

APPLICATION ENGINEERING BULLETIN Number # AE-007-05

TOPIC: Adjustment of Outside Air Intake Dampers for Minimum Position

SCOPE & PURPOSE:

Adjusting the outside air intake dampers or economizer dampers for their minimum position is an essential and important task, especially important to the proper ventilation and health of the building occupants. This bulletin covers the proper adjustment for minimum position as well as how to check the current adjustment of outside air intake dampers.

CONTENT:

Most local codes and health officials require that all commercial buildings provide for a minimum amount of "fresh"¹ outside ventilation air to be introduced into every building when occupied. The actual amount may vary from locality to locality and according to local code. Consult with the local authority having jurisdiction over the codes in your area.² This "fresh" make-up air is used to offset the stale air inside the building. In some cases an equal amount of air must be exhausted from the building to prevent the building from becoming overpressurized. This is accomplished by adding a set of exhaust air dampers between the return air duct and the outdoor air intake damper section.

¹ The term "fresh" is used here to indicate that the outside air is nearly always of higher quality than the air indoors. "Fresh" is a relative term.

² Generally, the amount of outside air introduced into a building varies between 10% and 15% of the total amount of air circulated by the HVAC system. Always consult with the local authority having jurisdiction before making actual adjustments.

The following illustration shows a typical system consisting of a set of outside air dampers and return air dampers which allow for the introduction of outside air into the building. This example shows the sets of dampers controlled by a common actuator motor which drives one set of dampers in one direction while driving the other set in the opposite direction. This allows mixing the outside and return air in the desired proportion.



Determining The Current Percentage Of Outside Air

The existing percentage of outside air that is being brought into a building can be determined using the following method. Three temperature measurements must be taken. The greatest accuracy will occur when there is a large temperature differential between the return and outside air.

$$\% OA = \frac{MAT - RAT}{OAT - RAT}$$

For example; if the outside air temperature is 90 degrees, the return air temperature is 70 degrees and the mixed air temperature is 75 degrees insert the measured temperatures and compute as follows;

$$\% OA = \frac{75 - 70 (5)}{90 - 70 (20)}$$

% OA = .25 or 25%

The outside air damper is currently bringing in 25 percent outside air with 75% of the air coming from the return.

Changing The Minimum Position Of The Outside Air Damper

The outside air damper may be repositioned to bring in any desired percentage of outside air by taking measuring the outside and return air temperatures and calculating the mixed air temperature that represents the desired percentage of return air. Then the damper is positioned until the calculated mixed air temperature is achieved. The following equation is used;³

$MAT = OAT - \{(OAT - RAT) \times \%RA\}$

For example, assume it is desired to position the outside air damper to bring in 10% outside air and 90% return air. The outside air temperature is 100 degrees, and the return air is 70 degrees. Place each of the values in the equation. Remember, the equation asks for the percentage of return air which will be 90% if the desired percentage of outside air is 10%. In addition, percentages must be changed to decimal fractions. (Each step of the math is shown below)⁴

$MAT = 100 - \{(100 - 70) \times .90\}$

$MAT = 100 - \{30 \times .90\}$

³ Percentages must be changed to decimal fractions before performing calculations. This is accomplished by removing the percent sign and moving the decimal point two places to the left.

⁴ When performing math functions pay attention to parenthesis and brackets. Work your way from the inside of the equation to the outside until reaching the answer.

MAT = 100 - 27

MAT = 73 degrees

Now adjust the dampers until a thermometer placed in the mixed air section reads 73 degrees. A mixed air reading higher than 73 degrees means too much outside air is being utilized. A mixed air temperature less than 73 degrees means too much return air is being utilized.

Manual dampers are simply put in position and then locked down with their hold down screws. Dampers that are actuator controlled will have a controller with a minimum position potentiometer available. Adjust the potentiometer until the calculated mixed air temperature is obtained.

SUMMARY/CONCLUSION:

- Most areas have code requirements which state that all commercial buildings must bring a fixed minimum amount of outside air into a building whenever the building is occupied. This is required to provide "fresh" oxygen rich air to replace the stale indoor air.
- In some cases the outdoor air dampers are manually adjusted for a fixed position while in others the dampers are controlled by an automatic control system often operated by an economizer control. In either case, the damper minimum position can be determined using a thermometer and a simple calculation.
- When outside air is introduced to the interior of the building the building's interior air pressure will increase above that of the outside air. This can create problems with the exterior doors standing open or not closing properly. This over-pressureization problem can be controlled with another set of dampers which exhaust an equal amount of air from the building. (Application Engineering Bulletins are available on the topics of economizers and building pressure control)

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