

DATE: August 2018  
PRODUCT: Terminal Units  
SUBJECT: Fun Facts about VAV Terminal Unit Leakage – Part I  
ISSUED BY: Gus Faris

There are two ways for VAV terminal units to leak, through the casing and around the damper. The cost of leakage in VAV equipment has been calculated to be \$1.84 per cfm per year versus damper leakage @ \$0.04 cfm per year. Air leaked through the casing is returned to the air handler bypassing the occupied space. Some of this air is exhausted and replaced with outdoor air, hence the high cost. Damper leakage is from the duct to the zone. During occupied periods, most zones have minimum airflows assigned, which are greater than the damper leakage; consequently, there is no damper leakage in those conditions. Only spaces that are unoccupied and turned off with no building minimum airflow would have damper leakage, and that leakage may be advantageous to the surrounding spaces, hence the very low cost to damper leakage.

## CASING LEAKAGE

Casing leakage is most important upstream of the damper. The casing downstream of the damper is not subject to the system pressure. The VAV damper regulates airflow from the trunk duct to the occupied space. The duct system downstream of the damper is fixed, and the operating pressure there is minimal. This is important because the static pressure is the engine that drives leakage, and for a given airflow it is constant. Assuming good duct connections downstream of the damper, there should be very little leakage there.

Joints between the unit and reheat coils, silencers and duct connections are leakage points. These joints should be sealed with Hardcast sealant or something similar. Tube penetrations in water coils also leak, because the penetration holes in the end plates must leave room for pipe expansion without damaging the copper tubes. The header plates in electric heaters will also leak at the limit switches and electrical terminal penetrations. These are all points affected by very low pressure.

Upstream of the damper, the assembly is affected by the system static. This can be much greater than downstream of the damper. Generally, the only leakage points upstream are the openings through which the damper shaft and the airflow sensors penetrate. Airflow sensor penetrations are generally gasketed. Shaft penetrations through bearings are not gasketed to allow smooth motion with minimal friction.

## DAMPER BLADE DIFFERENCES

Round dampers that seal against an inverted bead inside the damper housing are generally low leakage dampers. Rectangular blades that close with ninety-degree rotation can offer very low leakage as well. This leakage can be less than 1% of the rated flow at 6" w.g. static pressure. Rectangular blades that close with forty-five-degree-closure are more difficult to seal. Forty-five-degree closure does not allow a fixed seal at the damper apex. The blades are forced to seal against each other at the apex, and very tight seals there become problematic; however, leakage can still be maintained below 2%@3" w.g., and damper leakage has a very low cost. There are benefits over the ninety-degree dampers that should be considered.

## CONCLUSIONS

Casing leakage is expensive and should be carefully controlled. Damper leakage has a minor effect on energy used, but damper design can make huge differences in comfort and performance.