



**Commercial Refrigeration  
Cold Controls  
UNI-LINE® PRODUCT KNOWLEDGE**

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Subjects We Will Cover In This Session

- Refrigeration Overview
  - Refrigeration System Basics
  - Differentials
  - Cut-In and Cut-outs
- Existing Product Features
- Troubleshooting
- Literature
- Website
- Q&A



What Is The Difference Between A/C And Commercial Refrigeration?

- Scientific principals are same, however refrigeration systems are:
  - Operation Time 24 / 7
  - Defrost Cycles
  - Load Changes
- Energy Conservation Important on A/C Systems
  - However, more critical on Commercial Refrigeration Applications



Technical Terms and Definitions

- PSIG Pounds per Square Inch Gauge
- PSIA Pounds per Square Inch Absolute
- BTU British Thermal Unit
- Conduction Flow of heat with solids
- Convection Flow of heat with fluids (or gas)
- Radiation Flow of heat with air (or space)
- Superheat Heat added to a refrigerant in the evaporator just after it changes from *liquid to gas* up to the compressor
- Sub Cooling The difference in temperature in the condenser just after it changes from *gas to liquid* up to the expansion device
- TXV Thermal Expansion Valve
- Compressor A pump or mechanical device that increases the pressure of gases

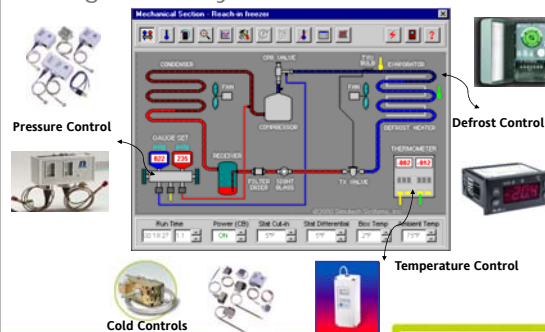


Technical Terms and Concepts

- **Refrigerant Thermodynamics** - The transfer of heat from a place where it's not wanted to a place where it's not objectionable.
- **Hot Gas Defrost System** – Hot refrigerant is pumped directly to the evaporator tubing. Defrost time is usually 5 to 10 minutes.
- **Rules of Heat**
  - Heat always moves from a warmer to a cooler surface
  - Heat always moves in three ways:
    - conduction, convection, or radiation
  - When a refrigerant substance boils, it absorbs heat
  - When a refrigerant substance condenses, it rejects heat



Refrigeration System



## Cut-In And Cut-Out Cooling Applications

- Cut-out mode: Differential is above setpoint
  - Output relay energizes when temperature rises to setpoint *plus* the differential value
  - When temperature drops to setpoint, the relay de-energizes
- Cut-in mode: Differential is below setpoint
  - The output relay energizes when the temperature rises to setpoint
  - When the temperature drops to setpoint *minus* the differential value, the relay de-energizes



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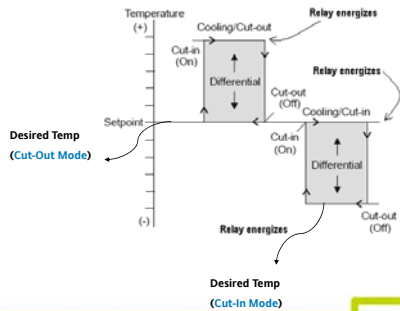
## Differentials

- Narrow Differential (10°F or less)
- When a narrow differential is desired
- Closely maintain within 5 to 6°F
- Wide Differential (10°F or more)
- Required due to swing in evaporator temp between compressor ON and OFF
- Household refrigerators and room air conditioners
- Differential between 8 to 14°F



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## Cut-In And Cut-Out Cooling Example



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## Terms and Concepts Continued

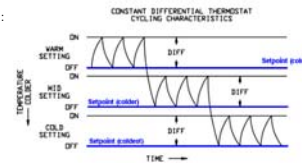
- Two Types of Cold Controls:

- Constant Differential
- Constant Cut-in

- Applications

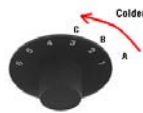
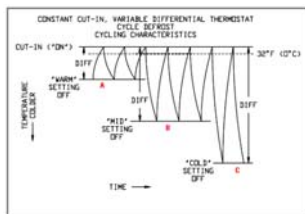
- Water coolers
- Beverage dispensers
- Display cases

- Constant Differential also called "straight range controls"
- Designed for household refrigerators and freezers



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## Constant Cut-In With Dial



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## Terms And Definitions Continued

- Constant Cut-in type controls

- Designed for frost free refrigerators
- Used in coolers and display cases

- Operation of Cut-in controls

- This type of control offers an *adjustable differential*
- Rotating the dial indicator to the colder position changes the cut-out temperature only and widens the differential

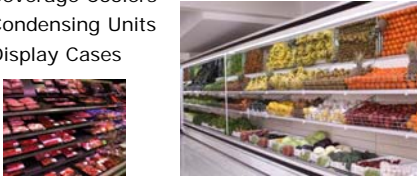
- Capillary tube

- The gas within the capillary tube reacts to temperature changes
- Actuates the power element diaphragm to trip the toggle mechanism

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## Temperature Controls Applications

- Ice Machines
- Reach-In Refrigerator/Freezers
- Walk-In Refrigerator/Freezers
- Beverage Coolers
- Condensing Units
- Display Cases



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## Application For Cold Controls



Ice Maker



- Ice Bin Level Control
- Ice Harvest
- Commercial Refrigeration
- Household
- Water Coolers

- A and CC Series
- K and RC Series
- 3030 Series are Uni-Kits

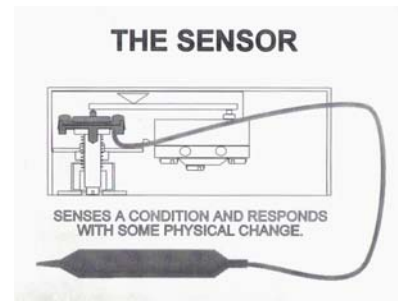
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## Temperature Controls Continued

- The Capillary-only bellows sense from the coldest exposure point
- The Capillary with bulb senses from the bulb only
- The bulb portion of the A22 & A30 capillaries must be mounted with tip end pointing upward within 65° of vertical
- Sensing elements of A22 & A30 contain saturated vapor liquid refrigerant and are sensitive to barometric pressure changes
- Sensing elements C12 & C17 contain liquid filled bulbs for accurate temperature control
- C12 & C17 bulbs may be oriented in any position

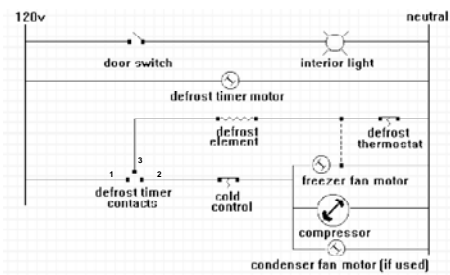
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## Capillary Tube Mechanics



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## Troubleshooting Exercise - Electrical



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## Unit Cooler Troubleshooting Tips

- Observe unit cooler conditions and collect current operation information.
- Correct unrestricted airflow is mandatory with all evaporators.
- Suction pressure at the evaporator is necessary in order to correctly calculate superheat at the Thermostatic Expansion Valve (TXV).
- Check feeding supplied to the evaporator by the TXV and distributor assembly.
- The ability of the evaporator to efficiently exchange heat is totally dependent on having a fully active coil as near to saturated suction temperature of the refrigerant as possible.
- Remember superheat can be correct with incorrect refrigerant distribution.

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## Unit Cooler Troubleshooting Tips

- Check electrical compartment for proper operation.
- Ice accumulations inside the compartment resulting in moisture to flow into the compartment condensing on all cold components.
- This can result in large ice or frost accumulation inside the compartment or conduit.
- This condition can affect defrost termination and fan control operations, which can leave defrost heaters operating longer than needed, resulting in heaters creeping or coming out of heater slots.
- Defrost heaters can suffer damage resulting from ice or frost which can damage electrical wiring.

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## Troubleshooting Tips Continued

- Suction pressure, suction line temperature, liquid line pressure, liquid line temperature, and correct operating charge at the condensing unit are necessary to properly make a complete system diagnosis.
- Correct superheat range at the compressor is the only crucial superheat that really matters in refrigeration.
- Superheat at discussed compressor should be between 15° and 35° F in order to protect the compressor from flooding or possibly more importantly overheating.
- Superheat for scroll compressors should be between 10° to 20° F.
- Serious compressor damage can result from operating outside the above conditions.
- Frost at the compressor does not necessarily mean low superheat, and no frost at the compressor certainly does not mean there is sufficient superheat.

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## Commercial Refrigeration Catalog



Order Commercial Refrigeration Brochure with Cold Controls:  
• 150-2282

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## Cold Control Sell Sheet

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**Features and Benefits**

- Compact size
- Flexible mounting configurations
- Compact efficiency
- Light duty and heavy duty
- 100V and 240VAC input

**Temperature Range (°C)**

Model	1	2	3	4	5	6	7	8	9	10
Temp. Range (°C)	0 to 10	0 to 20	0 to 30	0 to 40	0 to 50	0 to 60	0 to 70	0 to 80	0 to 90	0 to 100

Order Cold Control Sell Sheet:  
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## Website Tools: [www.Uni-Line.com](http://www.Uni-Line.com)

Enter part numbers

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Cross reference

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