

Advantages of a Remanufactured MV3000 Delta Module from Avid Controls

The purpose of this document is to outline the advantages of the Avid Controls GE/Converteam MV3000 remanufactured Delta modules, compared to merely repairing or replacing only the components that are defective on Delta modules. The prominent and most important point is that **Avid** is the only Original Equipment Manufacturer (OEM) authorized and **licensed by GE to manufacture and/or remanufacture the MV3000 product line**. Avid is the only OEM that has the complete GE/Converteam detailed design, manufacturing and testing documentation. Avid's years of experience with the MV3000 product line, in numerous applications, allows us to understand and improve the manufacturing processes to prevent potential issues, but even more so to implement an improvement to the design. The following are a few areas which describes the intensive steps taken during our remanufacturing process:

- Avid completely disassembles and tears down the incoming cores. We do not reuse any fasteners, O-rings or active components; these are discarded. The passive components recovered must be cleaned following detailed standard procedures which include ultrasonic cleaning and steam cleaning with de-ionized water and environmentally accepted solvents.
 - We DO NOT just clean the area of a failure and repair. Historical data collected shows a repaired unit will show leakage during hi- potential testing over 100X greater than the completely cleaned remanufactured units. We feel that the Avid remanufactured Deltas are as good as or better than a new Delta and we put our warranty behind this claim.
- During the Avid remanufacturing process, all parts are reconditioned and ONLY passive parts are reused. These passive parts are ONLY used if the parts meet and/or exceed the original GE/Converteam manufacturing test specifications.
 - No other company except Avid and GE has access to these manufacturing test specifications.
- Avid purchases all components from the same exact suppliers as original OEM (GE/Converteam).
 - No other companies are allowed to purchase these original OEM parts
- Avid replaces all three (3) IGBT packs (SKiiP) on a Delta, no exceptions.
 - Others replace only the damaged SKiiP. The remaining SKiiPs can be stressed during the failure of another SKiiP within the same delta.
- Avid performs a test to verify the delta T (difference in temperature) of the IGBTs. We exceed the GE specifications on allowable delta T and do NOT accept IGBTs that exceed this new higher Avid standard even though allowed by GE.
 - No other manufacturers or repair facilities do this test nor have this test specification. Not even GE.
- Avid uses the latest GE specified SKiiP 3V3D+ IGBT pack from Semikron.
 - The SKiiP 3V3D+ is a proprietary IGBT exclusively sold to ONLY AVID and GE.

- SKiiP 3V3D+ have been a 15-year evolution with improvements and better reliability due to specifications required and changes made with AVID/GE/Converteam guidelines.
 - Corona free ceramics/ special insulation on the DC outputs/Burn-in testing/ matched silicon wafers/ etc...
- No other company can offer this device; they use the older standard SKiiP 3V3 IGBT pack from Semikron.
 - The SKiiP 3V3s have a higher mortality rate than the more reliable SKiiP 3V3D+
- Avid changes all three (3) IGBT O-rings. This seals the SKiiP cooling plate to the Delta casting.
 - Changing these O-rings prevents premature leakage failures.
 - Repair Facilities that do not change all three (3) IGBTs do not change all three (3) O-rings
- Avid has engineered and calculated a way to test the life of the electrolytic power capacitors.
 - All capacitors reclaimed are put through stringent and documented testing to confirm and verify the life expectancy by measuring resistance.
 - Avid will only reuse capacitors that show a minimum of 80% or more of the designed 20-year life remaining. Each capacitor is labeled with specific serial number with all test results recorded and maintained as part of the QMS System per ISO 9001:2015.
 - All capacitors that do not show at least 80% life are discarded and not placed into the remanufacturing process.
 - Avid is the only company that has the know-how and testing plan in place to predict the life of electrolytic capacitors used in the MV3000 product.
- Avid performs and documents voltage balancing tests on every assembled remanufactured Delta.
- Avid performs high-potential testing on all electronic and power circuits. We measure the leakage current to 3.8kV to meet or exceed the requirement per the GE/Converteam original manufacturing test specification with all documented test results maintained as part of the QMS System per ISO 9001:2015.
- Avid exceeds the GE test specifications for casting pressure testing. Avid discovered the GE specified pressure test was not effective and did not catch all of the potential issues; therefore, Avid has modified and exceeds the GE pressure testing specifications in order to catch any potential failures using accurate operating pressure in an effort to prevent any in-field issues during normal use.
- Avid full load tests each Delta at 110% current for 30 minutes after stable temperature of IGBTs takes place. We used 50 deg. C temperature-controlled coolant (50% De-

Ionized water and 50% glycol). We also test run a motor with every remanufactured delta.

- IGBT Manufacturer reports they historically have approximately 7% of the IGBTs fail on the test stand during the specific GE required burn-in. The extended Avid testing further eliminates the change of an IGBT failure after delivery.
- All electrical connections and fasteners are tightened using computer operated Smart-Tools. Avid uses these Smart-Tools to ensure we precisely meet the GE torque specifications. The machines record and print receipts confirming the torque on every fastener which becomes a part of the unique serialized remanufactured delta product documentation package maintained as part of the QMS System per ISO 9001:2015.
- Any remanufactured delta shipped from Avid has several value-added items which include:
 - Lexan barrier under the capacitor bank. This barrier protects the delta from the heat generated by the capacitor bank which removes a failure mode that could occur in hotter operating climate.
 - Avid requires that the voltage sharing resistors maintain a smaller variance between the phases. We will not pass test for any delta that does not maintain voltage sharing within our variances, which is much tighter than factory standard. We feel this prevents over/undervoltage failures during operation.
- Avid stands behind every remanufactured delta offering the same 12/18 standard warranty as our newly manufactured units. As long as the proper dry-out procedures are followed upon start-up after lengthy shut down as required by the turbine manufacturer.

Avid's environmentally conscious manufacturing process.

During our remanufacturing process, we reclaim approximately 40-60% of the passive components within the delta core exchange units being returned. With these parts renewed through our very extensive processes, as mentioned above, we are performing closed-loop recycling which is considered the primary type of recycling. Closed loop recycling is a process where items are collected, processed (recycled) and then used again to make the same product it came from. This process is restorative and regenerative by design and aims to keep materials at their highest quality. Although our costs are approximately the same as new, once we have completed the process, we are doing our part for the environment. We not only reduce Avid's carbon footprint, but that of the Renewable Energy Sector in the USA, Denmark, UK and Germany, just to name a few.

SOME OF THE BENEFITS REALIZED BY USING AVID REMANUFACTURED PRODUCTS

- Reduces the amount of waste sent to landfills and incinerators
- Conserves natural resources such as timber, water and minerals
- Prevents pollution by reducing the need to collect new raw materials
- Saves energy



Recycling includes the three steps below, which create a continuous loop, represented by the familiar recycling symbol.



Step 1: Collection and Processing – achieved by Avid as we accept the delta cores from our customers and return to our facility for processing.

Step 2: Manufacturing – achieved by Avid once we have reclaimed and processed the renewed components and complete the assembly, testing and packaging of a remanufactured delta unit.

Step 3: Purchasing New Products Made from Recycled Materials – achieved by all of Avid customers that choose to purchase our remanufactured products and turn in their core to maintain the continuous loop of the recycling process.