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# Department of Environmental Protection

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DARM-OGG-07

**SUBJECT:** Guidance on Rate of Operation during Compliance  
Testing for Combustion Turbines

**DATE :** March 1, 2000

This memo is to provide guidance on determining the rate of operation during compliance testing for combustion turbines (CTs).

The mass throughput rate of combustion turbines is inversely proportional to temperature and humidity measured at the CT inlet as a result of the changing air densities encountered. Inlet air temperature is the predominant factor; therefore, higher temperatures will result in a lower heat input rate (MMBtu/hr) and vice versa. The temperature is referenced to the CT inlet temperature rather than ambient temperature, as some CTs are equipped with inlet air conditioning systems (e.g., chillers or evaporative coolers) to maintain optimum operating temperature. Inlet air temperature and ambient temperature are equivalent in cases where no conditioning systems are used. Variations of heat input (capacity) are to be expected due to the range of ambient temperatures and humidities encountered in Florida. Over the usual operating ranges, the CT operating curve (capacity vs. inlet air temperature) is essentially a straight line.

The determination of the rate of CT operation during compliance testing is illustrated in the following example. The heat input limit is often referenced to 59°F, and in this example, corresponds to 750 MMBtu/hr (Point A). On the date that compliance testing is conducted, the average ambient (or conditioned) air temperature during the test period is determined to be 80°F. According to the attached curve, the maximum design heat input rate achievable is 700 MMBtu/hr (Point B). The CT has successfully achieved 90 percent of its maximum permitted capacity for this temperature if it is determined to be operating at 630 MMBtu/hr or more (Point C). In this example, the dashed line represents 90 percent of the maximum heat input value achievable over a range of inlet air temperatures. Heat input may vary depending on CT characteristics; therefore, manufacturer's curves for correction to other temperatures shall be provided to the Department, if a source intends to use the curves for compliance purposes. At the request of a permittee, the following conditions may be incorporated into the construction and corresponding operating permits:

1. An owner or operator may use manufacturer's curves or tables in determining the maximum heat input or fuel usage rate for compliance testing. These curves or tables relate compressor inlet conditions to heat input or fuel usage rate and are part of the permit. The data shall have a resolution of 1% of the maximum heat input or fuel usage rate. Inlet condition monitoring shall

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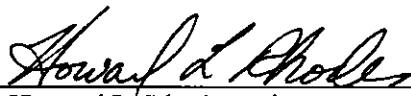
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include compressor inlet temperature with optional monitoring of inlet pressure and/or moisture levels when these parameters are also used to correct heat input or fuel usage rate.

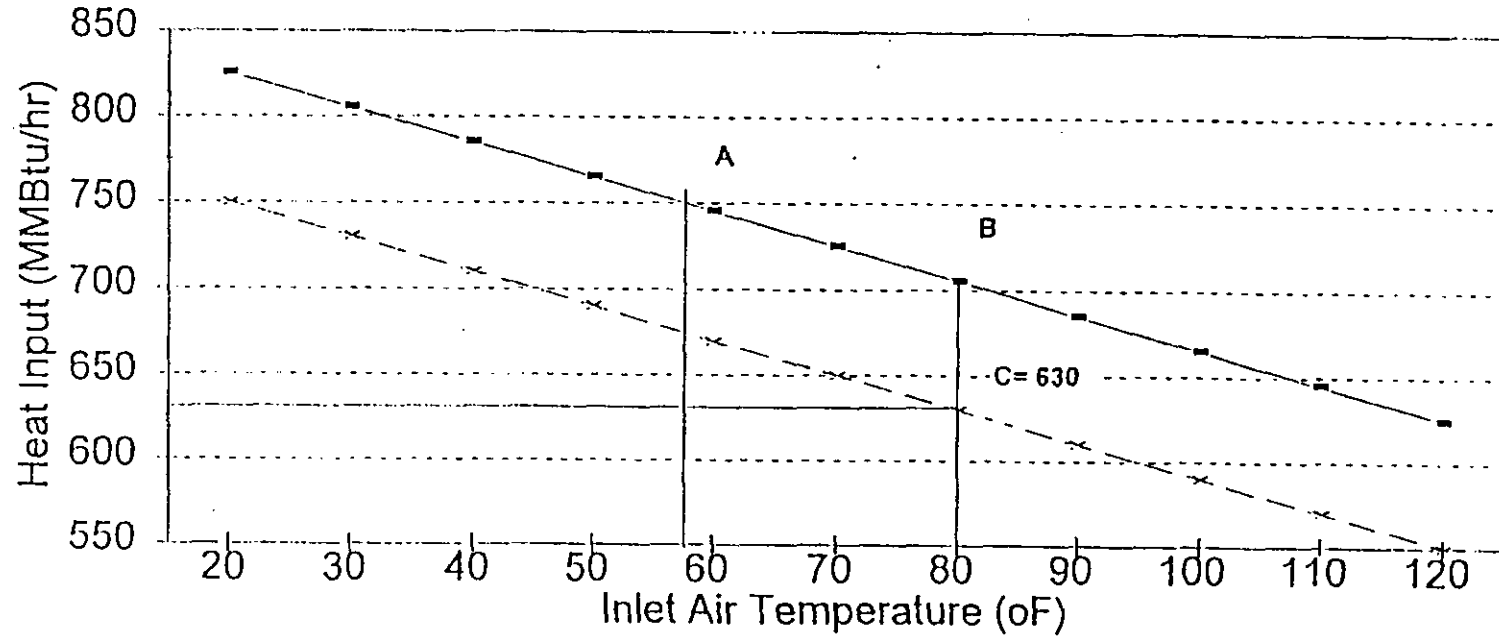
2. Compliance testing of emissions shall be conducted with the combustion turbine operating at capacity. Capacity is defined as 90-100 percent of the manufacturer's rated heat input achievable for the average compressor inlet conditions during the test. If it is impracticable to test at capacity, then combustion turbines may be tested at less than capacity. In such cases, the entire curve or table shall be adjusted downwards by the increment which reflects the reduced rate of operation at which compliance was demonstrated. This increment is equal to the difference between the manufacturer's heat input or fuel usage value and 110 percent of the value reached during the test. In this case, the data and calculations necessary to demonstrate the heat input or fuel usage rate correction shall be submitted to the Department with the compliance test report.

3. To demonstrate compliance with 40 CFR 60.330 federal New Source Performance Standard (NSPS) Subpart GG - Standards of Performance for Stationary Gas Turbines, an initial test shall be conducted at four load points and corrected to International Standards Organization (ISO) conditions for comparison to the NSPS allowable. Subsequent annual compliance tests conducted to establish compliance with NO<sub>x</sub> limits that are more stringent than the NSPS standard shall not require an ISO correction or testing at four load points; rather, the testing shall be conducted at capacity, as defined above. However, when the Department has reason to believe that NO<sub>x</sub> emissions exceed an applicable NO<sub>x</sub> standard (based on emissions data from CEMS or stack testing, or based on fuel quality) the Department may require that the company conduct emissions testing at four loads as required in Subpart GG.



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COMBUSTION TURBINE OPERATING CURVE  
 FUEL HEAT INPUT vs. INLET AIR TEMPERATURE



--- 90% of Maximum Operating Level --- Maximum Operating Capacity