



OVERSIZING TERMINAL UNIT PRODUCTS

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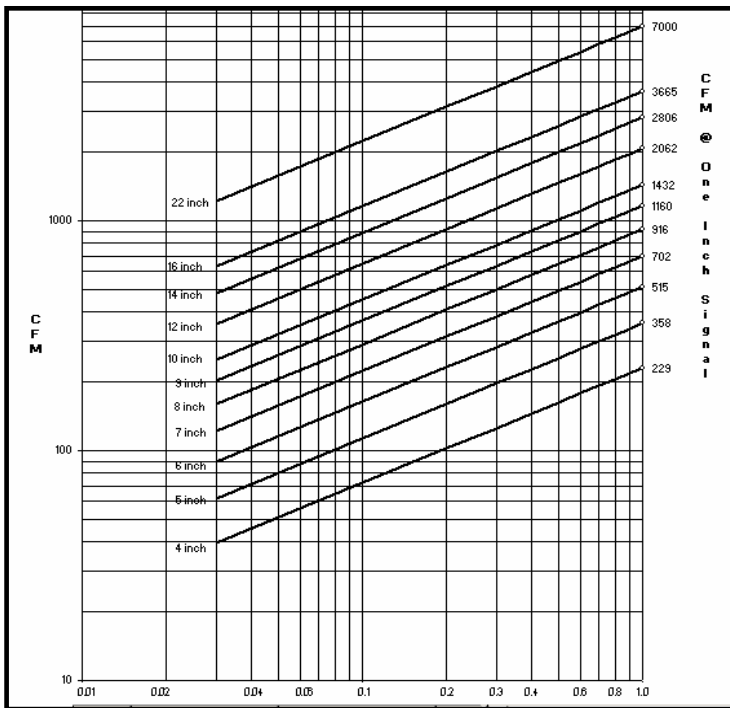
OVERSIZING TERMINAL UNIT PRODUCTS

Oversizing terminal unit products can be a serious design mistake. In most cases, terminal units should be sized to perform at as close to their maximum capacity as possible. The idea of oversizing the terminal unit for benefit of reduced noise and/or pressure drop may not be the best decision in a properly designed system.

There are a number of problems that occur due to oversizing. Some can be alleviated, or at least the severity may be reduced at additional expense, others cannot. The increased material cost that oversizing requires will not be addressed; although, it should be a major concern to the purchaser.

Oversizing an air terminal unit product severely affects the control of the unit. Many standard pressure independent controllers provide less than acceptable control at very low airflows. Most modern DDC units respond to an inlet airflow sensor pressure differential that range from zero to one inch of water column (0.00" Ps – 1.00" Ps). Terminal units should be selected at CFM values, which will take advantage of as much of the available range as possible to get the best control performance of the unit.

Notice on the attached calibration chart that the catalogued maximum CFM value of each terminal unit size (based on approximately 2600 feet per minute inlet velocity and the averaging type inlet sensor) occurs at approximately 1" Ps differential between the high and low pressure sensor tubes.



A terminal unit sized for the maximum rated CFM and a zero minimum CFM would be close to an ideal selection. If a terminal unit is chosen at 50% of its maximum rated value, the sensor pressure signal required at maximum CFM is only in the range of 0.25" Ps. This means that the unit is functioning within only 25% of the pressure independent controller's range. The unit is going from minimum airflow to maximum airflow in a very limited thermostat signal range. The result could be a two position terminal unit. If you add excessive system supply air pressure to an oversized unit, the terminal unit damper will only move a few degrees from the minimum CFM to the maximum CFM. Again, this is not a desired control situation.

The accuracy of most pressure independent controllers is about + or – 5%, down to approximately 20% of the terminal units' rated airflow, which means that it will

maintain the airflow set point within that tolerance. When operating the unit below 20% of the maximum unit airflow, the unit performance quickly deteriorates from the + or – 5% control accuracy, depending on the DDC controller's low end accuracy. Many DDC and all pneumatic controllers are not sensitive enough to perform optimum control when CFM values are below the 0.03" Ps sensor differential pressure.

For most applications, it is suggested that the maximum CFM setting of a terminal unit be at least 60% of its maximum rating. For example, when selecting a Krueger model LMHS, size 10, the maximum CFM

should be at least 60% of 1450 CFM (the size 10 maximum CFM rating), which comes out to be 870 CFM or greater. It is also suggested that the minimum CFM setting of a terminal unit be no greater than 40% of its maximum rating (1450 CFM), which comes out to be no less than 500 CFM.

These guidelines are also recommended when a single duct terminal unit is selected for constant airflow volume. Although a lower airflow could be selected (at least above the 20% level for + or – 5% control accuracy), the unit may have trouble if used for variable (modulating) control at a later date.

These guidelines are for use whenever pressure independent controls are used, whether pneumatic or electronic. The oversizing problem can relate to any terminal unit manufacturer. The same or similar controls are used by most manufacturers and most inlet sensors have similar response curves. Intelligent choices in unit selection will avoid the hazards of oversizing.

Another problem comes with age. Over time, a VAV terminal unit damper can take a ‘set’. This will not affect leakage, which remains minimal, but with low minimums and higher pressures (such as near the air handler), it is possible to get a damper gasket to flutter under just the right conditions. We have seen this happen only in a few cases. The acoustic effect of this can be unsettling and has been described as the “whale mating sound”. The cure is to reset the pressure set point of the duct static control system. Again, this is rare and an unfortunate occurrence.

A recent California study showed that the multiport sensors used on today’s VAV terminal units are typically linear and accurate to very low sensed pressures. The pressure transducer used on many DDC terminal controllers is also capable of low signal response – and with great accuracy. Dynamic reset of transducer minimums can reduce zero drift to very low levels. There is a California paper that recommends that by oversizing VAV terminal units, you can reduce water coil pressure significantly. All the above issues are true, but not necessarily all the time. For this reason, Krueger and other VAV terminal unit manufacturers have decided to recommend a minimum delta-p of 0.03” probe differential as a published minimum. Below this point, one should validate the combination of controller, probe, and damper to assure trouble free operation.

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