HVAC Economizers 101
Principles and Operations for Efficiency

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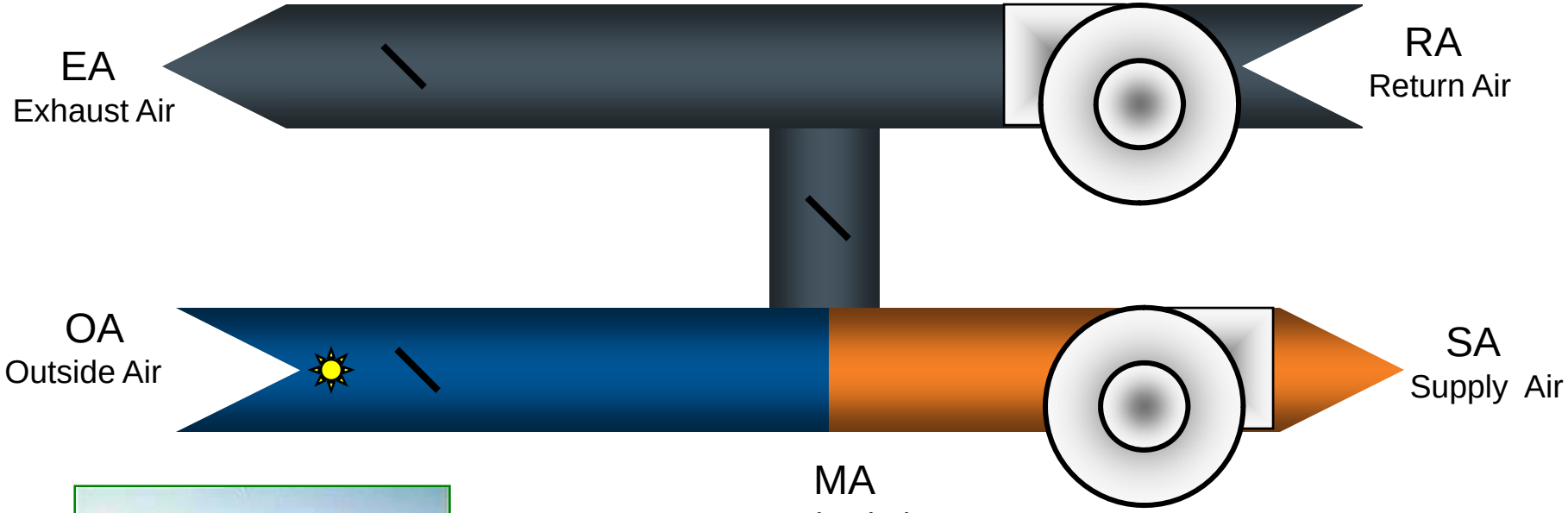

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What We'll Cover in the Class

Introduction and Background Information

1. **Economizer Fundamentals**
2. **Economizer Control Methods**
3. **Why Economizers Fail and Increase Energy Use**
4. **Economizers on Packaged Roof Top Uints**
5. **Typical Economizer Controls of Rooftop Units that Utilize Honeywell Controls**
6. **Manufacturer Specific RTU Economizer Controls**
7. **Central Air Handling Units Economizers and Controls**
8. **Dampers: Types, Actuators, & Characteristics**
9. **Determining the TRUE % of OSA Air Using Charts and Formulas**
10. **General Maintenance, Testing, and Troubleshooting of Packaged RTUs and Central AHU Economizers**

HVAC Economizers 101

Introduction and Background Information on Economizer Project

Recommended Reading and References

- *Control Systems for Heating, Ventilating, and Air Conditioning*, By Roger Haines and Douglas C. Hittle, Springer Publishers at http://www.springer.com
- *Honeywell Technical Reference Manual* at web site: http://customer.honeywell.com/techlit/pdf/63-0000s/63-8594.pdf
- *HVAC Control Systems*, by Ronnie Auvil, ATP Publishers
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Handbook of HVAC Systems and Equipment
- *Refrigeration and Air Conditioning Technology* By Whitman, Johnson, and Tomczyk, Delmar Publishers
- Eugene Water and Electric Board at: http://www.eweb.org/
- PNNL web site at: http://www.buildingsystemsprogram.pnl.gov/publications.stm
- Lennox web site at: http://www.lennoxcommercial.com/
- Portland Energy Conservation Inc., at: http://www.peci.org/
- Trane web site at: http://trane.com/Commercial/
- Carrier web site at: http://www.commercial.carrier.com/commercial/hvac/homepage/1,3052,CLI1_DIV12_ETI372,00.html
- York web site at: http://www.johnsoncontrols.com/publish/us/en/products/building_efficiency/products/Industrial___Commercial_HVAC_Equipment.html

Group Exercises

- Identify economizer sensors, controllers, and controlled devices on a miniature or packaged HVAC unit.
- Experiment with a working economizer unit under normal operations and abnormal or failed conditions to help students to determine a solution to the economizer problem for optimum efficiency of the equipment.
- Lab exercises will be based on testing and troubleshooting economizer systems for task specific applications including testing:
  - actuators and modulating motors
  - dry bulb and enthalpy sensors
  - Packaged controllers and DDC controllers
- Experiments with preset problems to demonstrate the energy impact on malfunctioning economizer units vs. proper functioning units to include:
  - Economizers stuck open vs. stuck closed
  - Malfunctioning sensors and controllers
  - Improperly wired thermostats to controllers

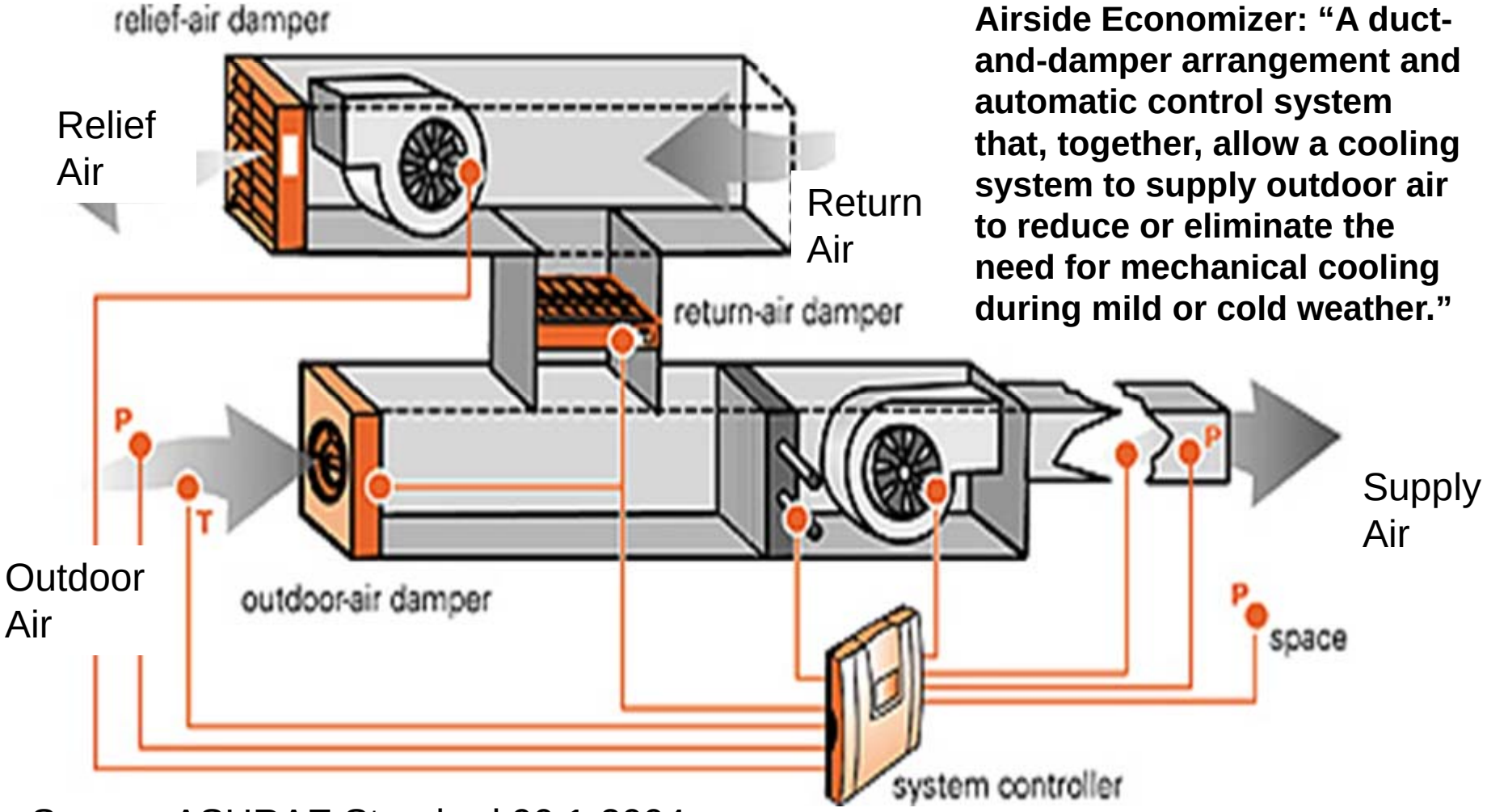
Example Evaluation Methods

- Short exercises will be given after each major section to reinforce key concepts.
- Lab exercises will evaluate that students have comprehended key concepts.
- Students will have an hour and half to complete the final exam.
- Final exam is open-book at the end of the class.

HVAC Economizers 101
Section #1

Economizer Fundamentals

Section #1
Economizer Fundamentals
The Basics of Airside Economizers



Airside Economizer: "A duct-and-damper arrangement and automatic control system that, together, allow a cooling system to supply outdoor air to reduce or eliminate the need for mechanical cooling during mild or cold weather."

Source: ASHRAE Standard 90.1-2004

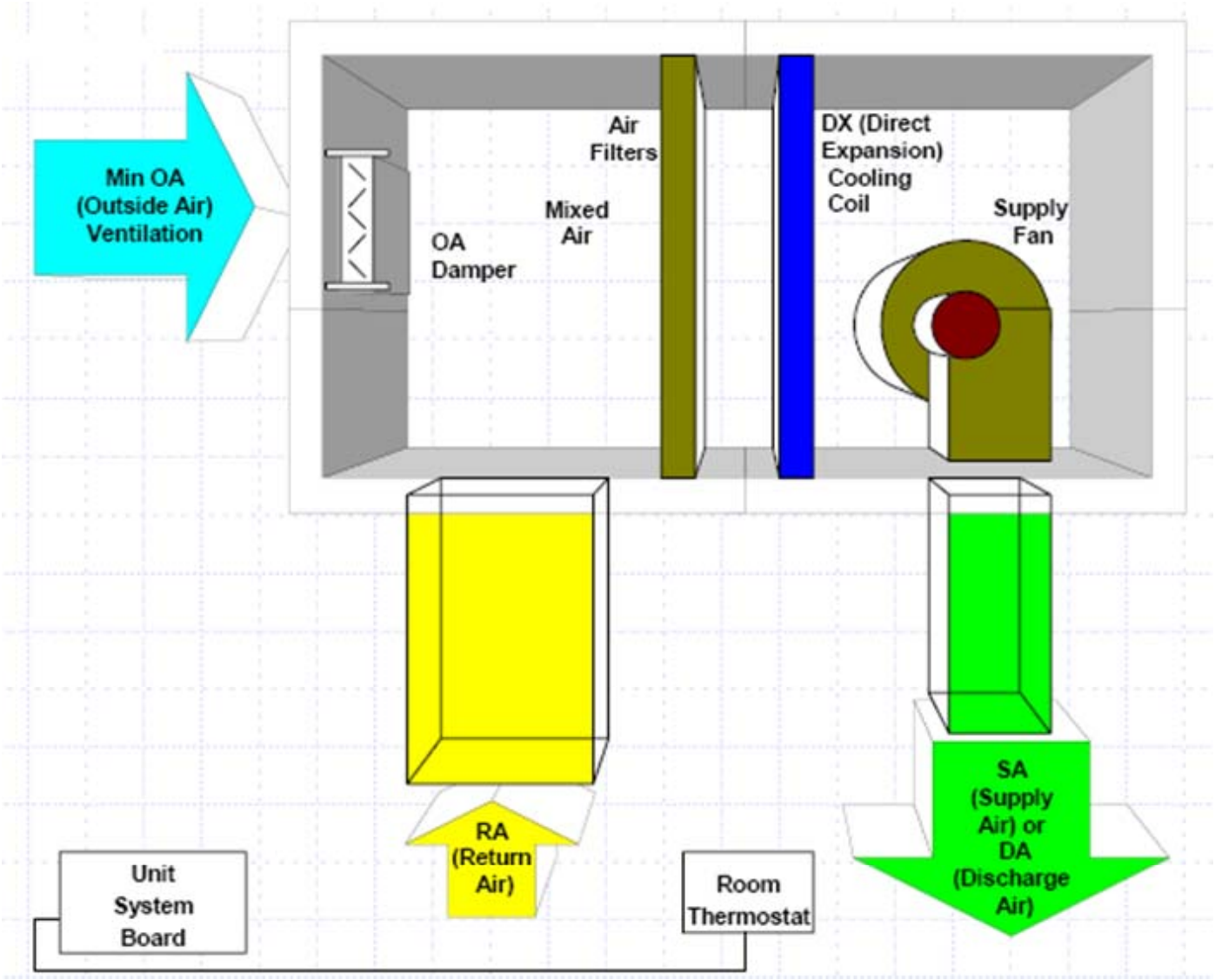
Economizer Fundamentals

- Economizers reduce air conditioning costs by using outside air (OSA) for free cooling causing the compressor to run less.
- OSA dampers switch over to minimum OSA when free cooling is not available.
- Economizer dampers switch to minimum ventilation position when OSA conditions are not favorable for cooling.
- The outside air sensor for economizers must be installed properly and sense the true outside air stream temperature to be effective.

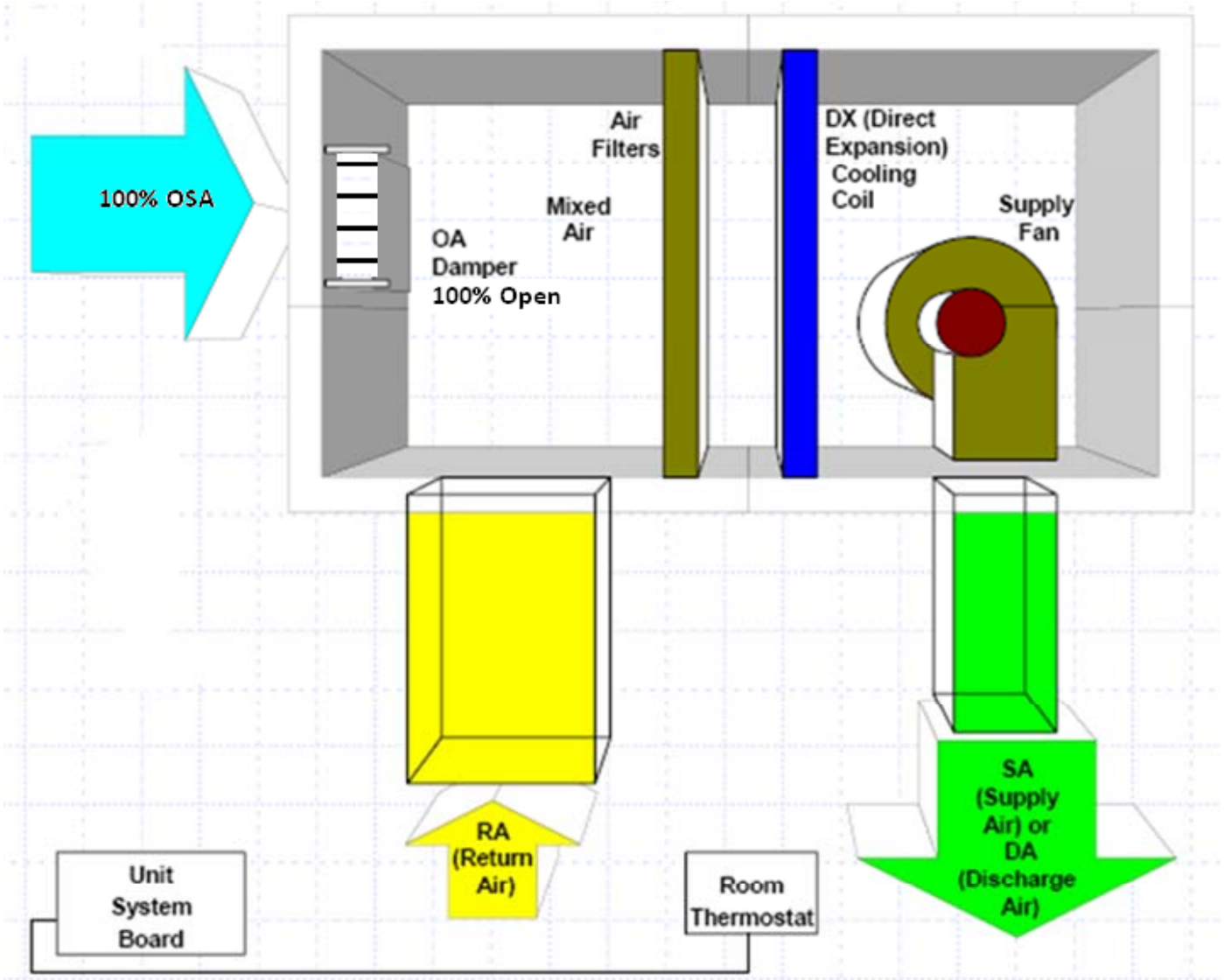
Ensuring Proper Economizer Operation

- Eliminate outside air for ventilation during unoccupied periods by closing OSA dampers.
- OSA damper operation should be monitored and recorded to verify actual operation of economizer.
- Percent OSA can be used to verify that the economizer is properly operating.
- Percent of OSA is calculated using a formula or graph (to be covered later).

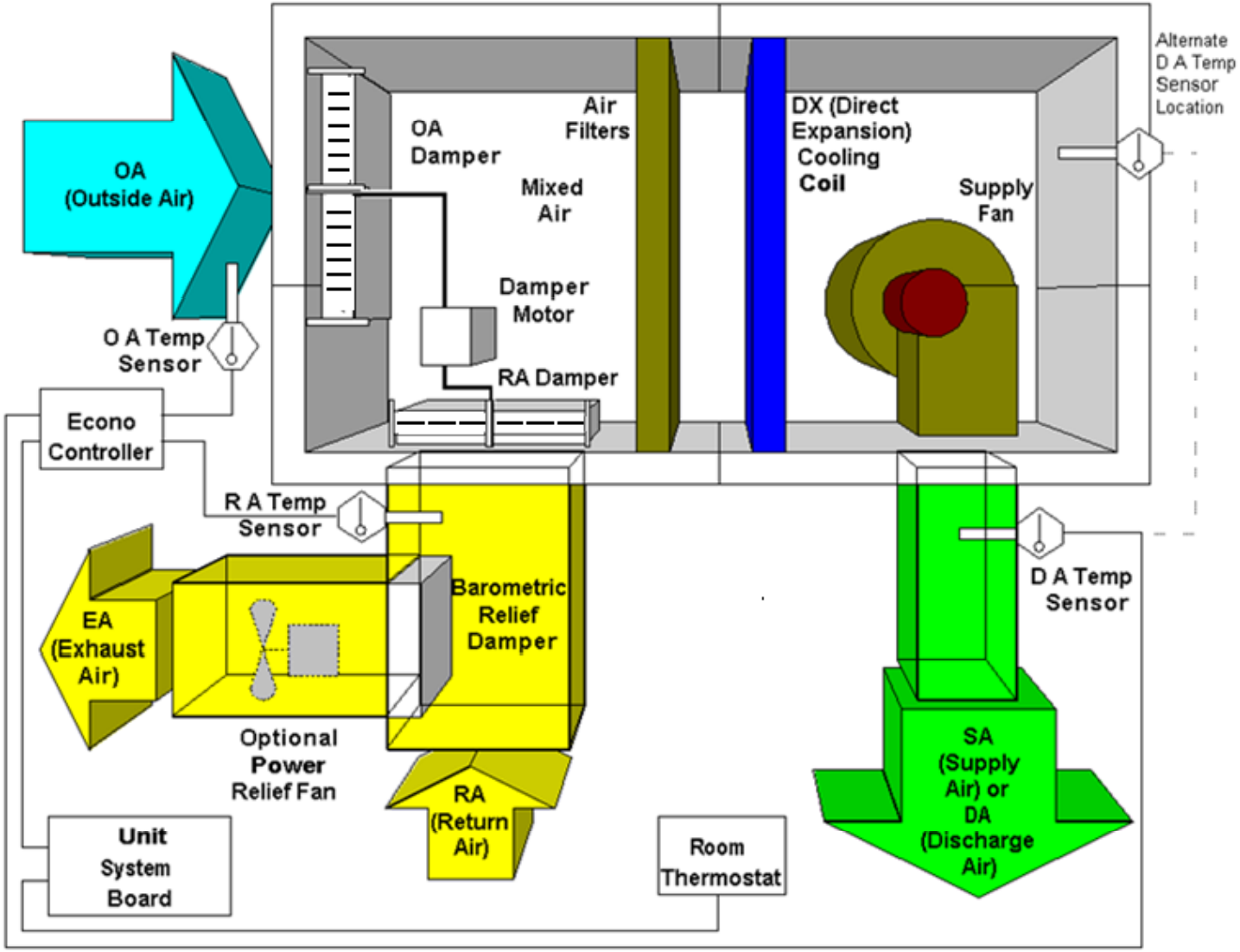
No Economizing Case: Minimum OSA Ventilation



Economizers Case: 100% OSA



Airflow and Controls for Economizer Unit



Economizer Fundamentals
Exercise #1
(Provide Answers below on notes page)

1. What is the condition of the air conditioning compressor when the thermostat is calling for 1st stage cooling but the OSA is below 55°F?
2. When should outside air dampers switch to minimum position?
3. What should happen to the OSA dampers when the building is unoccupied?
4. How is the actual percentage of OSA entering a building determined?
5. When economizers bring in fresh air, where does the stale air from the building go if there are no exhaust dampers?