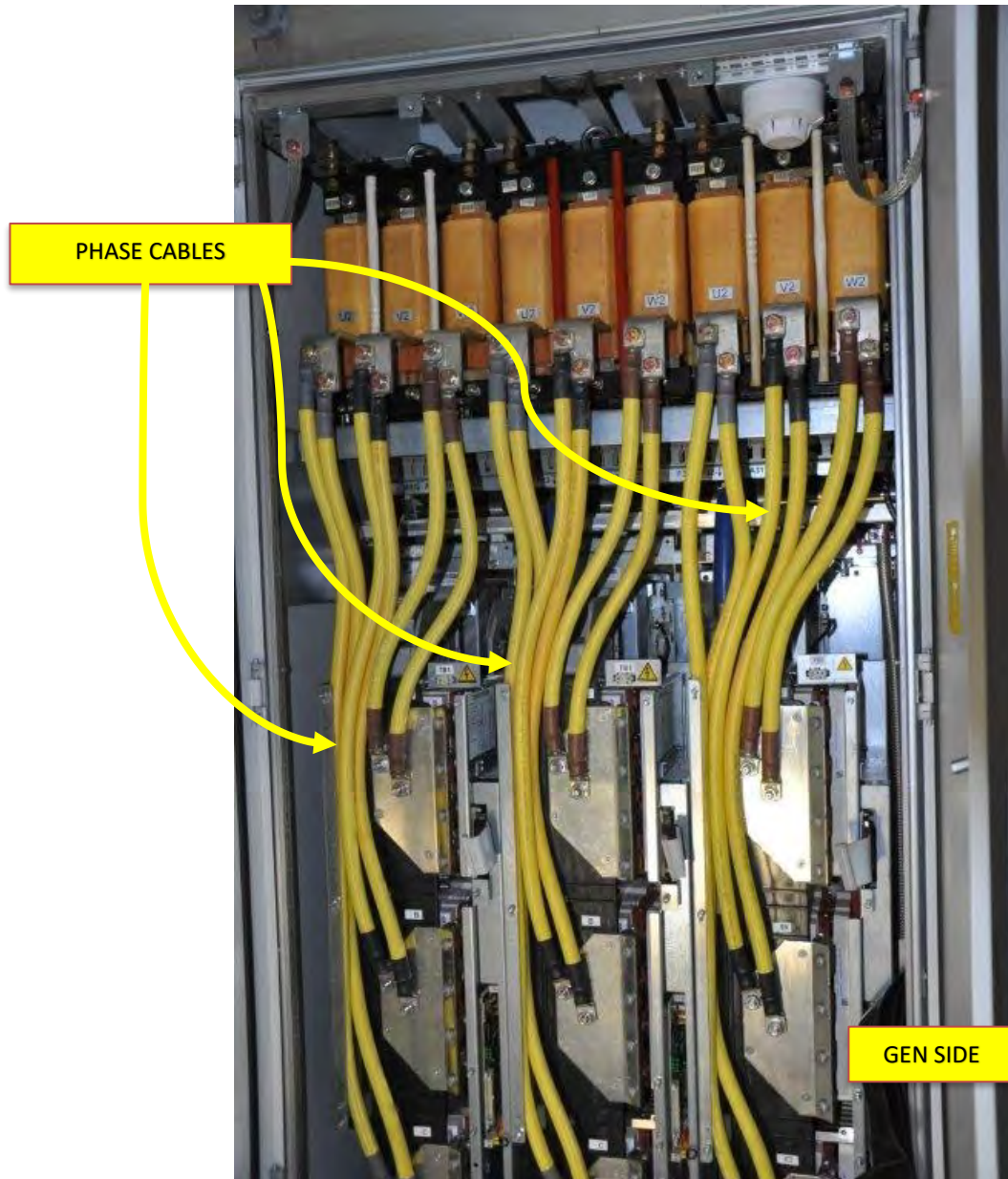
15. Reinstall Grid-Side AC Cables

- Remove the cover plates from each GRID side AEI.
- Reinstall the GRID side AC cables in the same locations identified on removal, using the supplied M10 flange nuts. Torque all connections to 35Nm.



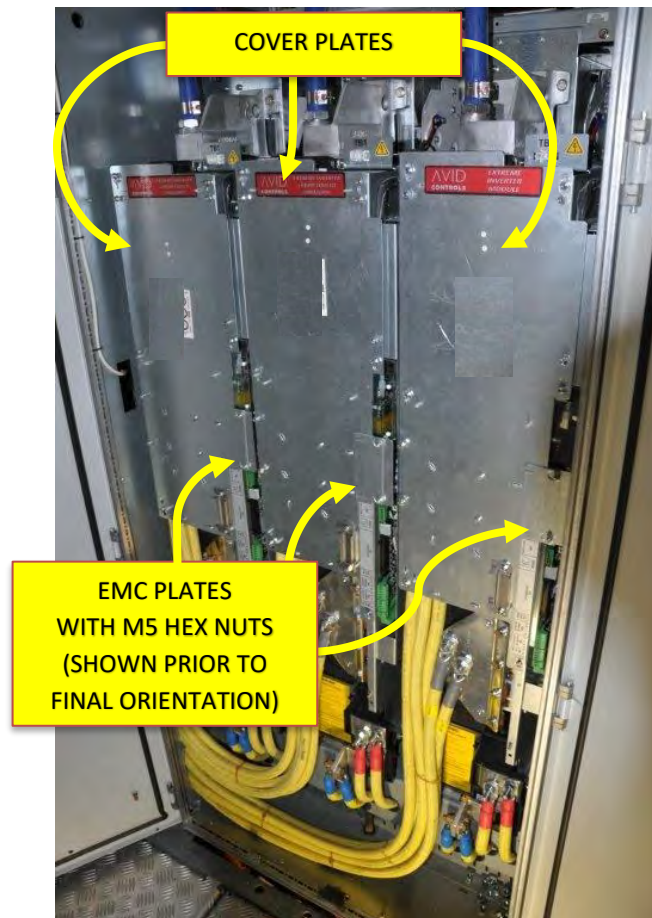
16. Reinstall Generator-Side AC Cables

- Remove the cover plates from each GEN side AEI.
- Reinstall the GEN side AC cables as identified on removal, using the supplied M10 flange nuts. Torque all connections to 35Nm.



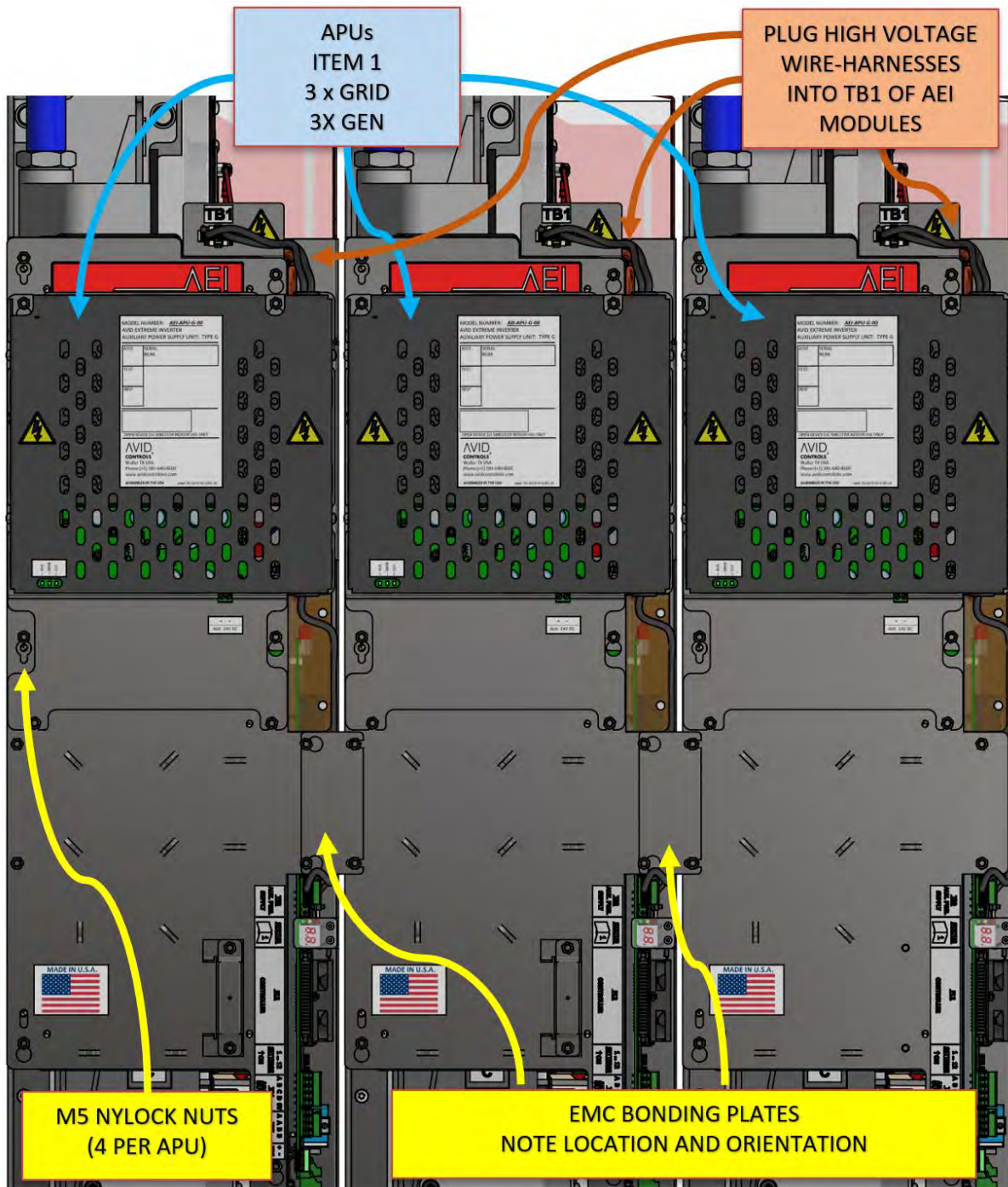
17. Reinstall AEI Cover Plates

- The following steps are the same for both GRID & GEN sides.
- Remount the cover plates to each AEI, as shown. Tighten down all M5 Hex Nuts firmly to secure to the AEI
- Remove, flip, and attach the EMC plates to join each adjacent AEI unit, and tighten down firmly with the provided M5 Hex Nuts

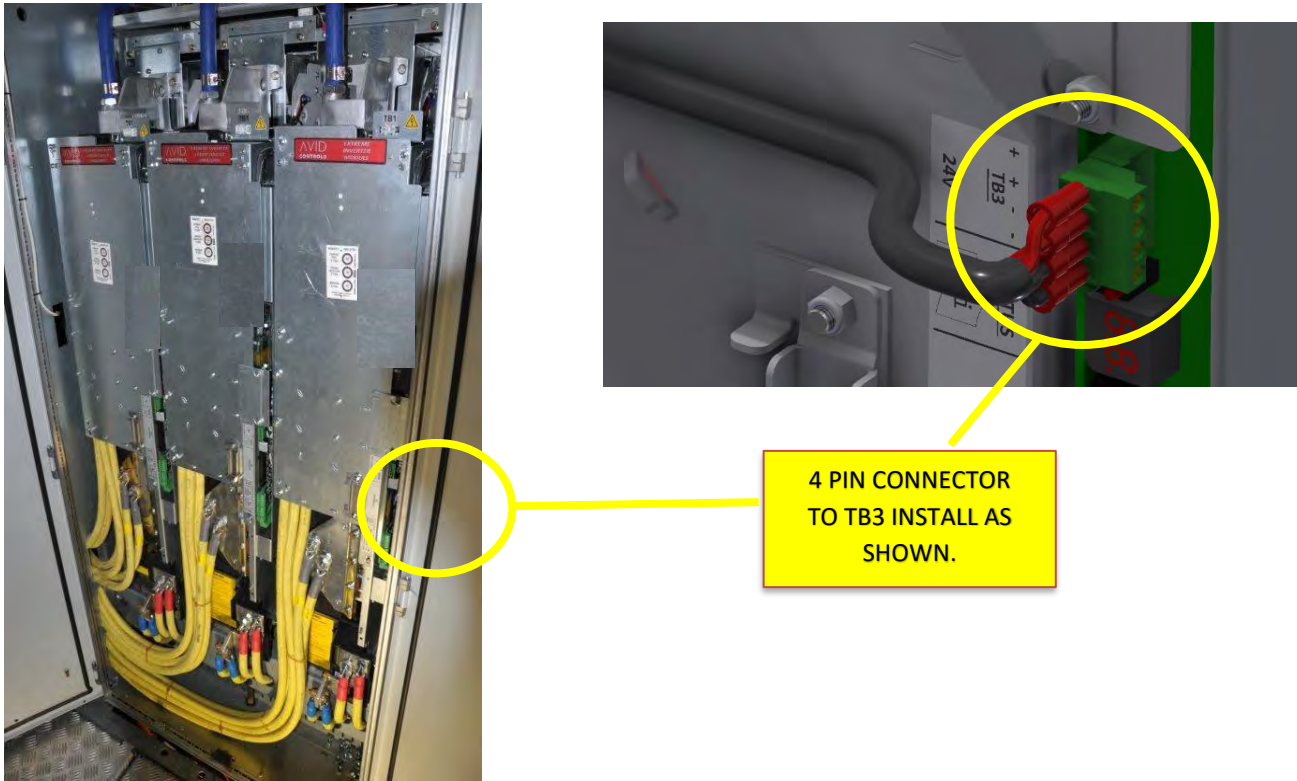


18. Install Auxiliary Power Units

- Mount the Auxiliary Power units onto the AEI Cover Plates.
- Mount the APU units (*Item 1*) onto the AEIs as shown below.
- Tighten the M5 Nylock nuts securely.



- For each APU, plug the 4-pin connector into the corresponding AEI module:

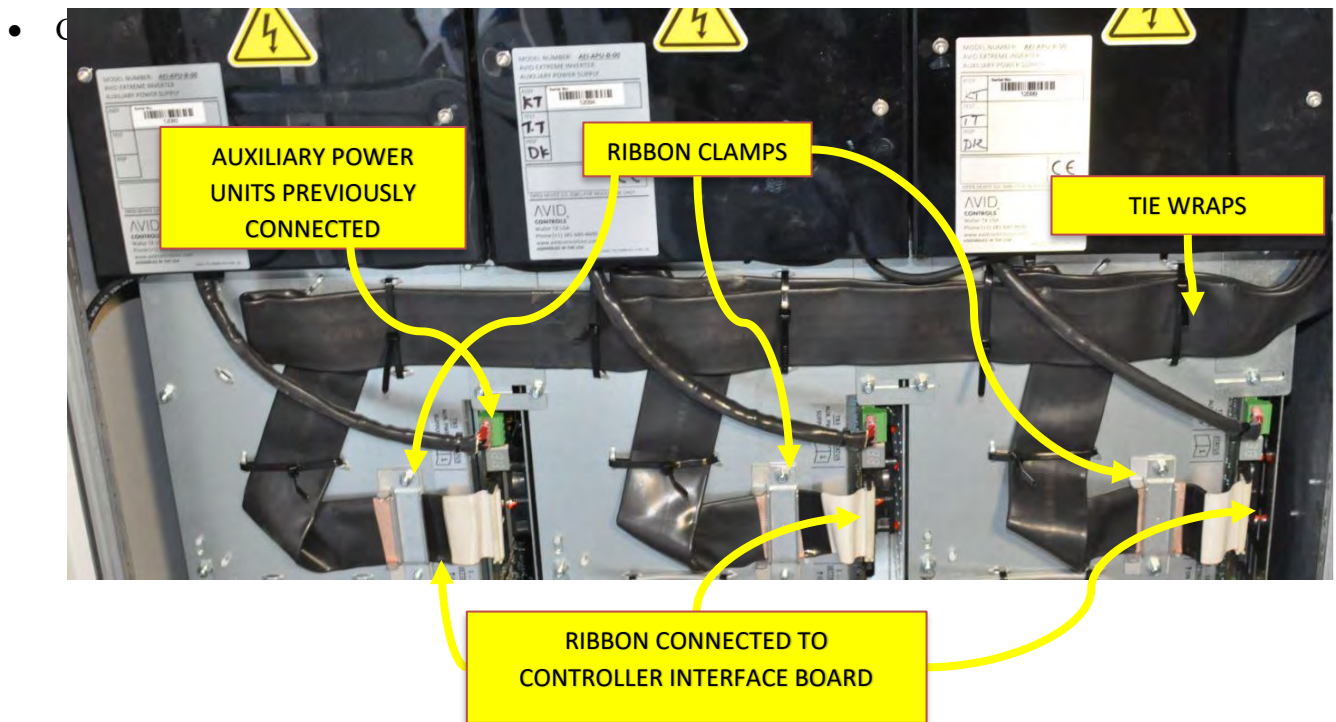


19. Optional Connection of Auxiliary 24VDC Supply to APUs

- The AEI modules and CDCs may be powered from an auxiliary 24VDC supply, connected to the $\frac{+}{-}$ AUX. 24V DC input of the APU-G units.
- **Refer to Section 6 of the Auxiliary Power Unit – Type G Data Sheet (DTS-02175-ASY-A) for complete details.**
- Attention is drawn specifically to:
 - The rating of the auxiliary 24VDC supply must be adequate for the startup current of the AEIs.
 - If the auxiliary 24VDC supply to the APUs is used, it is recommended to disconnect the auxiliary 24VDC supply to the CDCs from TB2 on the I/O panels.

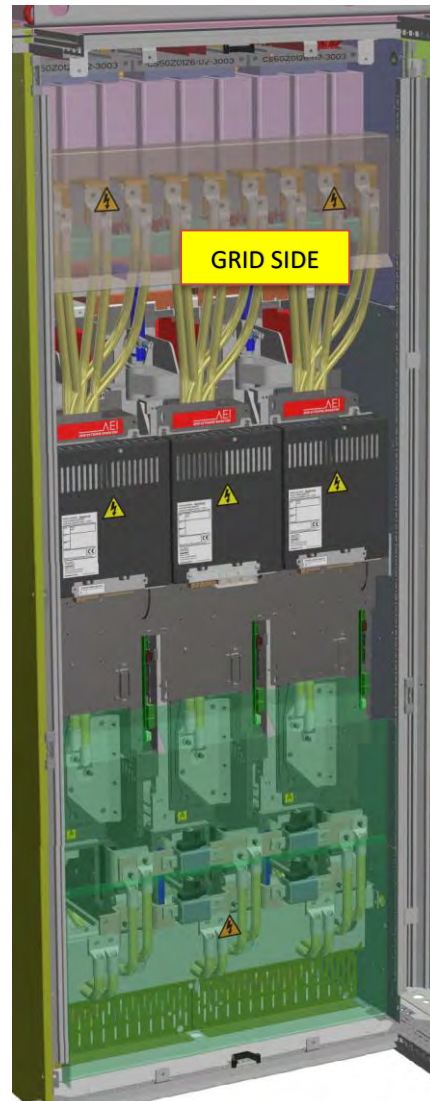
20. Install Ground Brackets and Ribbon Cables

- Install the offset ground brackets (**Items 6 & 7**) to allow the routing of the ribbon cables from the GEN & GRID cubicles into the control cubicle.
- Take care to use the correct bracket for the correct cubicle – they are mirror images of each other:



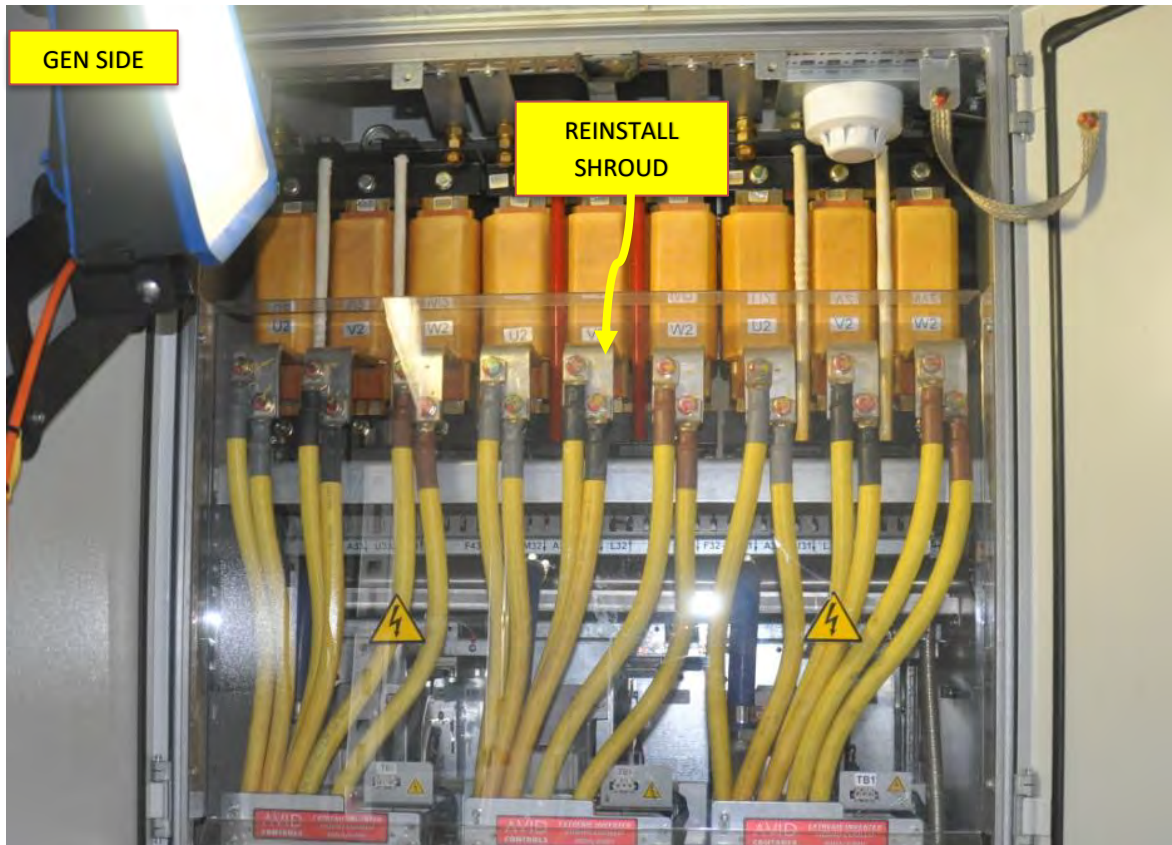
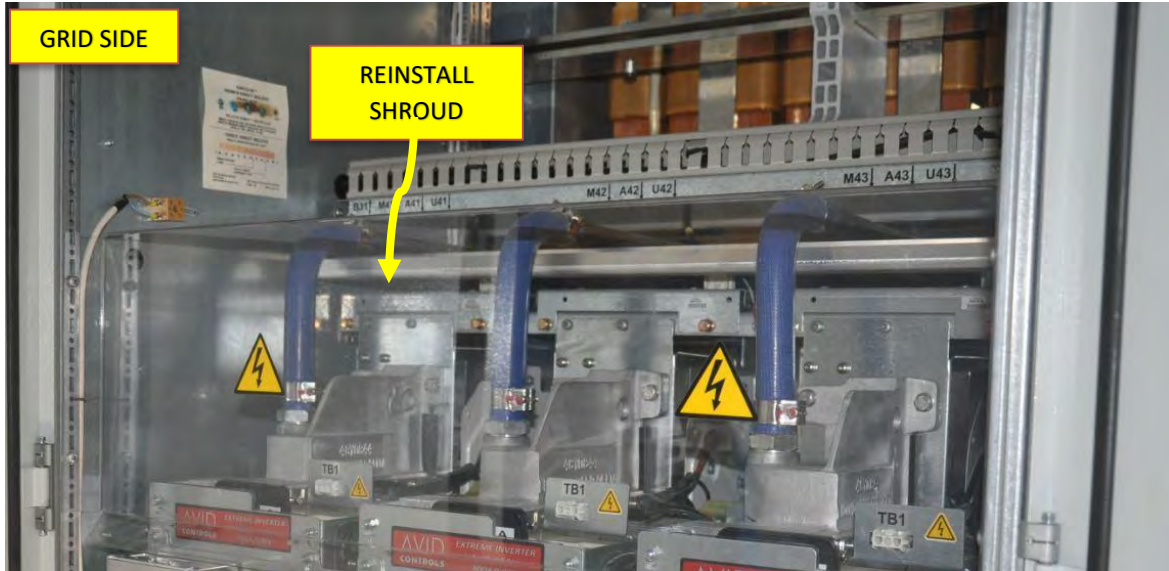
21. Reinstall Lower Cubicle Shrouds

- Referring to the figures below, re-install the two-part polycarbonate lower cubicle into the GEN and GRID inverter cubicles.
- **DEPENDING ON THE EXACT CABINET CONSTRUCTION, IT MAY BE NECESSARY TO REMOVE (BY CUTTING) CERTAIN FLANGES ON THE SHROUDS TO AVOID INTERFERENCE WITH THE AEI OR APU MODULES.**
- **IT MAY ALSO BE NECESSARY TO REMOVE THE PLUGGABLE TERMINAL BLOCKS TB4, TB5 & TB6 FROM THE AEI MODULES. IF THE FUNCTIONALITY PROVIDED VIA THESE TB'S IS REQUIRED, PLEASE CONTACT AVID FOR SUPPLY OF REPLACEMENT SHROUDS.**



22. Reinstall Upper Cubicle Shrouds

- Referring to the figures below, reinstall the polycarbonate upper cubicle shrouds into the GEN and GRID inverter cubicles:

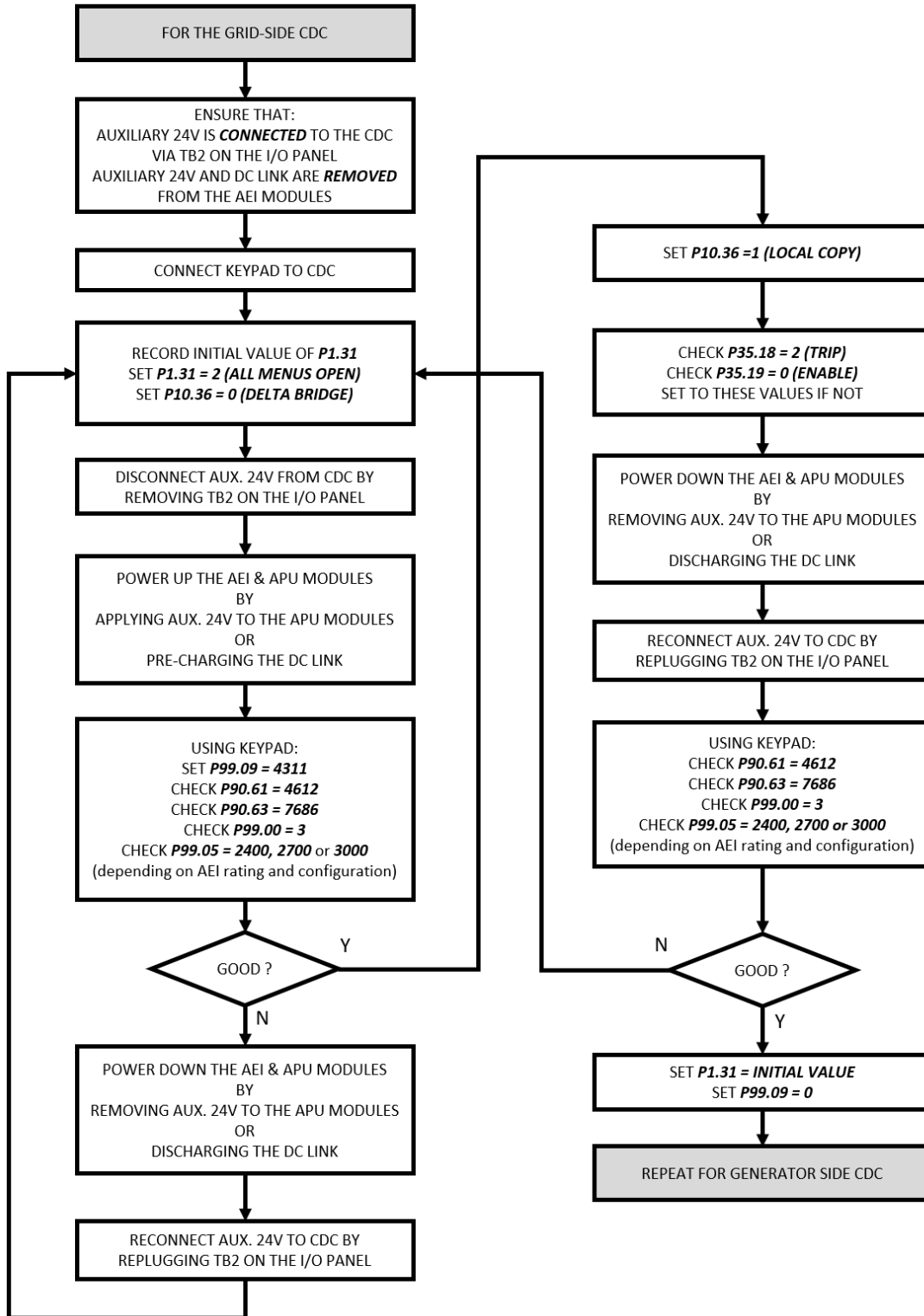


23. Turbine Restart

Background

- In normal operation, the CDC controllers are powered by the auxiliary 24V supply before the main DC link is energized (hence the Delta/AEI modules are not powered). This means that the CDC cannot identify the Delta/AEI modules - leading to faults that interfere with the Siemens control system. To avoid these faults, P10.36 instructs the CDC not to read data from the Deltas/AEIs, but to remember the previously identified values.
- After changing from Deltas to AEIs, it is necessary to perform at least one power cycle with P10.36 set to “Delta Bridge”. This causes the CDC to read the new information from the AEIs. After this has been successfully achieved, P10.36 can be returned to its normal position to avoid the faults prior to charging the DC link.
- It is also necessary to set the active-sharing parameters for the AEI drives to their default values in case they have been changed for the Delta system.
- This procedure will need to be repeated in either the GRID or GENERATOR CDC is replaced at a future date.

Procedure

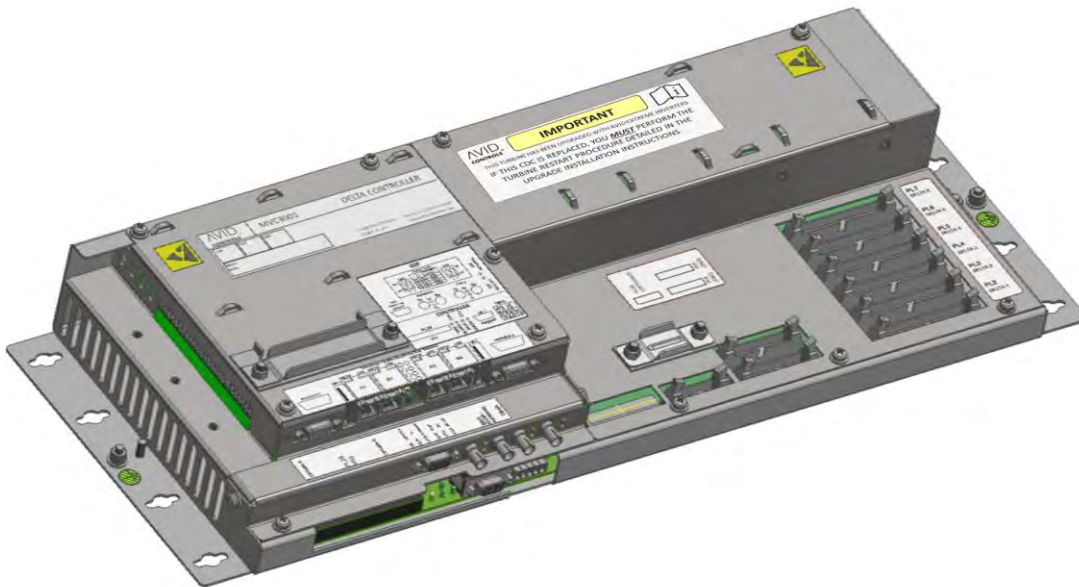


24. Label CDCs

- If at any time a CDC module needs to be replaced with either a brand-new unit, or one that has previously operated with Delta modules, ***IT IS CRITICAL THAT THE ABOVE PROCEDURE IS FOLLOWED FOR THE REPLACEMENT CDC.***
- To help ensure this happens, the upgrade kit includes several copies of this label:



- Which should be attached to BOTH CDCs as shown:



- **Also, temporarily remove the CDCs and attach another copy of this label to the cabinet back-panel underneath the CDC so that it will be visible whenever the CDC is removed.**
- A total of eight copies of this label are provided in the upgrade kit (peelable from a single sheet). Place the sheet with the spare labels into the magnetic envelope provided so that they are available if the CDCs are replaced in the future.

25. Attach Documents for Reference

- Locate the magnetic clear plastic envelope supplied with the upgrade kit.
- Place one copy of the following documents inside:
 - DTS-01776-ASY-A - This Data Sheet
 - DTS-MID0012 - Avid Extreme Inverter Data Sheet
 - DTS-02175-ASY-A - Auxiliary Power Unit – Type G data Sheet
 - PRL-MID0169 - CDC Warning Label (spare copies)
- Attach the envelope to the inside of the control cabinet door:



26. Fit the Upgrade Identification Label

- The upgrade kit includes two weather-proof self-adhesive labels (Item 3) that may be applied to the turbine to clearly indicate that it has been upgraded with Avid Extreme Inverters:



- These may be applied on the interior or exterior of the turbine as-per customer preference (e.g. on the turbine door).
- Surface preparation wipes are also included in the kit.

27. Document Revision History

Rev.	Date	Author	Changes
00	July 19 2021	G. Pace	Document created
01	Oct 22 2021	G. Pace	Minor format changes Correction to turbine restart flowchart Hose torque changed Instructions to set SW7 added
02	Nov 12 2021	G. Pace	Add label to CDCs Further modifications to restart flowchart Polycarbonate shrouds to be re-used Upgrade identification label added Tighten manifold hose clamps before fitting AEIs
03	Mar 24 2022	G. Pace	M10 electrical connection torques changed to 35Nm
04	Aug 1 2022	G. Pace	Appendix A – Installation check-list added
05	Mar 30 2023	G. Pace	Recommendation to replace DC fuses added
06	Dec 12 2023	G. Pace	Added instruction to place label on cabinet back-panel behind the CDCs

28. Appendix A – Installation Checklist

Before Going to Turbine

CUSTOMER:		SITE NAME:	
TURBINE NUMBER:		AVID TECHNICIAN (or N/A):	
CUSTOMER LEAD TECHNICIAN:		DATE:	

All Tools Available:

Item	Initial	Item	Initial	Item	Initial
MV3000 Keypad with Cable		Diagonal wire cutters		8mm crescent wrench	
Torx T25 Driver		Phillips #2 x 4" Screwdriver		3/16" x 4" Slotted Screwdriver	
#3 Pozi-drive Screwdriver		Socket Wrench, 3/8" Drive		Torque Wrench, 3/8" Drive	
5mm Socket, 3/8" Drive		8mm Socket, 3/8" Drive		10mm Socket, 3/8" Drive	
17mm Socket, 3/8" Drive		Socket Extension 10" Long, 3/8" Drive		Adjustable Crescent Wrench, 1" Jaw Capacity	
Laptop with Drive Coach and RS232		10" 1/4" Drive Extension [*1]		1/4" Hex to 1/4" Drive Socket Adapter [*1]	
8mm 1/4" Drive Socket [*1]		Digital Voltmeter (DVM)		4 NM Torque Key [*1]	
Hydrometer Kit		AEI/Delta Installation Dolly (if available)		Torque Seal [*1]	
AEI/Delta Lift Hoist (if available)					

[*1] : These items are provided as part of the AEI upgrade kit



Avid Extreme Inverter – Turbine Upgrade Installation Instructions, APU-G, SWP Type 28

At Turbine, Before Removing Deltas

CUSTOMER:		SITE NAME:	
TURBINE NUMBER:		AVID TECHNICIAN (or N/A):	
CUSTOMER LEAD TECHNICIAN:		DATE:	

Status of Turbine:

Turbine Faults (if applicable)
(blown fuses, tripped breakers, system fault codes etc.):

Visible Damage (Before Removing Deltas)
(Damaged cables or ribbons, missing hardware, coolant leaks etc.) :

Check coolant with hydrometer and record result
If out of specification, coolant must be replaced before installation of AEI units:

Hydrometer Reading: _____ Units: _____ In Spec ? : _____

Customer Lock-out Tag-Out Procedures complete: _____ System safe voltage checks AC & DC complete: _____

Position of all cables, ribbons, tie-wraps etc. recorded: _____

Identify and record GEN side master SMPS jumper settings (jumper 10-13) and record below:

Jumper 10: _____ Jumper 11: _____ Jumper 12: _____ Jumper 13: _____

Identify and record GRID side master SMPS jumper settings (jumper 10-13) and record below:

Jumper 10: _____ Jumper 11: _____ Jumper 12: _____ Jumper 13: _____

After Installation, Before Power-On

CUSTOMER:		SITE NAME:	
TURBINE NUMBER:		AVID TECHNICIAN (or N/A):	
CUSTOMER LEAD TECHNICIAN:		DATE:	

CHECK ITEM	Grid Position 1	Grid Position 2	Grid Position 3	Gen Position 1	Gen Position 2	Gen Position 3
AEI Serial #						
APU Serial #						
DIP Switches ON (circle those that are ON)	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6
	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9
	10 11 12	10 11 12	10 11 12	10 11 12	10 11 12	10 11 12
Power Terminal Torque set to 35Nm and sealed	Aph #1					
	Aph #2					
	Bph #1					
	Bph #2					
	Cph #1					
	Cph #2					
	DC+ #1					
	DC+ #2					
	DC- #1					
DC- #2						
Pull-test control wires						
DC fuses replaced						
Ribbon clamps secure and not damaging insulation						
Coolant hoses torqued to 4 Nm using torque-key						
All wires/cables correctly tie-wrapped						

Turbine Restart Checklist

CUSTOMER:		SITE NAME:	
TURBINE NUMBER:		AVID TECHNICIAN (or N/A):	
CUSTOMER LEAD TECHNICIAN:		DATE:	

All air purged from cooling system: _____ No coolant leaks detected: _____

Check and record the final values of the following parameters etc. for both GEN and GRID CDC:

Parameter Etc.	Expected Value	GEN Value	GRID Value	Notes
P99.00	3			
P99.05	2400, 2700 or 3000			Depends on AEI type and setting
P10.36	1			
P35.18	1			
P99.09	0			Return to zero <i>after</i> restart procedure
P1.32	Customer Preference			Return to its original value <i>after</i> restart procedure
CDC Part Number				
CDC LED Shape	Round or Square [R/S]			
CDC Firmware Version				
Parameter Set File				

