



DATE: May 22, 2014

SUBJECT: TURNDOWN RATIOS

Since 1965, ThermoTek has been a leading manufacturer of direct-fired make-up air systems. One of the major advantages of direct-fired equipment is its high turndown ratio. Understanding turndown ratios and how they change is critical for understanding the performance of the equipment.

The turndown ratio is defined as the maximum to minimum BTU output. ThermoTek direct-fired makeup air units are capable of a maximum 30:1 turndown ratio. This means the burner can modulate between 3.33% and 100%, given the BTU requirements. Higher turndown ratios allow the unit to respond appropriately to a greater range of outdoor conditions.

The actual turndown ratio is calculated by taking the ratio of the design maximum to minimum BTU. The example shown in Table 1 compares the maximum to minimum BTU for two different burners. Since the minimum firing rate is lower on the 48" burner, it is capable of a higher turndown ratio. As engineers design these systems, they must pay special attention to the burner selected in order to maximize the turndown ratio.

**Table 1: Effects of Burner Size on Turndown Ratio**

(Design BTU calculation based on 20,000 CFM unit with 100 °F temperature rise)

Burner Size (inches)	Minimum Firing Rate BTU	Design BTU	Turndown Ratio (Design BTU: Min BTU)
48	85,333	2,172,000	25.45:1
60	103,666	2,172,000	20.95:1

Turndown ratios are also affected by VAV systems. As the air volume decreases with a VAV system, the maximum firing rate is reduced and the minimum firing rate is held constant. As seen in Table 2, this change in firing rates ultimately reduces the turndown ratio of the system.

**Table 2: Effects of VAV on Turndown Ratio**

(Design BTU calculation based on 100 °F temperature rise)

CFM (cubic foot/minute)	Minimum Firing Rate BTU	Design BTU	Turndown Ratio (Design BTU: Min BTU)
8800	48,666	962,400	19.78:1
7000	48,666	768,000	15.78:1
6000	48,666	660,000	13.56:1