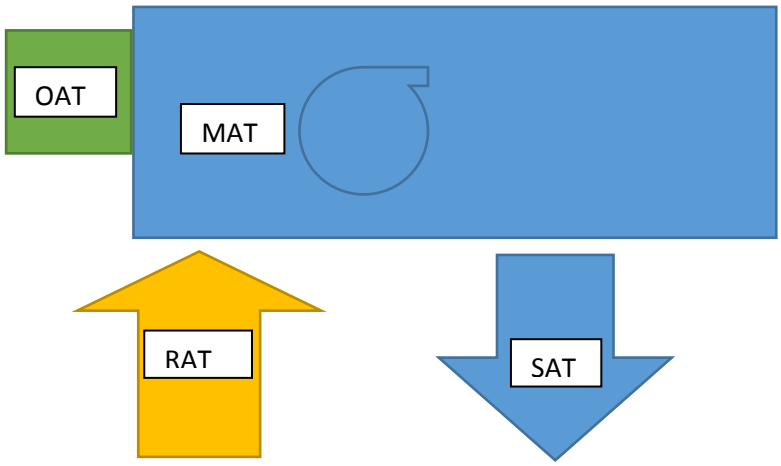
# Calculating Outside Air Percentages

There are several things you will need to know in order to calculate the percentage of Outside Air being supplied to the RTU with an economizer.

**You will need to know the following:**

- RAT- Return Air Temperature taken in the return air duct or at a return grille in the space
- OAT- Outside Air Temperature taken where the air enters the economizer
- MAT- Mixed Air Temperature taken where the OAT and the RAT mix inside the unit




**To calculate the % of OA use the following formula:**

% OA = RAT-MAT / MAT-OAT X 100

**Example:**

RAT 70 degrees less MAT 65 degrees = 5

MAT 65 degrees less OAT 45 degrees = 20

5 Divided by 20 = .25 x 100 = 25% OA

Using this formula is useful to figure out the percentage of OA but to get the actual amount of OA measured in CFM you will need to know the airflow of the unit and duct system.

**If you know the OAT %, the OAT, RAT % and the RAT you can calculate the MAT using the following formula.**

**MAT = (% OA x OAT + % RA x RAT) / 100**

**Example:** 10% OA x 45 degrees OA = 4.5  90% RA x 70 degree RAT = 63.

63+4.5 = ***67.5 MAT***

**RAT= (MAT X 100 – %OA X OAT) / %RA**

**Example**: 67.5 MAT X 100 = 6750  10% OA X OAT 45 = 450

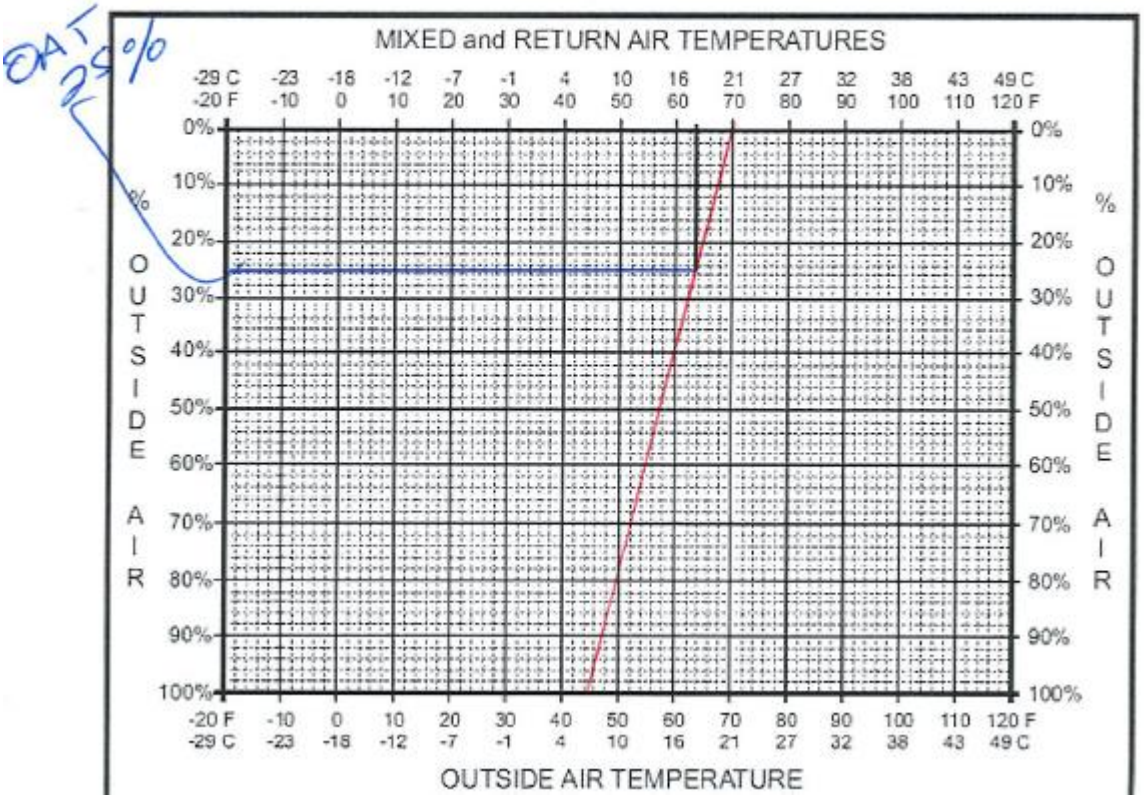
6750-450= 6300 / 90 = ***70 Degree RAT***

**Attached is an Outside Air Percentage Chart that can be used to calculate the OAT %**

1. Measure the Return Air Temperature and draw a point on the top line of the chart at that temperature.
2. Measure the Outside Air Temperature and draw a point on the bottom of the chart at that temperature
3. Draw a straight line connecting the two points
4. Measure the Mixed Air Temperature and draw a point on the top of the chart at that temperature.
5. Draw a line straight down from that temperature until it intersects the RAT/OAT line
6. Draw a line from that intersection to the left of the chart or to the right of the chart and it will tell you the OA percentage.
7. Using the original numbers you can see on the finished chart that the calculations are the same

**Note:** *The greater the difference between the OAT and RAT the more accurate these formulas are*

# Outside Air Percentage Chart



## Air Changes Per Hour

Due to the current health concerns there will be an added emphasis on fresh air requirements for buildings and one of these requirements will be Air Changes Per Hour. Air changes per hour is the amount of times all the air in a space is replaced by new air. The amount of ACH's are based on the building and code requirements but attached is a typical ACH table. To calculate ACH use the following formula:

**ACH= CFM x 60 / Cubic Feet**

- CFM is the amount of air supplied to the space
- 60 is the amount of minutes an hour
- And cubic feet is the volume of the space which is length x width x height

**Example:** Using the chart below we have a business office that requires 7 air changes per hour.

- The space measures 20 x20 x8 which is 3200 cubic feet.
- The measured airflow is 375 CFM.
- 375 X 60 = 22500  22500 /3200 = 7.031 ACH

******** *If the airflow was only 300 CFM the ACH would be 5.6 which is too low so the airflow will need to be increased based on the table below***.******

**Typical Air Changes Per Hour Table**

| | |
|---|---|
| **Residential** | |
| Basements | 3-4 |
| Bedrooms | 5-6 |
| Bathrooms | 6-7 |
| Family Living Rooms | 6-8 |
| Kitchens | 7-8 |
| Laundry | 8-9 |
| **Light Commercial** | |
| **Offices** | |
| Business Offices | 6-8 |
| Lunch Break Rooms | 7-8 |
| Conference Rooms | 8-12 |
| Medical Procedure Offices | 9-10 |
| Copy Rooms | 10-12 |
| Main Computer Rooms | 10-14 |
| Smoking Area | 13-15 |
| **Restaurants** | |
| Dining Area | 8-10 |
| Food Staging | 10-12 |
| Kitchens | 14-18 |
| Bars | 15-20 |
| **Public Buildings** | |
| Hallways | 6-8 |
| Retail Stores | 6-10 |
| Foyers | 8-10 |
| Churches | 8-12 |
| Restrooms | 10-12 |
| Auditoriums | 12-14 |
| Smoking Rooms | 15-20 |

*This table is for general use only and is not to be used as exact ACH requirements. The proper ACH requirements are based on building code requirements and conditions that this table cannot take into account*