Energy & Store Development Conference

E+SD 2013

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Refrigerant Leak Detection

Jim Kirk – AAA Refrigeration

I am Not THAT James Kirk!!

Leak Detection

- Why Is it needed?
- Sensing Technologies / Tools
- Compliance Monitoring Vs. Refrigerant Management
- Best Practices

Leak Detection – Code Compliance

- ASHRAE 15 – Requires Refrigerant sensors in machine rooms
  - "All machinery rooms are required to have detectors that will activate an alarm and mechanical ventilation.."
- Safety Requirement! – Protects occupants of the space

Leak Detection – Code Compliance

- California Sub Article 5.1– Requires Automatic systems for facilities with over 2,000 lb charge
  - "By January 1, 2012, the owner or operator of a refrigeration system, that operates year round, or is intended to be operated year-round, must install an automatic leak detection system…"
  - Requires annual calibration and ability to detect down to 10 PPM
- Environmental Requirement!

Leak Detection – Code Compliance

- ASHRAE 147-2002:
  - "Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems"

- Environmental Compliance

Other Reasons…

- Reduce Energy Consumption
- Protect Associates
- Protect Product
- Extend equipment life
- Reduce amount of refrigerant used

If none of that appeals to you – how about just save $$$$$

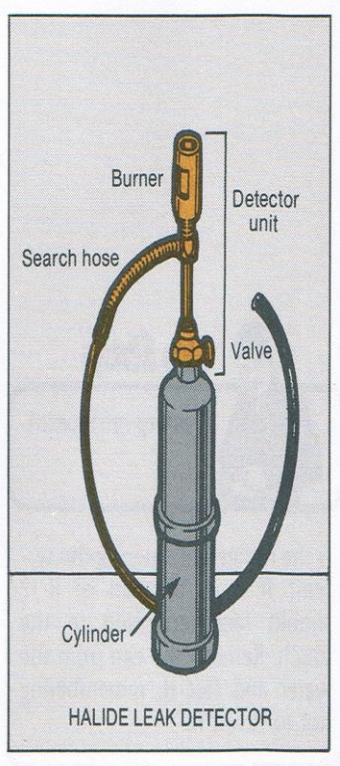
How do you know you have a leak?

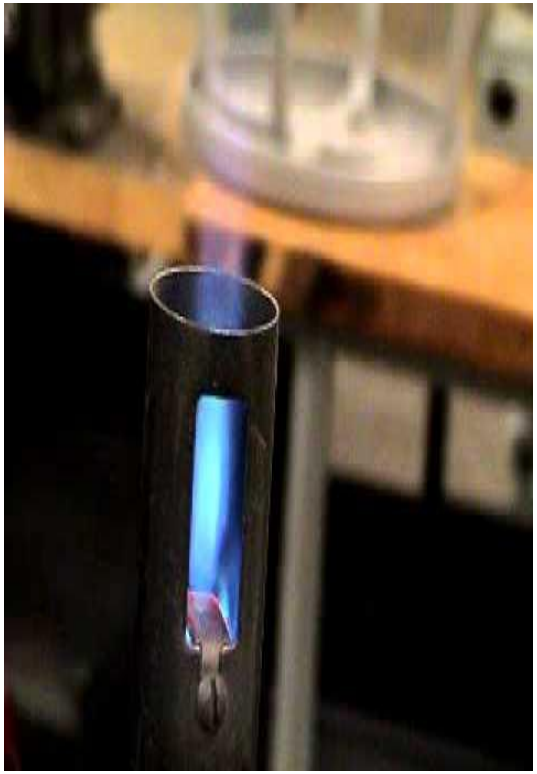
Low Liquid level alarm???

High Temperature alarms???

High Head Pressure Alarms???

How we used to do it!





Remember when it was just this!!

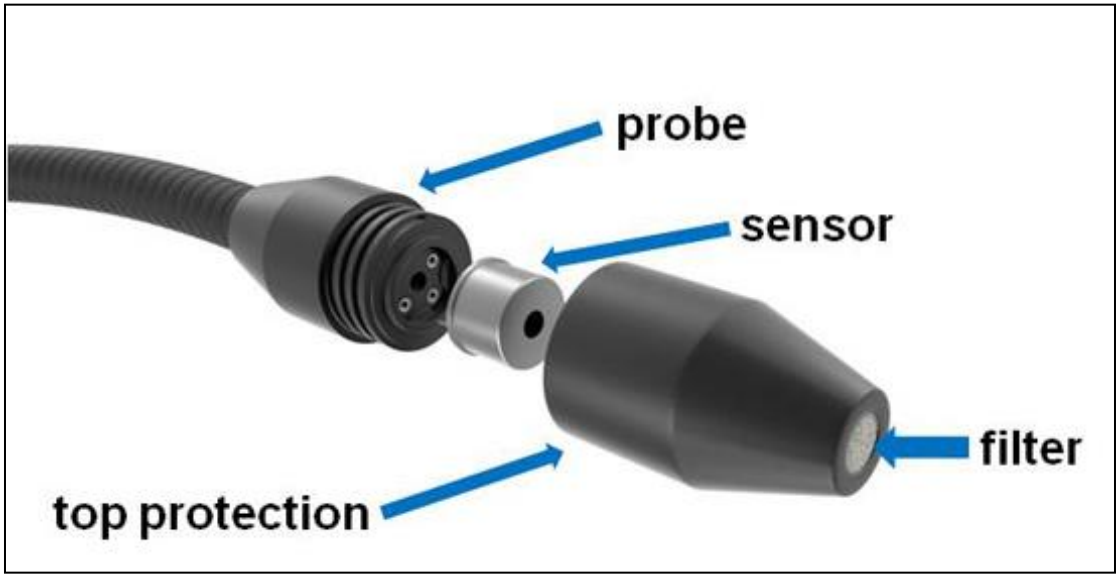
Common Sensing Technologies

- Electronic Devices
  - Heated Diode
  - Metal Oxide Semiconductor
  - Infrared
- Visual
  - Fluorescent Dye

Heated Diode Sensors

- Detect all types of Refrigerant Gases
- Most Common, Low cost
- Typically found in handheld tools
- Life Span – up to 100 hours
- Differential sensing – does not quantify
- Will respond to many compounds, temperature change, and even blowing on them
- Can be destroyed by over saturation

Heated Diode Sensors



Metal Oxide Semiconductor

- Detect all types of Refrigerant Gases – but generally sensors are tuned for specific gas
- Typically an be found in stationary mount sensors
- Low cost
- Life Span – 5-7 years
- Can Quantify – Reads in PPM, Reasonably accurate – Will typically meet ASHRAE-15 standards
- Will respond to many compounds, and rapid temperature change
- Requires calibration

Metal Oxide Semiconductor

Infrared

- Detects all types of refrigerant gases and Co2
- Sampling & Diffusion Systems
- Available as portable or fixed systems
- Highly Accurate- Sampling systems can get as low as 1 PPM
- Quantifiable – reads in PPM
- Self Tests and Calibrates
- Very Selective to specific refrigerant
- Sensitive to H2O and requires maintenance

Infrared


GRM2


HGM-MZ
HALOGEN GAS MONITOR
Multi Zone
BACHARACH

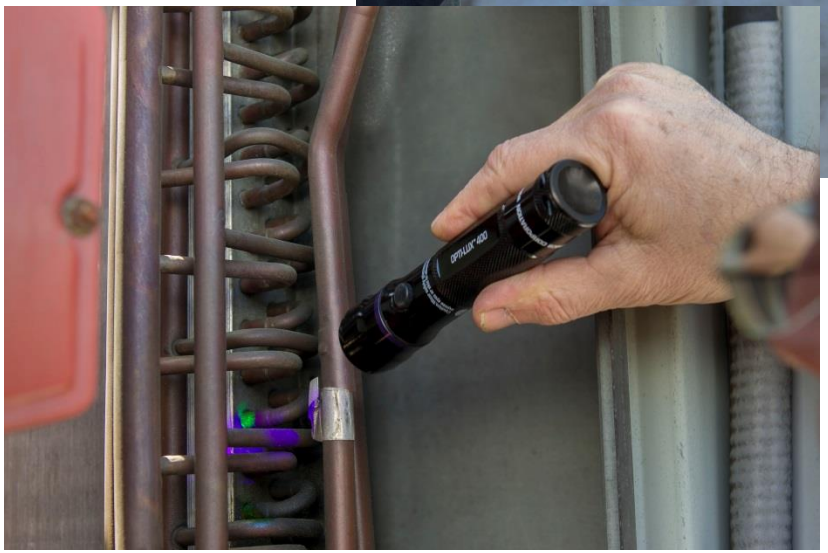

BACHARACH


EMERSON

Fluorescent Dye

- Injected into System
- Not an “Immediate” tool on larger systems
- Visual detection
- Be careful to make sure you have OEM approval
- Best used in conjunction with other tools

Fluorescent Dye



So, Now you have all these tools to choose from….

Compliance vs. Refrigerant Management

- Compliance Monitoring:
  - Meets regulator requirements
  - Looking for larger leaks
  - Typically Semiconductor

- Refrigerant Management:
  - Find leaks sooner
  - Locate smaller leaks
  - Infrared Detectors /Analyzers

Compliance – Minimum ASHRAE-15

- Sensors in your motor room
- No Early Warning – if leak not in motor room – wait for high temp or poor performance
- Find and fix leaks as they occur
- Some combination of the tools mentioned
- Likely inexpensive electronic sensors in motor room, hand held detectors to find leaks.
- **Reactive…**

Refrigerant Management

- Pro-Active – Immediate notification of a leak
- **Permanently Installed Automatic Leak Detection Systems**
- Variety of Options

System Types

- Infrared Sampling – uses central system with tubing run throughout facility to sensor locations – Highly Accurate
- Infrared Diffusion – uses central system and wiring run throughout facility to electronic sensor locations – Highly Accurate

Some Features to Look For

- Ability to connect to EMS – Can you "see it" through EMS or just know there is an alarm?
- Multiple Refrigerants on same unit?? - Do you have more than one refrigerant in the facility?
- Variable / Multiple Stage Alarm set-points
- Fault Detection – Can the system tell you there is something wrong with it??
- Maintenance- what's required?
- Sensor Life?

Sensor Locations

- You cannot monitor everywhere
- **Monitor high probability areas**
- **Compressor room**
- **Walk in freezers**
- **Cases / aisles**
- Refrigerant and CO2 are heavier than air – tend to fall
- Pick up locations should be close to ground for Refrigerant
- Pick up locations should be higher for CO2 (as it disperses)

Where do I monitor cases?

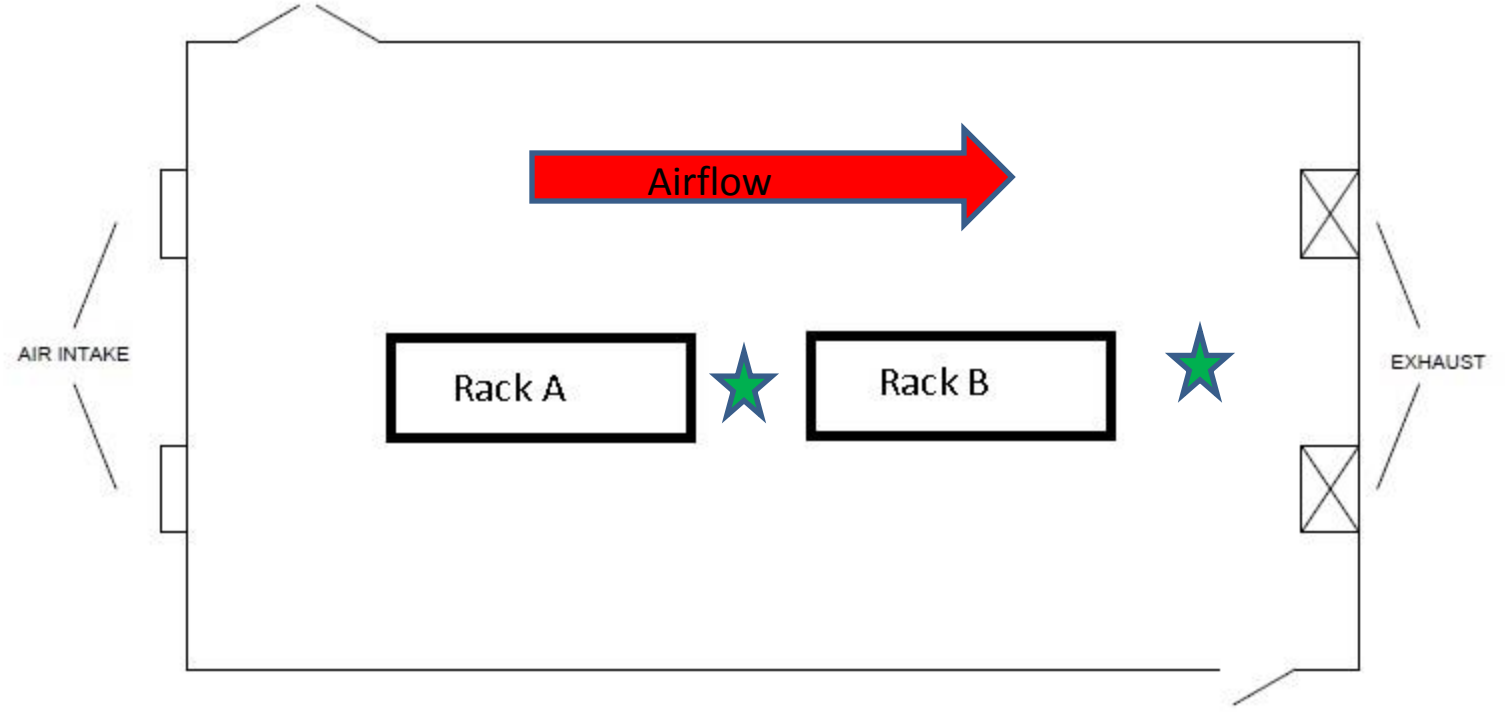
- Monitor inside or outside cases
- In kick rails
- On Top of cases
- At each end
- Behind and in between Back to back aisles

Where do I monitor coolers / Freezers?

- Inside Boxes – Under Evaps

- Outside Boxes - Next to Door

Where do I monitor Machine Rooms?



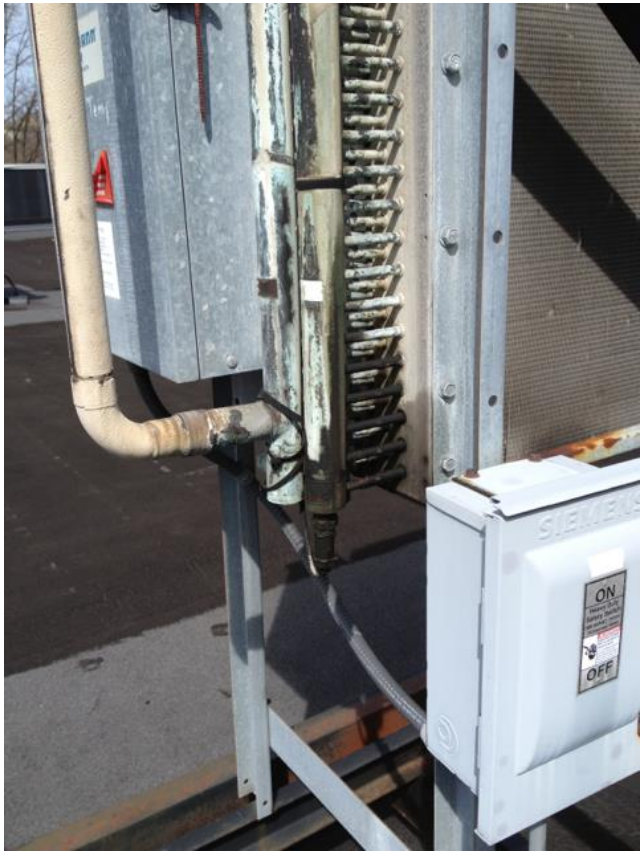
Best Practices

The Best Leak Detector ever Invented!

What else travels around the system with the Refrigerant?

Best Practices

Best Practices



Best Practices

- Keep Your Equipment Clean!
- REACT TO ALARMS!!!!!
- Use a quality tool!
- Maintain & Calibrate your tools- use an actual calibration tool.
- Train Your technicians – don’t just give them a leak detector and send them off to work.
- Work Slowly!! Don’t Rush through it.

Best Practices

- Use a method – start in one place – either motor room or sales floor and methodically work towards other end.
- Use the same crew if more than one day.
- Don’t stop at the first leak you find!
- Did I mention… Keep your equipment clean!!!

My IDEAL World!

- Every Facility has an Automatic System
  - Early warning – alarms set at 10PPM
  - Gets me in the general area very quickly
- Every technician has Infrared sampling detector…
  - Quickly narrows down the specific fixture or leak location
- Every systems has dye
  - Pinpoints the exact leak location immediately

The Excuses….

hand held or that dye…

It costs way too much to do this!!!!

The Cost of Leaks

Leak Rate in Lbs Per Month	Refrigerant Type	Cost Of Refrigerant	Cost Per Month
50	R-22	$18.00	$900.00
100	R-22	$18.00	$1,800.00
200	R-22	$18.00	$3,600.00
300	R-22	$18.00	$5,400.00
400	R-22	$18.00	$7,200.00
500	**R-22**	**$18.00**	**$9,000.00**

One Leak Event Can almost pay for the cost of an automatic system!!

The Cost of Leaks

Leak Rate in Lbs Per Month	Refrigerant Type	Cost Of Refrigerant	Cost Per Month
50	R-404 / 407A	$8.00	$400.00
100	R-404 / 407A	$8.00	$800.00
200	R-404 / 407A	$8.00	$1,600.00
300	R-404 / 407A	$8.00	$2,400.00
400	R-404 / 407A	$8.00	$3,200.00
500	**R-404 / 407A**	**$8.00**	**$4,000.00**

Two Leak Events Can almost pay for the cost of an automatic system!!

The Bottom Line ….

Compliance is not enough…..

You cannot afford to not have a Refrigerant Leak Management Plan!

Thank You!!

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AAA
Refrigeration Service, Inc.
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