

Direct-Air Cooled vs. Conduction Cooled Traveling Wave Tube Amplifiers (TWTAs)

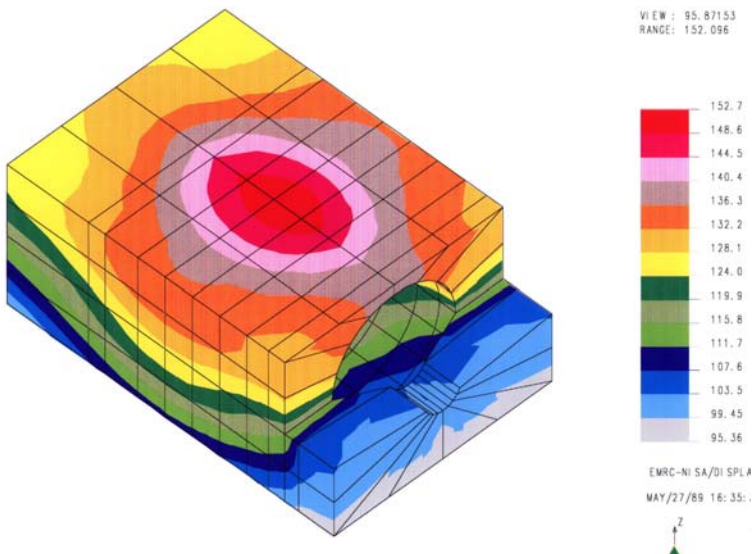
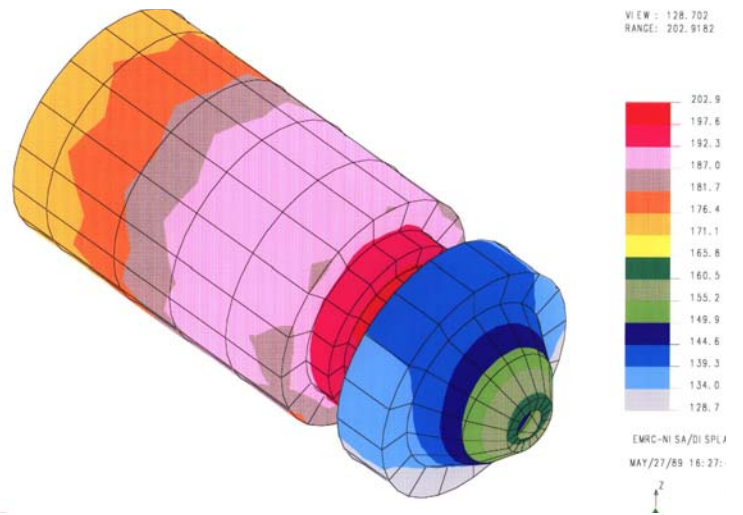
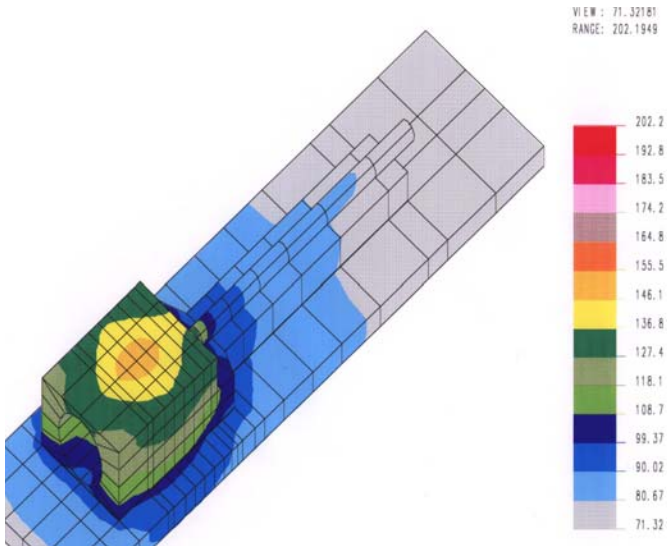
Both direct air-cooled and conduction-cooled traveling wave tubes are used in communications amplifiers. However, superior performance is obtained in CPI's 700/750 watt indoor TWT amplifiers by using direct air cooled technology. This technology, also used for klystron amplifiers, is known for its high reliability.

Direct air-cooled devices are more efficient in utilizing the cooling medium than conduction-cooled devices. The technical reason for the improvement is because the heat exchanger on an air-cooled TWT is directly coupled to the source of heat as opposed to a conduction cooled HVED where the exchanger is remotely located from the source of heat. This is illustrated in the attached diagrams (see attached pages). In the example we have identical collectors, inlet air temperature and air flow rates. It is clear that the air-cooled unit operates cooler given this set of conditions. One additional concern is that of the operating temperature of the output body and output waveguide. Because of the highly effective thermal separation between the collector and the output body in the direct-air cooled device the body and waveguide run at substantially lower temperatures.

The delta T between the collector and the output body in an air-cooled device may be -10 deg. C. where in a conduction cooled device the delta T is +20 deg. C. This 30 degree C advantage for direct air cooling dramatically improves the Mean Time Before Failure (MTBF). As a general rule of thumb, the reliability of electronic devices is reduced by 2x for every 20 degree C temperature rise. The 30 degrees C advantage for CPI's direct air cooling translates to a theoretical 3x improvement in length of life. In practice, a 50% improvement is typically realized.

In summary, the direct-air cooled TWT design is technically superior to the conduction cooled design. This advantage translates to substantially improved reliability and life.

MODEL OF CONDUCTION-COOLED COLLECTOR



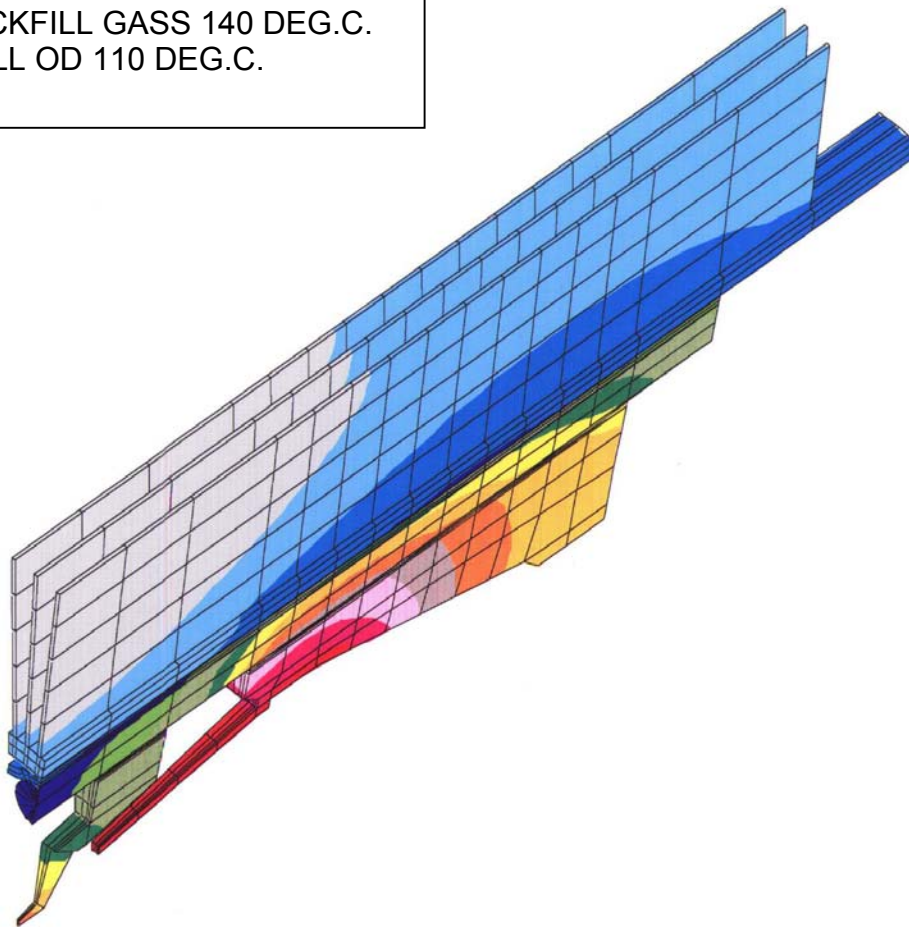
INLET AIR TEMP 55 DEG. C.
AIR FLOW RATE 150 CFM
DISSIPATED POWER
FIRST STAGE 75 WATTS
SECOND STAGE 1300 WATTS

MAXIMUM TEMPERATURES
CORE 203 DEG. C.
BACKFILL GASS 192 DEG.C.
COLL OD 152 DEG.C.

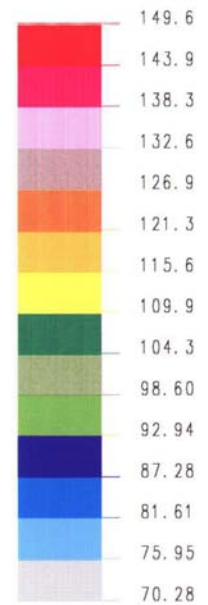
MODEL OF AIR-COOLED COLLECTOR

INLET AIR TEMP 55 DEG. C.
AIR FLOW RATE 150 CFM
DISSIPATED POWER
FIRST STAGE 75 WATTS
SECOND STAGE 1300 WATTS

MAXIMUM TEMPERATURES
CORE 150 DEG. C.
BACKFILL GASS 140 DEG.C.
COLL OD 110 DEG.C.



VIEW : 70.28304
RANGE: 149.5807



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