

# Freeze Protection Effectiveness w/Channel Blender

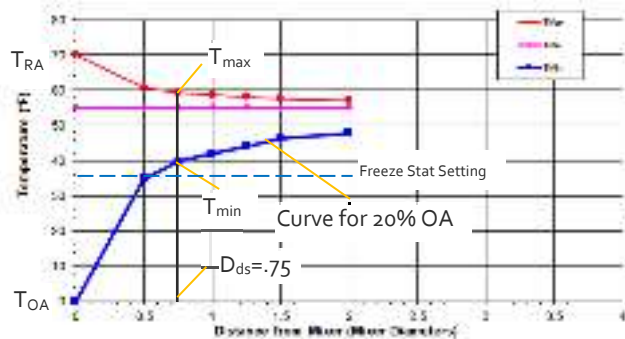
## Freeze Protection Effectiveness (FPE):

The Channel Blender is designed to increase the coldest temperature in the plenum to eliminate freeze stat trips and protect coils, and purposely maintains some temperatures in the plenum very close to the RA temperature entering the air handling unit. The outermost channels on either side of a Channel Blender are RA channels. If OA was in the outermost channels, cold OA would “hug” the plenum walls and may not mix well enough with the adjacent (RA) channels. Since we are not trying to mix all the air in the plenum with the Channel Blender, we developed a new term for defining mixing effectiveness – **Freeze Protection Effectiveness or FPE**. The **FPE** is expressed as:

$$FPE (\%) = 1 - \left[ \frac{(T_{MIX} - T_{MIN})}{(T_{MIX} - T_{OA})} \right] \times 100$$

This is a departure from the engineering approach developed in the 1980s, in which Mixing Effectiveness was the key consideration. Blender Products introduced the term mixing effectiveness (**ME**) with the Air Blender product. The term is expressed as:

$$ME (\%) = 1 - \left[ \frac{(T_{MAX} - T_{MIN})}{(T_{RA} - T_{OA})} \right] \times 100$$



For the term to be properly defined it requires additional parameters including the (OA CFM) or OA as a % of total CFM, and the distance downstream of the Air Blender where mixing effectiveness is measured ( $D_{ds}$ ). If the mixing effectiveness term described above was applied to the Channel Blender it may indicate less mixing effectiveness even if the coldest temperature in the plenum was the same or even higher than the coldest temperature in the plenum with an Air Blender.

With FPE however the  $T_{MAX}$  is not a part of the effectiveness calculation. Since the % of OA directly impacts  $T_{MIX}$  we no longer need to define OA% as a separate parameter. We still must identify the plane where we wish to measure  $T_{MIN}$  similar to the  $D_{ds}$  with the ME calculation defined in the previous paragraph, but in this case the plane location is a simple dimension in inches measured from the furthest downstream edge of the dampers on the Channel Blender.