IEA Heat Pump Workshop

November 8, 2011

Atlanta, Georgia

Heat Pump Reliability
And
Installer Training

Nance Lovvorn

Who is Alabama Power Company?

- Electric Utility Company
- Investor owned
- 1.3 Million customers
- 1.1 million residential customers

How did Alabama Power Company get into Heat Pump marketing?

- 1950's
- 1960's
- 1970's
- 1980's
- 1990's
- 2000's

1950's

- Reverse Cycle air conditioners
- Many utilities got interested in load growth
- Lots of electric resistance heating installed
- Many homes did not have A/C

1960's

- Lots of electric resistance heat sold
- Air Conditioning demand increased
- Responsible load growth a goal
- Residential rates low-- $0.01/kWh
- Sales of air source Heat Pumps a goal

1960's
(Put up or Shut up!)

- APCo Certified Heat Pump Dealer 1964
  - No "teeth" in program
- APCo Assured Service Program-1967
  - Manufacturer Collaboration
  - Installation Standards
  - Application Standards
  - Service Standards
- 10 Yr. Service Contract – Parts and Labor (all air source HPS)

1970's

- Service Contracts served as base for information
  - Reason for customer call
  - Servicer's analysis
  - What repair done
  - Defects noted
- Service on demand – PM eliminated
- Service codes consistent -one person
- Verifiable records produced
- Manufacturers received timely reports of their equipment and summary comparisons to others

1970's cont'd

Five Major Defect Areas

- Compressors
- Fan Motors
- Defrost
- Compressor Motor Circuits
- Reversing Valves

1970's Cont'd

- Manufacturers affected if the cost to service their equipment and the projected cost based on their reliability records exceeded the revenue being collected.
- One (unnamed) manufacturer with 40% market share deleted from ASP. They did not address problems on existing units, so we did not take any more! (period)
- Several HVAC contractors placed "on hold" for failure to follow standards.
- Distributors/manufacturers asked to "step up to the bar" to correct chronic problems.

1980's

- APC HP market share low - 15% in early 80's ---Goal to reach 50% in 5 years
- HP shipments in U.S. low – 100,000/yr
- 12,000+ Heat Pumps under contract for long period
- How can we use data?

80's EPRI Involvement

- Electric Power Research Institute
- Consortium of Electric Utilities who did industry-wide research
- APCO provided data and project supervision.
- Manufacturers' names blocked
- Statistical expertise sought
- 3rd party provided objectivity

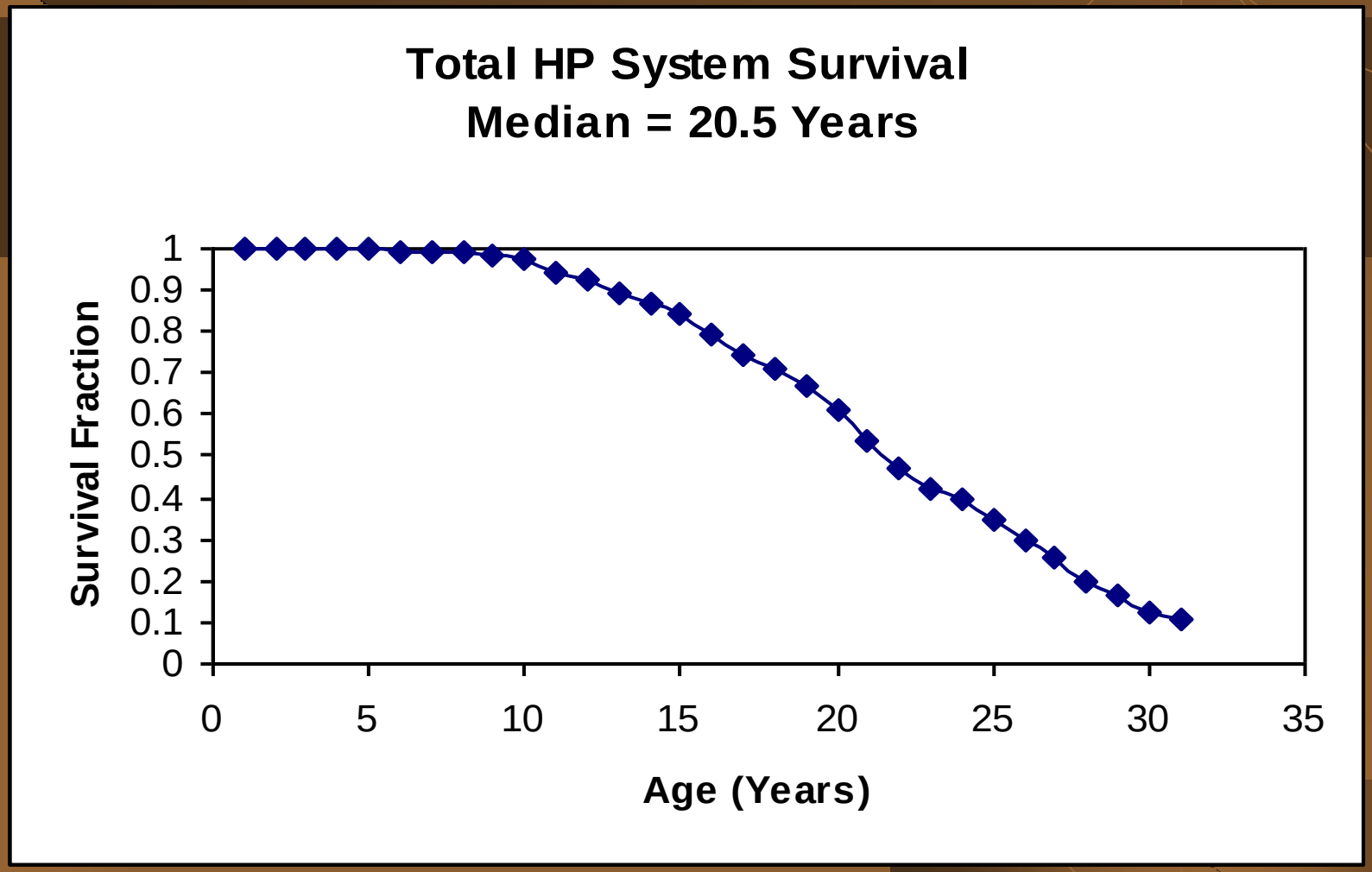
- EPRI did Six (6) studies
  - Four (4) in Alabama
  - one in northern climate
  - one in moderate climate
- Two Heat Pump "Life" studies
  - 1985 Heat pump
  - 2001 Heat pump

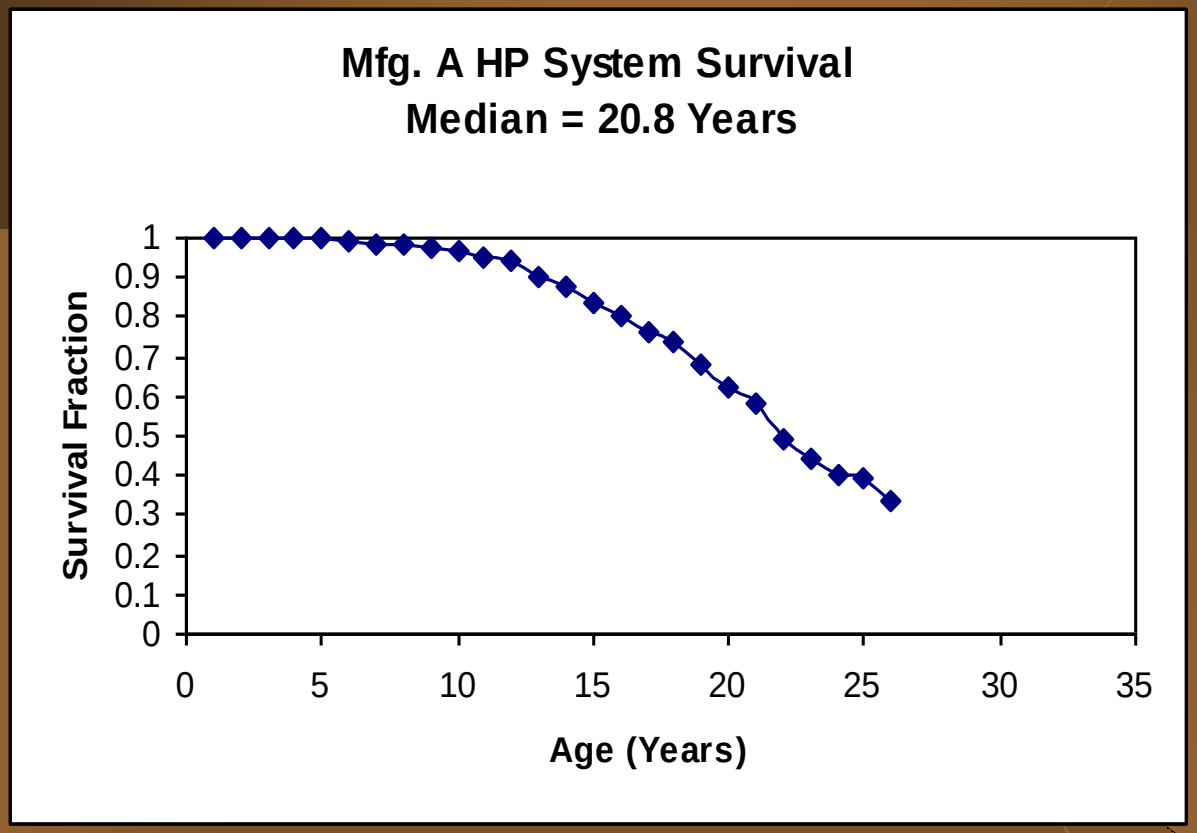
Methodology of 2001 Report

- Similar techniques as earlier surveys
- Telephone survey
- Questionnaire by research team
- Independent market research firm conducted surveys
- Heating & Cooling survey to avoid bias
- Sponsor not identified

Table 1
Survey Population

Group	Year Installed	Total Population	Target Surveys	Completed Surveys
1	1964-1967	663	50	71
2	1967-1971	3449	361	183
3	1972-1974	1973	201	108
4	1974-1985	6511	989	660
5	1986 & Later			796
Total		12566	1601	1818


Total HP System Survival
Median = 20.5 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
Age (Years)


Mfg. A HP System Survival
Median = 20.8 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
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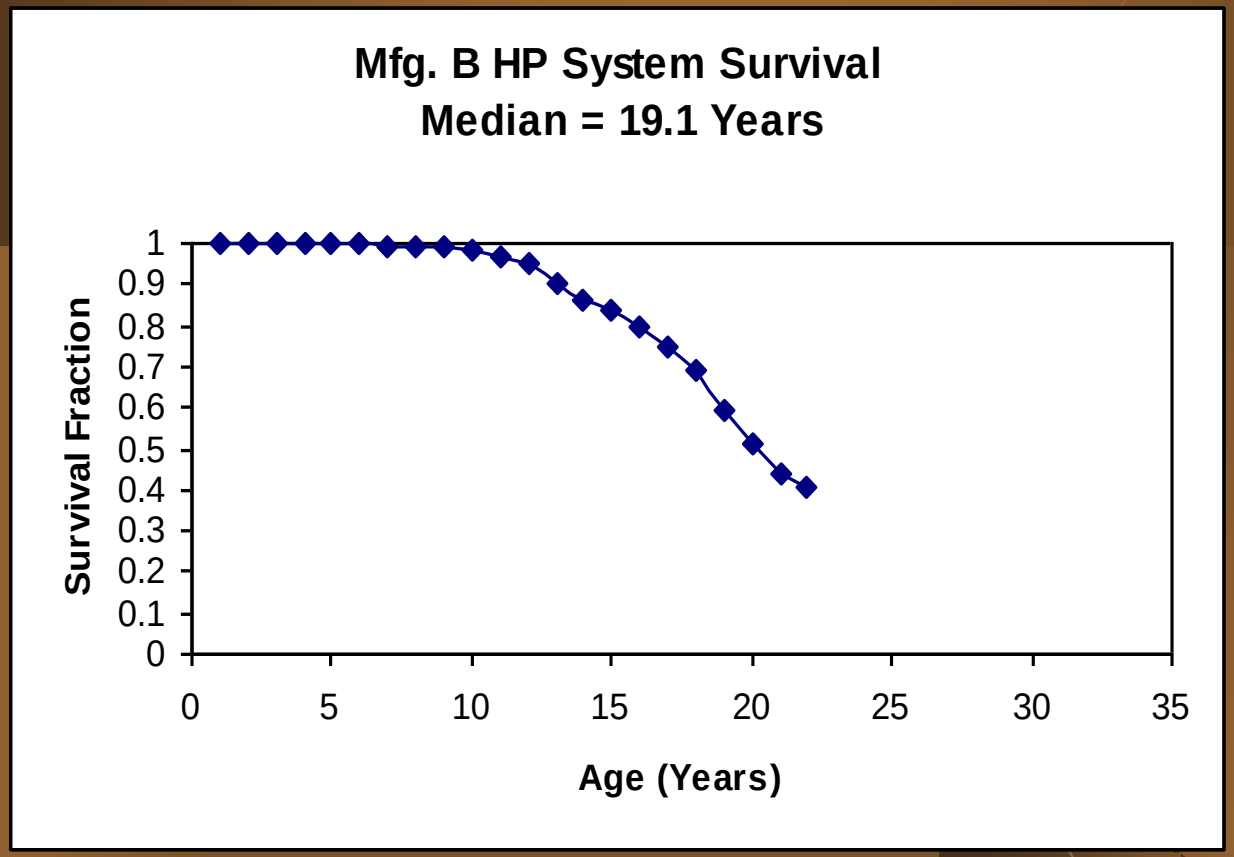
Age (Years)


Mfg. B HP System Survival
Median = 19.1 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
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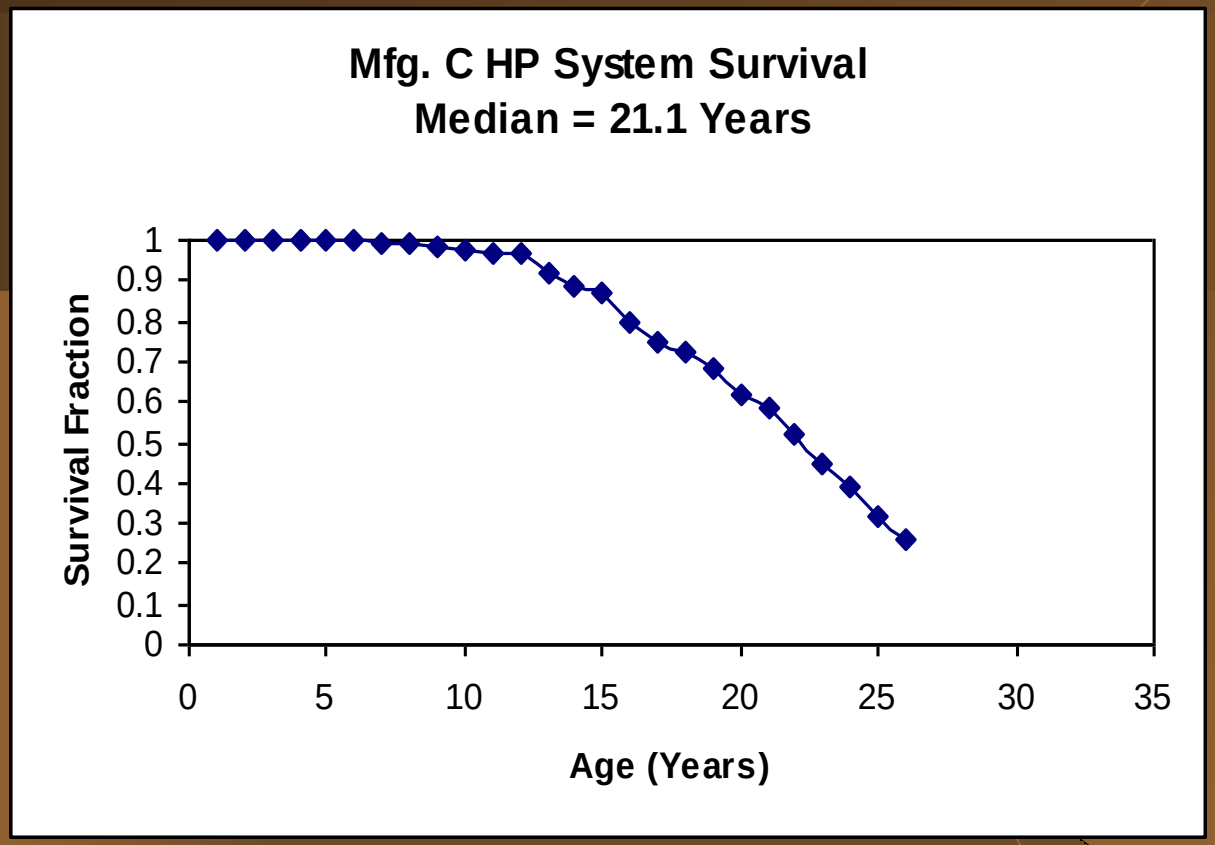
Age (Years)


Mfg. C HP System Survival
Median = 21.1 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
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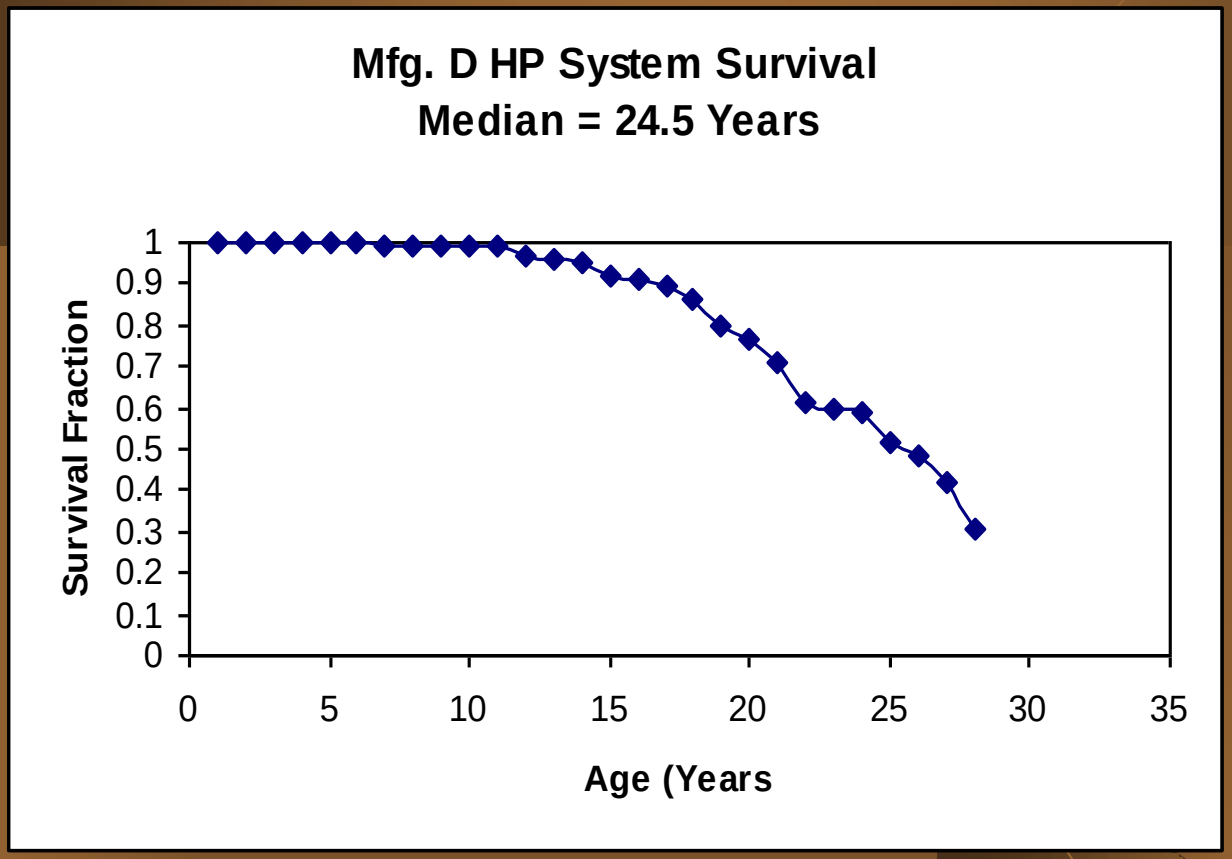
Age (Years)


Mfg. D HP System Survival
Median = 24.5 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
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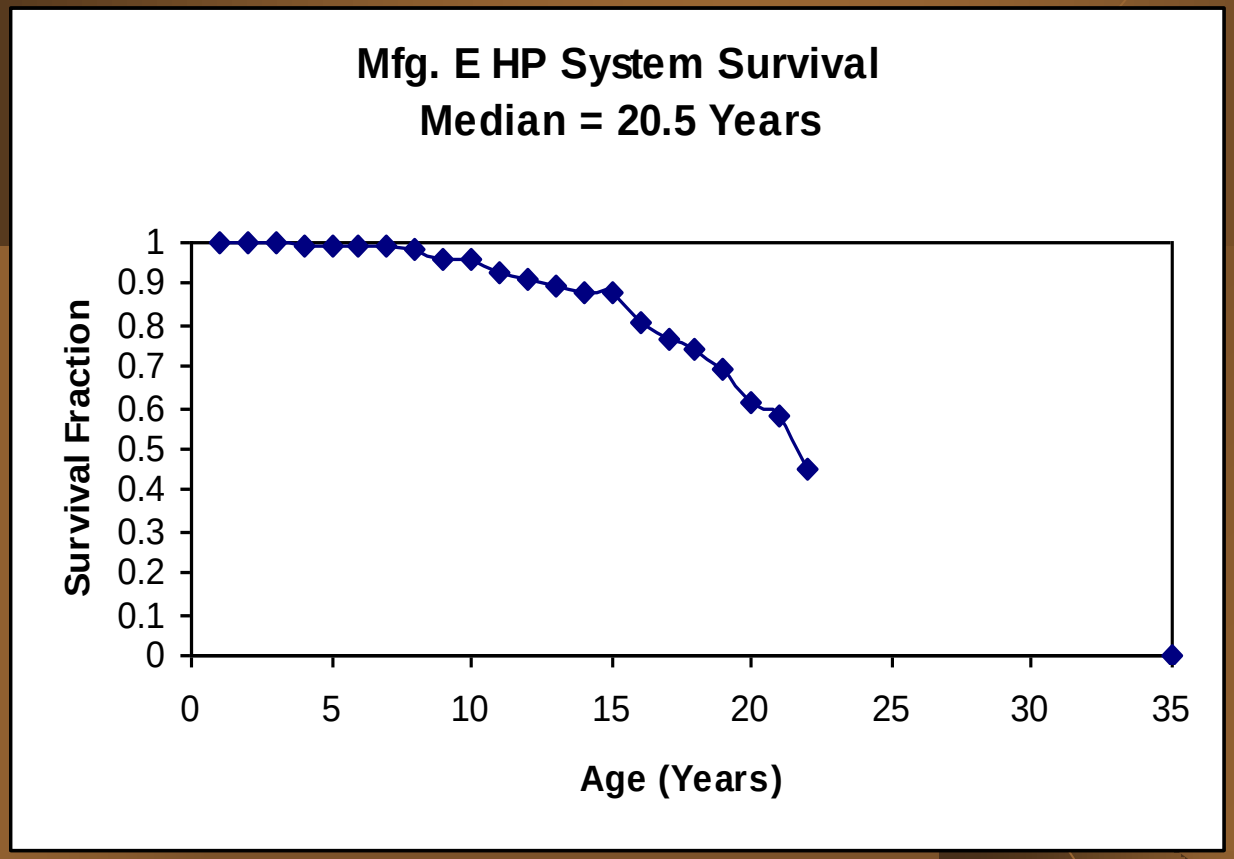
35
Age (Years


Mfg. E HP System Survival
Median = 20.5 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
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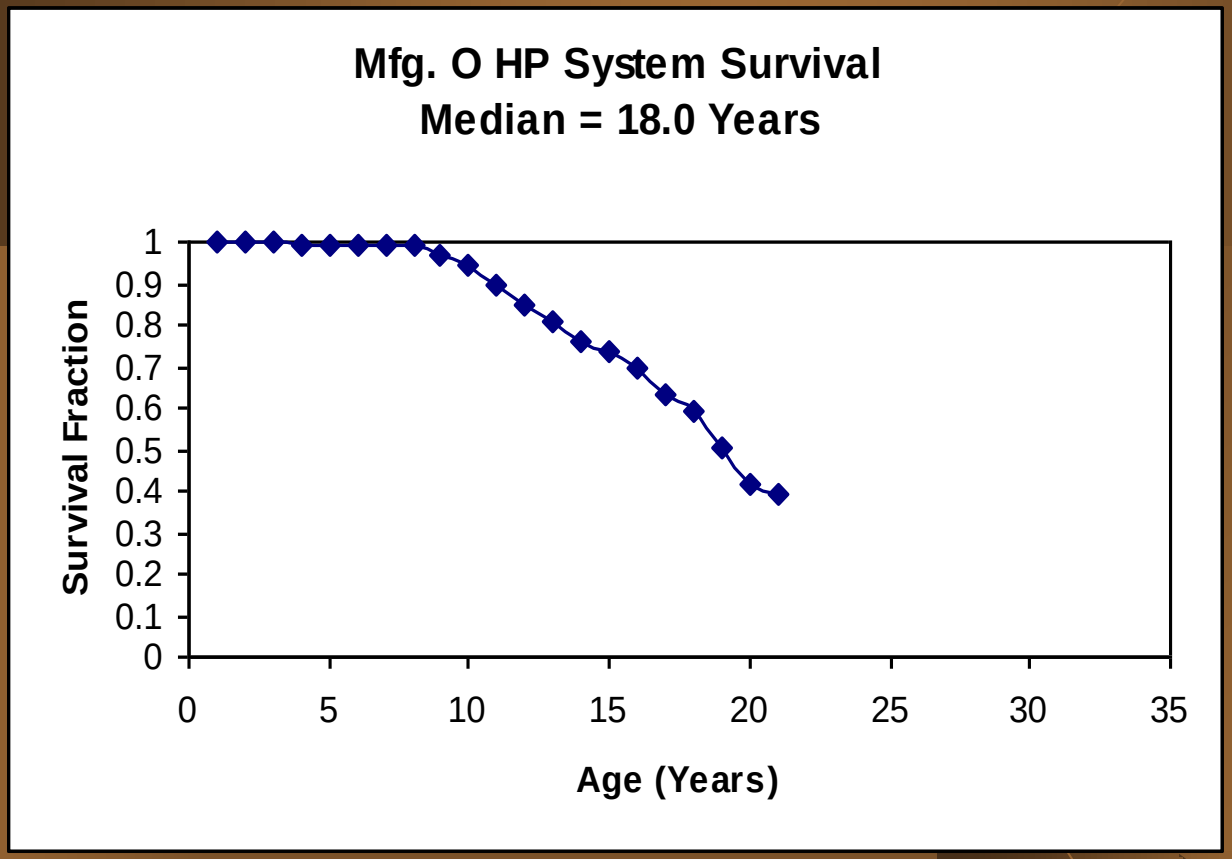
30
35
Age (Years)


Mfg. O HP System Survival
Median = 18.0 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
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0.3
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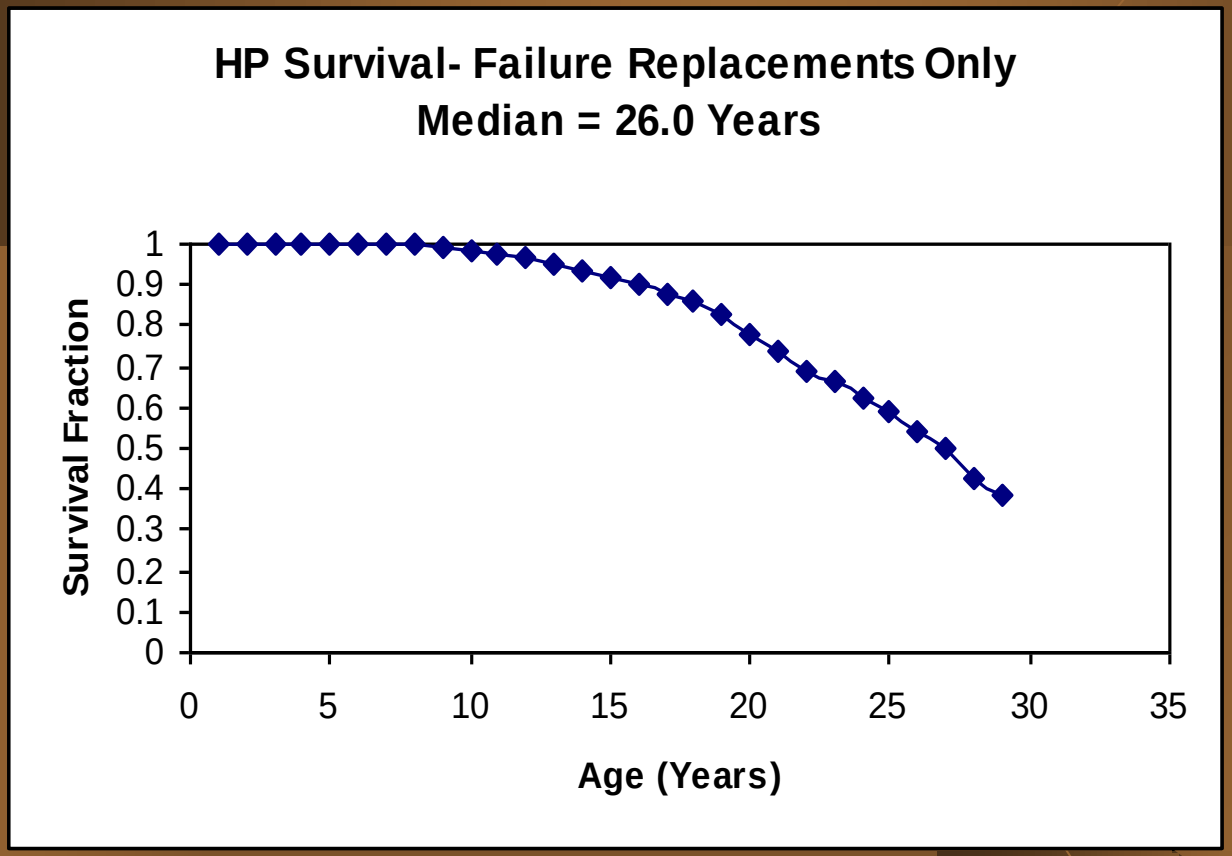
35
Age (Years)


HP Survival- Failure Replacements Only
Median = 26.0 Years
Survival Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
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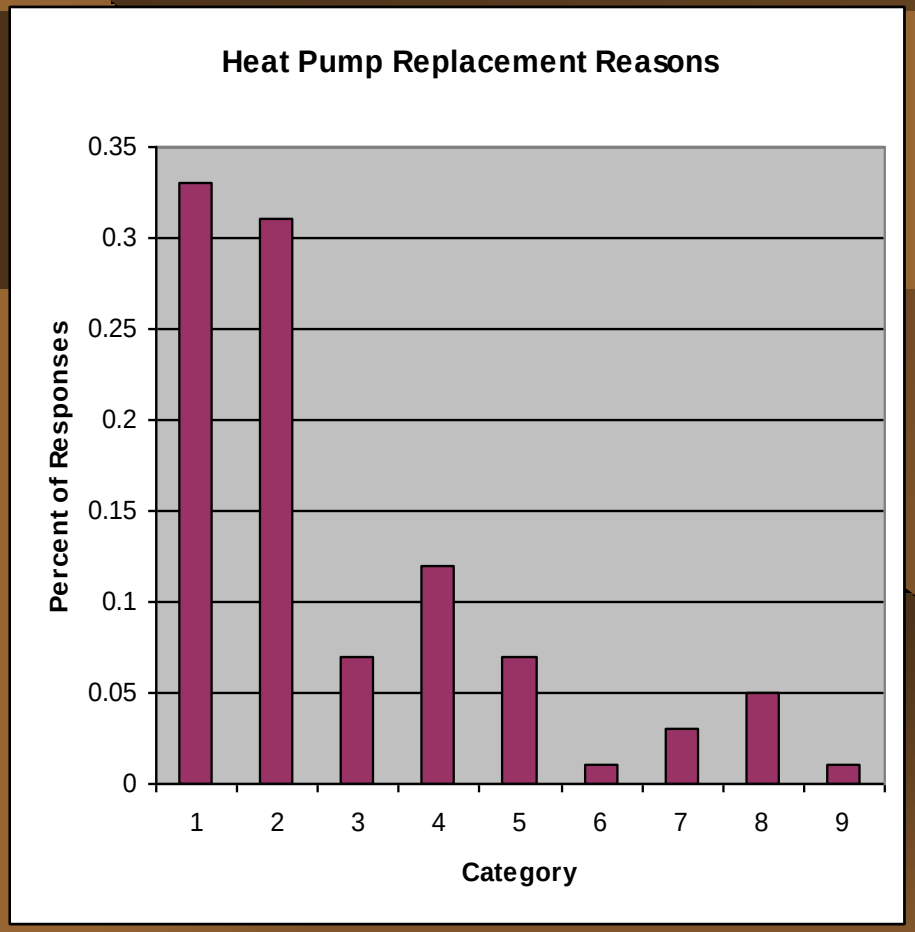
35
Age (Years)



- Unit getting old
- Unit failed
- Unit problems
- Upgrade
- Repair cost high
- Promotion
- Disaster
- Other
- DK

Conclusions from EPRI research

	2001	1985
Median Service Life	20.5	20
Avg Age at replacement	18.2	13.5
HPs in operation at replacement	63%	50%
Why replaced	1. old – Higher effic	
	2. failure	

When do we let the heat pump stand on its own merits? (mid 80's)

- Customer confidence increased
- Installations dramatically improved
- Products much improved
- Builder and dealer incentives introduced
- ASP was labor intensive
- Employees tired of acting like policemen
- Sometimes you need to "stop doing things"
- Cadre of trained utility "specialists"
- Valued relationships with manufacturers, distributors, dealers
- Available building
- Why not start a formal "Training Center"?
- Why not be "proactive" --train dealers to do it "right the first time"
- Let the dealer do his own start up "inspection"

What else can we do?

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The HVAC Training Center

World Class in HVAC Training

How Did We Get Here?

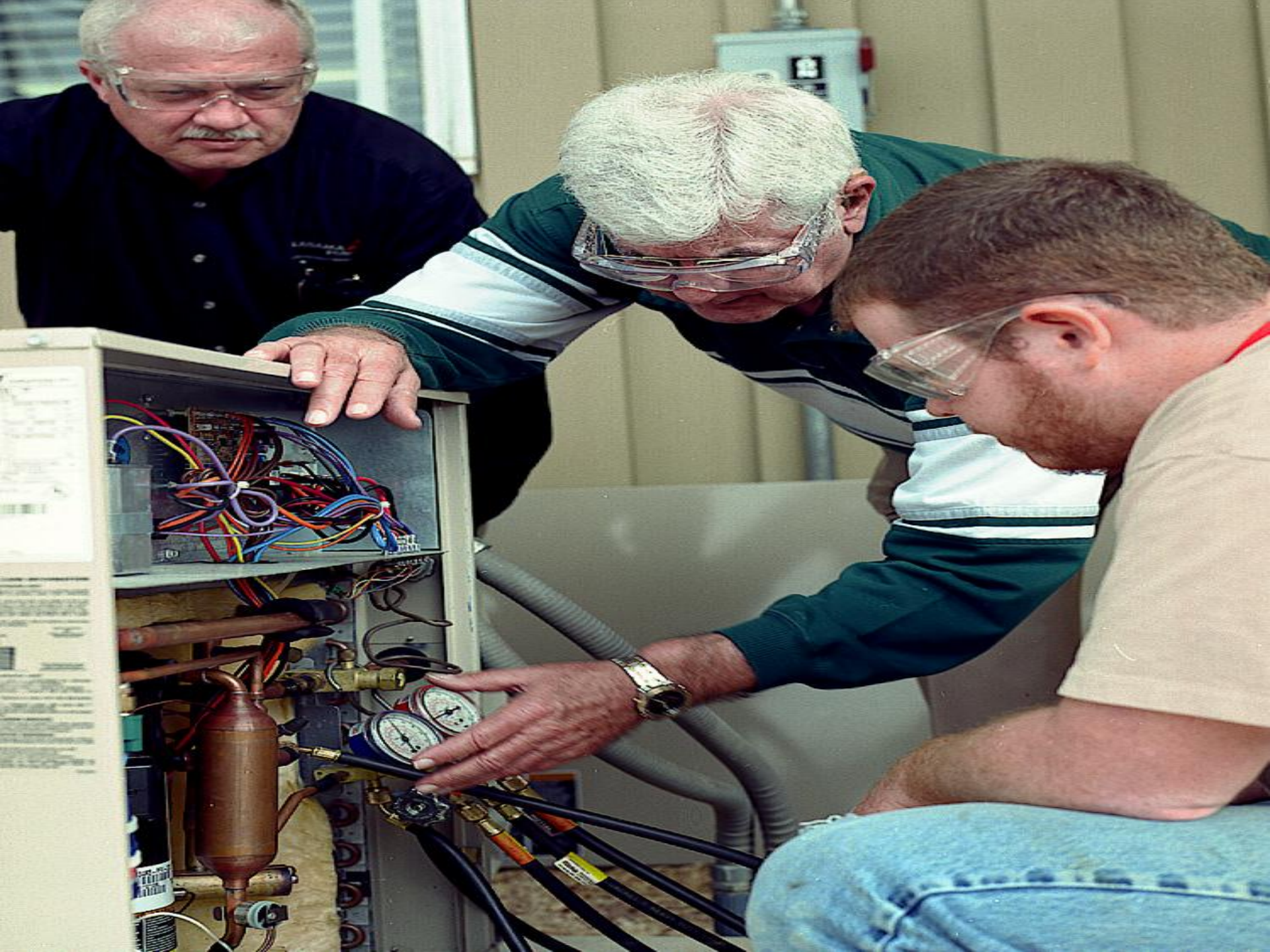
- Reliable Products
- Proactive
- Ready made Staff
- Available Building

HVAC TC Results 1986 to 2011

- 29000+ Participants from 43 States and several foreign countries
- Three Senior Training Analysts
- Three Field Specialists/Instructors
- Adjunct trainers used as needed

Hands-on, Performance- based training

- 15,000 Sq. Ft. building
- Labs
- Classrooms
- Energy Efficient house
- Remote site training
- Most brands of equipment
- Air source
- Geothermal
- Dual fuel
- Up-to-date equipment



HVAC TRAINING PRIORITIES

1. Proper Product Application
2. Proper Product Installation
3. Proper Performance Analysis
4. Proper Product Service

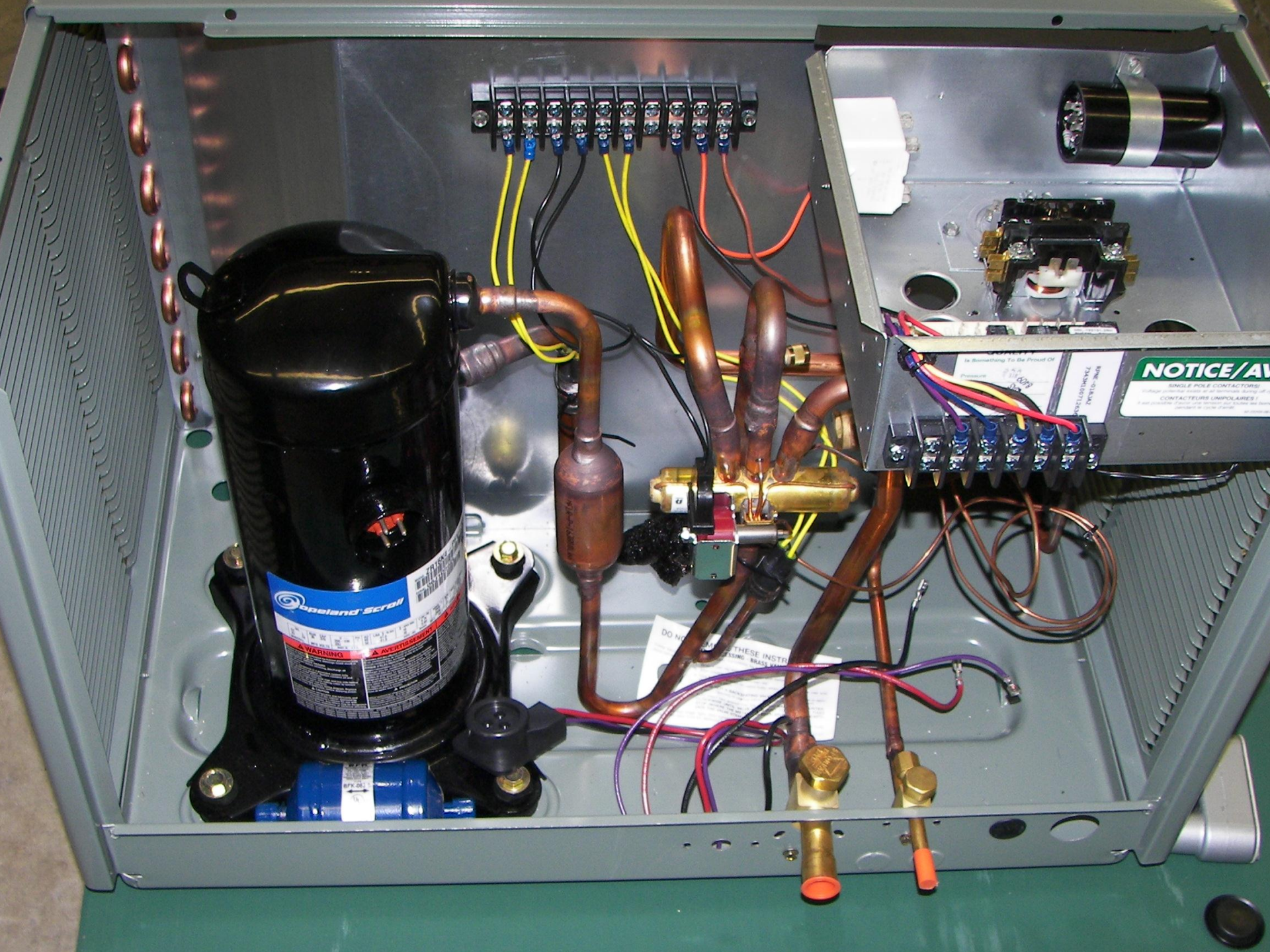

HEAT PUMP
SUPPLIED BY
RHEEM
AIR CONDITIONING
DIVISION
NOTICE
CAUTION
ENERGIZED
EQUIPMENT

TRAINING SCOPE
Phase One

To establish HVAC System Operation and Performance (i.e. establish normal/abnormal operation)

COURSE 1501: Foundations for Troubleshooting HVAC Refrigerant Systems

COURSE 1502: Foundations for Troubleshooting HVAC Electrical Systems

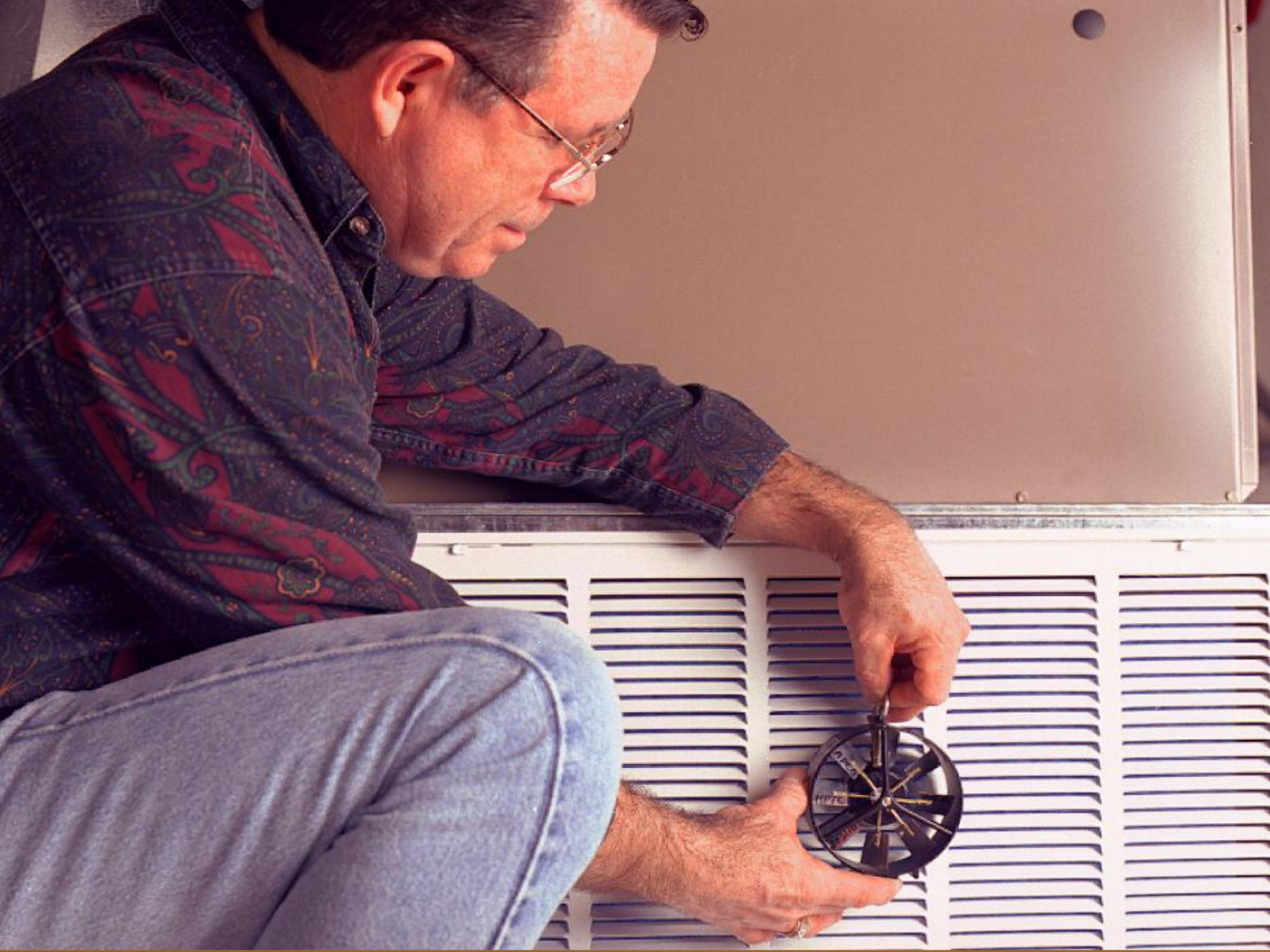

Copeland Scroll
WARNING
AVERTISSEMENT
NOTICE/AV
SINGLE POLE CONTACTORS!
CONTACTEURS UNIPOLAIRES !

TRAINING SCOPE
Phase Two

To establish / develop / implement proper troubleshooting methods and techniques.

COURSE 1503: Troubleshooting HVAC Refrigerant Systems

COURSE 1504: Troubleshooting HVAC Electrical Systems




HVAC
4
1
Rheem
ENERGY GUIDE

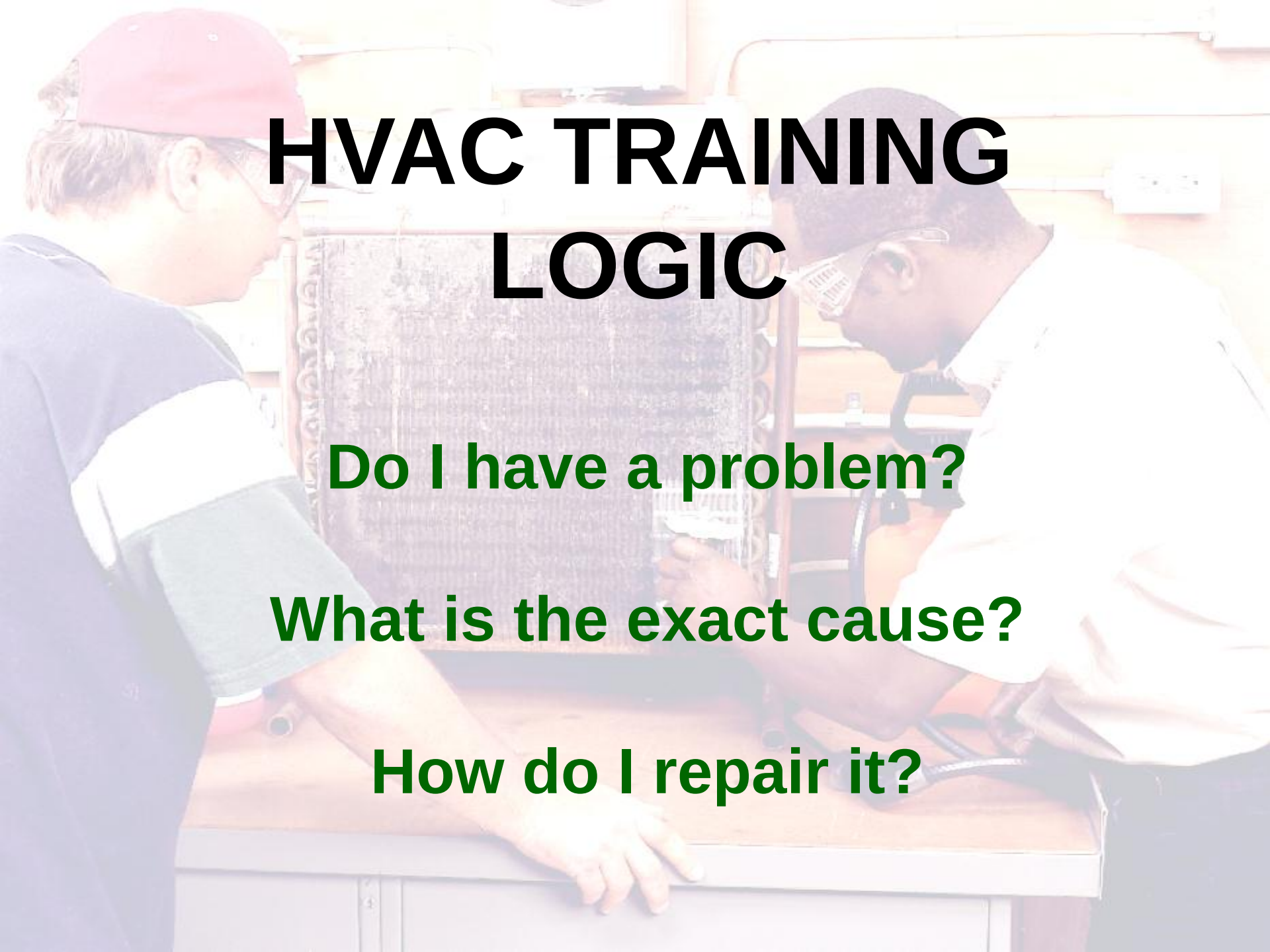
TRAINING SCOPE
Phase Three

To establish / develop / implement proper service methods and techniques.

COURSE 1505: Servicing HVAC Refrigerant Systems

COURSE 1506: Servicing HVAC Electrical Systems

COURSE 1507: Advanced HVAC System Analysis



HVAC TRAINING LOGIC

Do I have a problem?

What is the exact cause?

How do I repair it?

Do consumers have more confidence in Heat Pumps?

	2010	1980
Residential Customer Base	1.1 million	
New Mkt. HP penetration	70+%	17%
After Market	10000	3000
HVAC Training	29,000+	
	43 States	
	Several foreign countries	

How has HVAC Training Center Changed in 25 years

- Same Facility
- Increased management commitment
- Break even financially
- Continually updating equipment to meet challenges in today's environment

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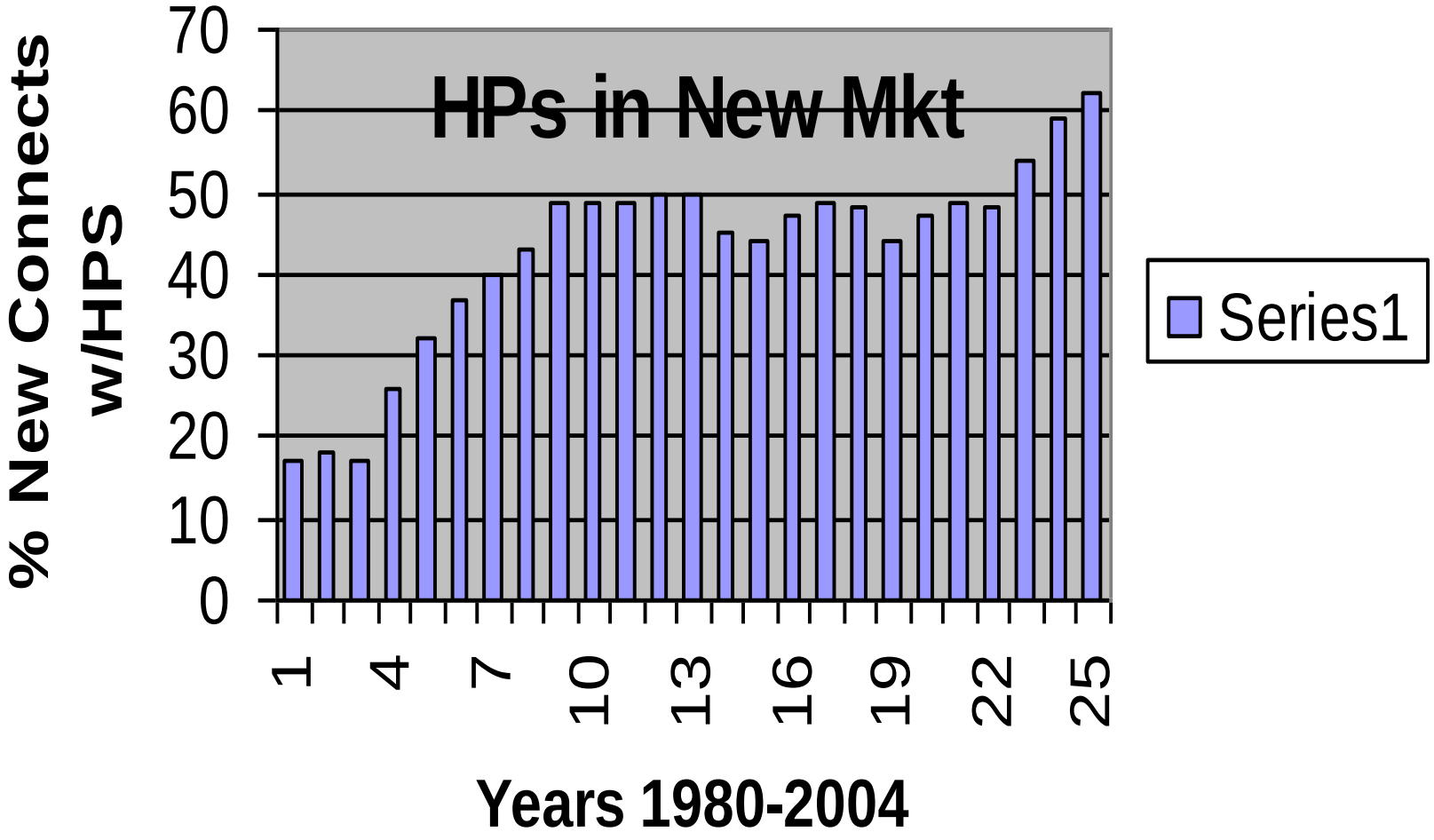
- Attracting new people to industry
- Dealers seeking personnel with renewed enthusiasm
- U.S. economy downturn
  - RNC down
  - Replacement market strong
  - Repair vs. replacement means more demand for qualified service personnel

The question in 1985 was

- Can the heat pump stand on it's own merits?

- 25 years
- 29,000 trained techs
- Heat pump sales in APCO territory too many to count
- National sales 2+ million annually


HPs in New Mkt
% New Connects w/HPS
70
60
50
40
30
20
10
0
1
4
7
10
13
16
19
22
25
Years 1980-2004
Series1

Questions??

ALABAMA POWER

A SOUTHERN COMPANY

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SAMPLE TRAINING PLAN FOR HVAC TECHNICIANS

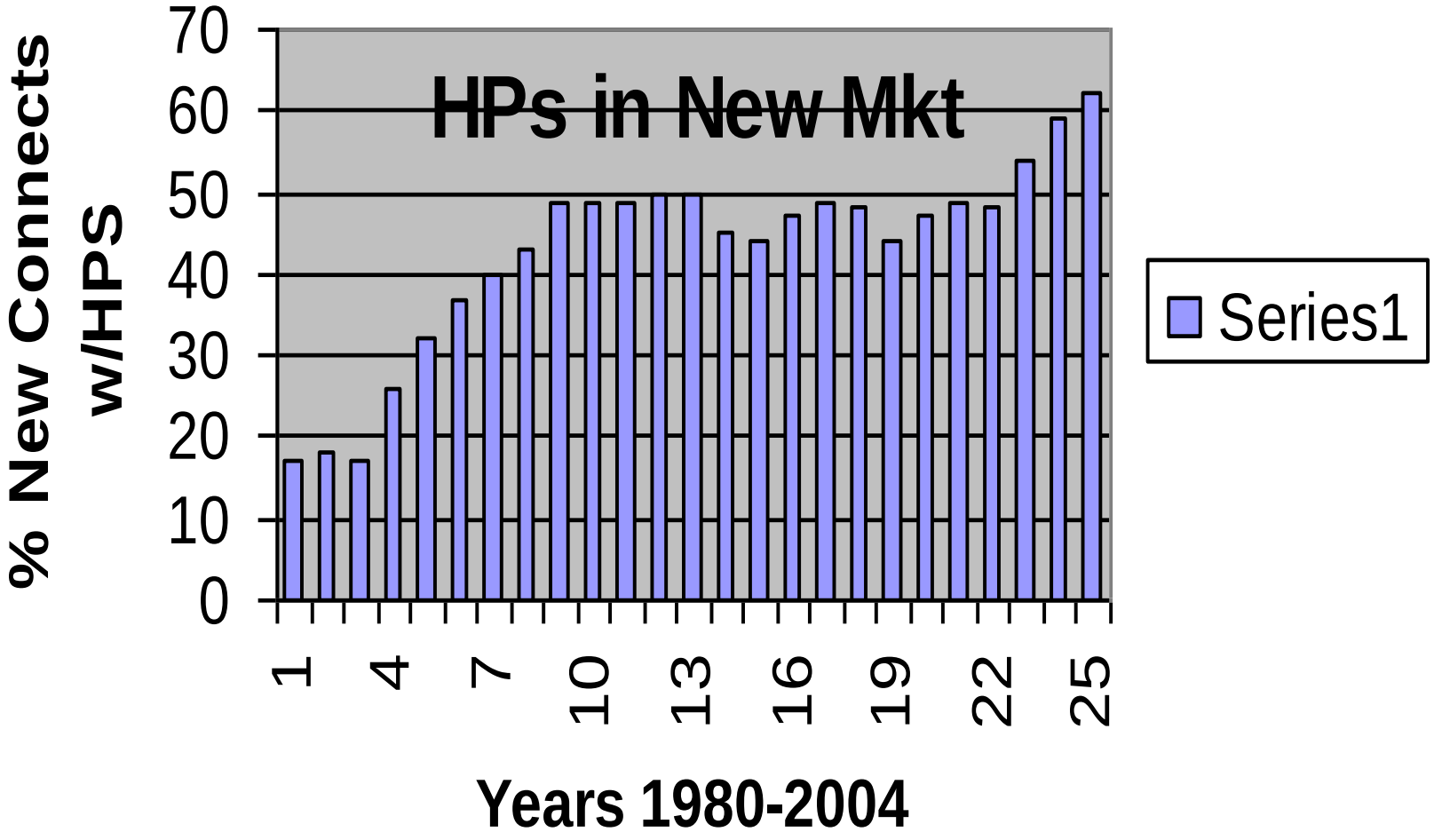
- Course 1501E: Basic Refrigeration and HVAC Operations
- Course 1501: Foundations for Troubleshooting HVAC Refrigerant Systems
- Course 1502E: Basic HVAC Electrical Operations
- Course 1502: Foundations for Troubleshooting HVAC Electrical Systems
- Course 1503: Troubleshooting HVAC Refrigerant Systems (Prerequisite: 1501)
- Course 1504: Troubleshooting HVAC Electrical Systems (Prerequisite: 1502)
- Course 1505: Servicing HVAC Refrigerant Systems (Prerequisite: 1501 and 1503)
- Course 1506: Servicing HVAC Electrical Systems (Prerequisite: 1502 and 1504)

Sample Plan (CONTINUE)

- Course 1507: Advanced Troubleshooting of HVAC Systems (Prerequisite: 1501-1506)

Additional Course Offerings

- Course 1905: Refrigerant Recovery Certification
- NATE: Exam Preparation Review and Testing
- Course 1802: Residential Load Calculations
- Course 1803: Residential Duct Design (Prerequisite: 1802)
- Manual N: Commercial Load Calculations
- Manual Q: Commercial Duct Design
- Course 1807: Air Duct Fabrication, Installation, Testing and Repair
- Course 1809: Air Infiltration Diagnostics and Repair
- IGSHPA: International Ground Source Heat Pump Association Closed Loop Certification


HPs in New Mkt
% New Connects w/HPS
70
60
50
40
30
20
10
0
1
4
7
10
13
16
19
22
25
Years 1980-2004
Series1

Data Processing and Analysis

- Interviews surveyed for procedural errors
- Coded information entered to allow correlation and verification
- Computerized database to catch interviewer errors
- Follow up contacts made to clarify input.
- Validated interviews entered into permanent database

Results

- 2026 heating and cooling systems
- 1818 Heat Pumps
- Remainder
  - 172 gas central
  - 19 central electric
  - 17 “other”

Factors Affecting Replacement Decisions

- Between 88% and 92% replaced with HPS
- Major Reasons
  - Getting old (33%)
  - Unit Failure (31%)

Homeowner Perceptions

- Proactive replacement by homeowners
- Maintenance requirements down on newer
- Satisfaction up on newer
- Future service life studies may verify improved equipment reliability

Attitudes Toward Heat Pumps

- Neutral to positive outnumbered negative by 4-1 (79% positive 21% negative)
- Why not
  - Cool blow heating (27%)
  - Excessive maintenance (10%)
  - Cooling problems (9%)
  - High operating costs (2%)
  - Odor (1%)
  - Other/general negative (51%)

Conclusions

- Total median service life 20.5 years
- Average age at replacement 18.2
- Approximately 63% units replaced were operational
- Most common reason for replacement was “unit getting old”
- No apparent differences in service life based on dates selected for survey

Conclusions (Cont'd)

- Estimated Service Life for failed units -26
- Compressor life not verifiable, but estimated to be at least 13.5 years
- Minimal fuel switching from heat pumps to alternate fuels (8%)
- Heat pump owners pleased by 4 to 1 margin