

**INTERPRETATION IC 15-1992-12 OF
ANSI/ASHRAE STANDARD 15-1992
SAFETY CODE FOR MECHANICAL REFRIGERATION**

December 17, 1993

Request from: David C. Partridge, P.E., Tri-Tech, 330 Carr Drive, PO Box 459, Brookville, OH 45309-0459

Reference. This request refers to Standard 15-1992, paragraph 7.2.4 and Table 1, Refrigerant and Amounts

Background. Paragraph 7.2.4 states:

"7.2.4 Ventilated Spaces. When an evaporator or condenser is located in an air duct system, the volume of the smallest occupied space, or unpartitioned building story, served by the duct will determine the permissible quantity of refrigerant in the system. Except, if airflow to any enclosed space cannot be reduced below one quarter of its maximum, the entire space served by the air duct system may be used to determine the permissible quantity of refrigerant in the system."

Table 1 limits the quantity of refrigerant per occupied space to 9.4 lb/1000 ft³.

In designing a direct expansion (DX) unit, Mr. Partridge's letter interprets the standard to mean that greater than 75% shutoff of a variable air volume (VAV) terminal device cannot be used on a typical DX unit, if the Table 1 restriction on R-22 to no more than 9.4 lb/1000³ is exceeded in the smallest (enclosed) occupied space. A typical DX unit would have approximately 1.6 to 2.0 lbs R-22 per ton. A 10 ton DX with 20 lbs of R-22 would require a room of 212 ft² with a 10'-0" high structural ceiling, as the smallest (enclosed) occupied space that would be permitted.

Mr. Partridge's letter opines that since a 74% VAV system might malfunction and close the air flow below 25% of its maximum, a literal interpretation of the standard would preclude using VAV on any reasonable DX unit.

Mr. Partridge's letter also opines that a literal interpretation would preclude using balancing dampers on the typical DX system, except if those dampers could not reduce flow below 25% of airflow. In the interim, he has been designing DX systems with a balance damper only 40% of duct diameter in rooms of volume smaller than R-22 , 9.4/1000 ft³.

Question 1. Is a system of VAV boxes with their minimum openings set at 26% considered "Means of restricting airflow below 25%?"

Answer 1. No.

Comment. So long as the VAV boxes serving two or more occupied (enclosed) spaces have minimum openings of 25% or greater, they are not considered a "means of restricting airflow below 25%." Generally, a mechanical stop is provided to limit the minimum opening.

Question 2. In a DX system, VAV type, if the answer to Question 1 is NO, does the restriction of 25% apply only to rooms with a volume less than R-22/9.4 lb/1000 ft³?

Answer 2. Yes.

Comment. If one or more rooms served by a common air duct system are each of a size permitted by the Table 1 amounts the requirement of 25% minimum opening does not apply. See ending general comment.

Question 3. Are balance dampers to be considered in the same manner as VAV devices with respect to restricting the airflow below 25%?

Answer 3. Yes.

Comment. Any restriction of airflow below 25% must be considered. See ending general comment.

Question 4. In a DX system, constant volume, if the answer to Question 3 is YES, can a damper of only 40% duct diameter be used to balance the system?

Answer 4. Yes.

Comment. So long as the minimum airflow is 25% or greater, the space being served may be used to determine the permissible quantity of refrigerant.

General Comment. The intent of 7.2.4 is to prevent a situation in which the refrigerant concentration in an enclosed space served by an air duct system might rise above a level of acute concern if the refrigerant circuit were to rupture with a complete loss of charge. For R-22 the acute concern is cardiac sensitization; Table 1 limits R-22 to 80% of this level, or 9.4 lb/1000 ft³. In the simplest example of an air duct system serving two rooms (each enclosed and occupied), if the airflow cannot be restricted below 25% to either of the rooms (a manual stop on a balance damper or a VAV device is sufficient) then the total volume of both rooms including plenums (7.2.5) may be used to calculate the permissible refrigerant charge. However, if one or both rooms can be restricted below 25% of airflow then the permissible refrigerant charge must be based on the volume of the smallest (enclosed) occupied space. This protects against the possibility of one room being closed off and the entire charge being discharged to the other room. Given the ventilation requirements of ASHRAE Standard 62, the minimum opening should not be a practical concern.