

The Opportunities of Duct Performance Contracting



Your Presenter Today:

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- VP and Co-Founder of Comfort Institute
- Started as HVAC Maintenance Tech
- Started with Retrotec in 1994
- Speaker at National Conferences:
- Published Author:



Understanding How Buildings Work

- They are in an interactive system
- There is more to HVAC than the box
- Understanding and being able to repair ducts is imperative
- Having a good knowledge of the thermal envelope

So How To Take Advantages of Missed Opportunities

- Train CSRs how to listen and ask questions on the phone
- Have training on teaching technicians to be lead generators
- Train technicians on the three “Ls”
- Have a system in place to follow up if not sold by a tech
- Learn that every phone call is an opportunity for a lead
- Decide on what your company wants to offer and have pricing

The Three Legged Stool



All Three Legs Must Be Strong



All Three Legs Must Be Strong



All Three Legs Must Be Strong



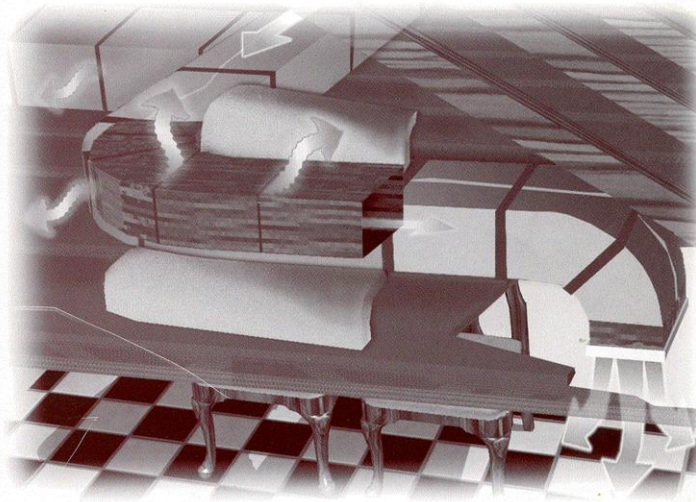
Duct System Problems & Complaints



AEROSEAL[®]
Duct Sealing From The Inside



IMPROVING THE EFFICIENCY OF YOUR DUCT SYSTEM



OFFICE OF BUILDING TECHNOLOGY, STATE AND COMMUNITY PROGRAMS
ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY



Department of Energy Report



COMPONENTS OF THE DUCT SYSTEM

A duct system is a branching network of round or rectangular tubes—generally constructed of sheet metal, fiberglass board, or a flexible plastic-

conditioner, or heat pump) contains a fan that forces heated or cooled air into supply ducts leading to the rooms. The fan gets its air supply through return ducts,

ENERGY LOSSES AND COSTS

Typical duct systems lose 25 to 40 percent of the heating or cooling energy put out by the central furnace, heat pump, or air conditioner. Homes

with ducts in a protected area such as a basement may lose somewhat less than this, while some other types of systems (such as attic ducts in hot, humid climates) often lose more.

electricity for central heating and cooling at national average energy cost of 70 cents per therm, and 8 cents per kilowatt-hour. With these savings, the cost to seal and insulate the ducts would most likely be paid for after three years. These estimates apply to retrofitting

an attic or vented crawl space that is nearly as cold as the outdoors, this heat is completely lost. If the ducts are in a basement, some of the heat lost from the ducts may be recaptured by warming the basement ceiling enough to reduce the heat lost from the house.

an existing home. For ductwork would be a potential savings would to install sealant and less than one year.

Duct systems lose energy of heat from the warm



Summer Comfort

- Hot Rooms
- Excessive Humidity
- Entire House Gets Hot, System Can't Keep Up



Winter Comfort

- Cold Rooms/Drafts
- Dry Air
- The Humidifier Didn't Help

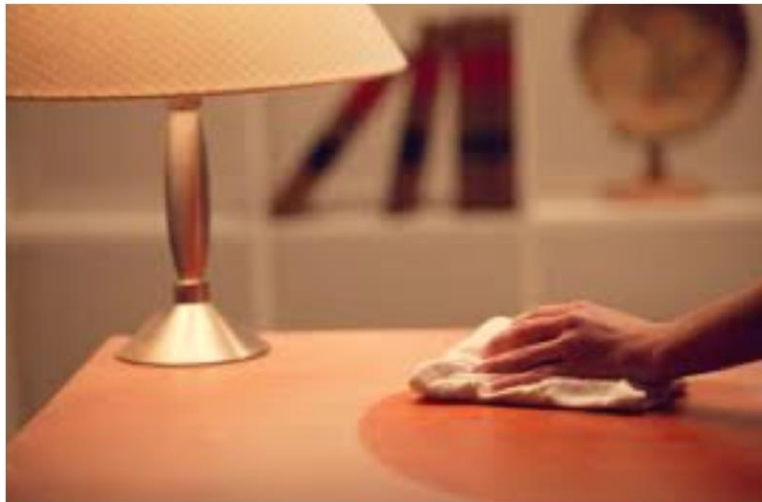


Our New System Is Noisier



Dust and Allergy Complaints

- Dust On Furniture
- The Air Cleaner Didn't Help



Odors and IAQ

- House Smells
- Registers Sweat
- CO Alarm Goes Off



High Utility Bills



Bought A New HVAC System

- Problems became Worse
- Didn't save anything
- Old one seemed to work better



Different Types of Leakage

- Duct Leakage
 - To Outside: causes energy loss and efficiency loss makes houses go negative
 - To Inside: causes room imbalances and air balancing issues
 - Both need to be dealt with but only duct leakage to the outside saves energy

Why Duct Leakage Adds Up

- Duct systems have Holes, which are ...
- Subjected to Mechanical Pressure ...
- At the Worst Times of the day or year ...
- Losing the Most Conditioned Air via supply leaks ...
- Often sucking the Hottest Possible Summertime Outside Air in the return leaks.

Little Leaks Really Add Up



“Diffuse Duct Leakage”

Sometimes They Have Fallen Apart



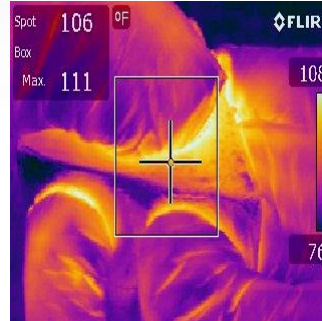
“Disconnected Duct Leakage”

And Often A Duct Isn't A Duct!



“Building Cavity Return Duct Leakage”

No One Method Approach



Utility
Rebate
Programs

Simple, Often Free

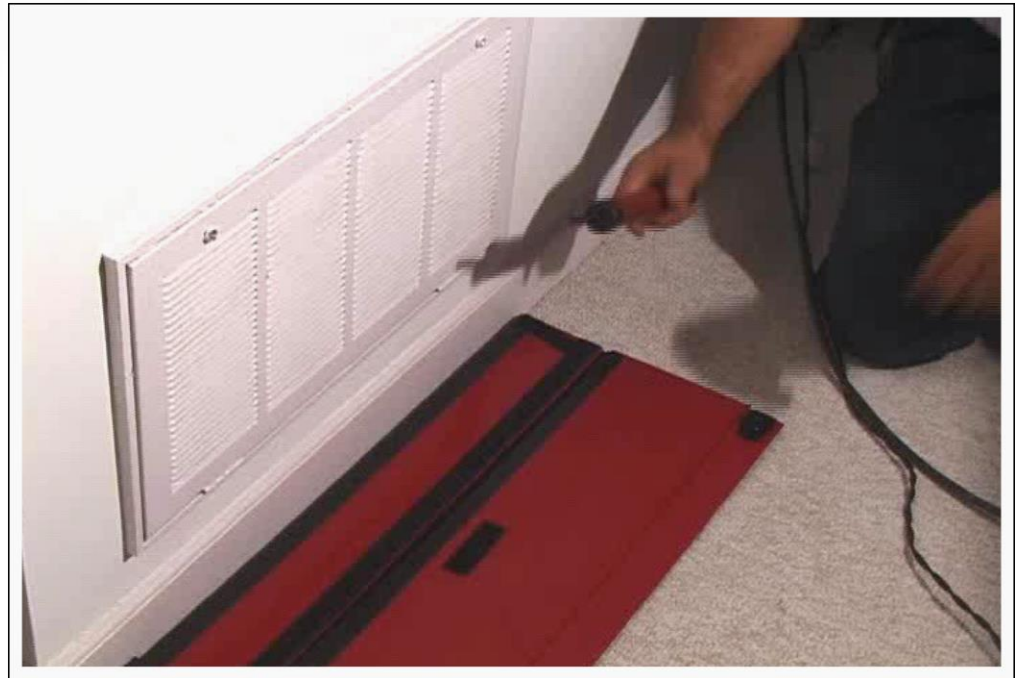
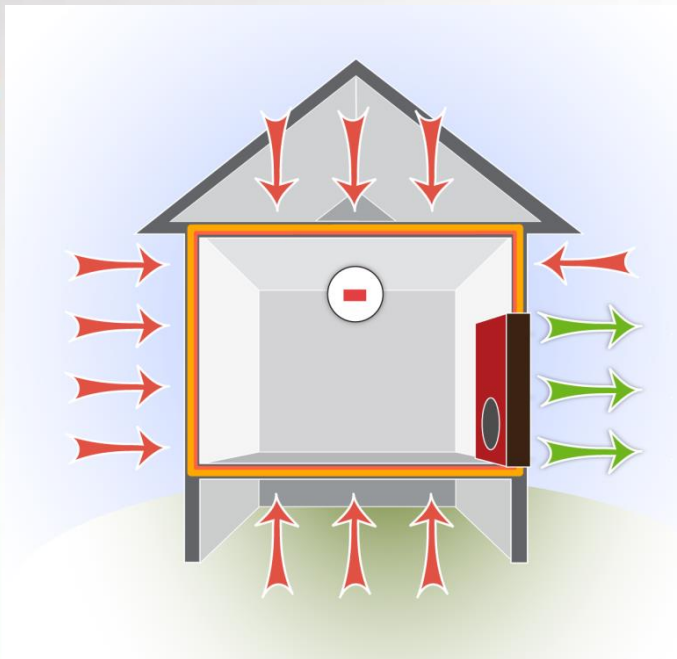
Involved, Often A Fee



Instruments Help Find Opportunities



Blower Door Demos Duct Leaks



Duct Airtightness Tester

- Measures total duct leakage
- Requires taping or covering of grilles



Blower Door With Flow Hood

- Quicker way to get a duct leak to outdoors
- Flow hood measures duct leakage at each register



Duct Leakage Flow Hood Test Report

Report Prepared For: **Vanvouver, 555 Any Street, Vancouver, WA**
 Prepared By: **Ken, Guy Smith Heating & Cooling, Virginia Beach, VA**
 System Description: **Whole House, 3 Ton, 1200 cfm**

Date Of Test: **July 7, 2015**

Living Area: **2,200 square feet on 1 Story; 3 Bedrooms; 8 ft Avg. Ceiling Height**

Duct to duct zone: **25 Pa of pressure**

Flow Hood Leakage Readings

Square
TEST Inches @
CFMs 25 pa

Return Leakage	170													170	32
Supply Leakage	100														
														100	19

Total Duct Leakage Corrected to 25 Pa **270 50**

New Construction Maximum Duct Leakage Standard Based On
Air Conditioner Size: **72 13**

Actual Leakage vs. Recommended Maximum for New Homes: **385%**

Report Prepared For: **Vanvouver, 555 Any Street, Vancouver, WA**
Prepared By: **Ken, Guy Smith Heating & Cooling, Virginia Beach, VA**
Date Of Test: **July 7, 2015**

Why Duct Leaks Are The Worst Leaks In Your House

1. They are subjected to much higher pressures than house leaks.
2. Supply leaks lose the most expensive, highly conditioned air.
3. Return leaks suck in unconditioned air from attics, crawlspaces, garages and outside.
4. Duct leaks may cause dust, pollen, mold, moisture and insects to be drawn into your home.
5. Duct Leaks can interfere with the safe operation of fireplaces, furnaces, or water heaters.

How Duct Leaks May Make Your Home Uncomfortable

Calculated loss of air conditioner cooling output on the hottest days:

0.84 tons (28% of your air conditioner capacity).

Calculated loss of furnace output on coldest days:

10,755 BTUs per hour (15% of your furnace capacity).

In addition to less total cooling or heating output, duct leakage often causes individual rooms to be hard to heat or cool.

How Duct Leaks Reduce Your Equipment's Energy Efficiency

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How Duct Leaks Reduce Your Equipment's Energy Efficiency

Calculated loss of air conditioner efficiency (SEER): **21%**

Calculated loss of furnace efficiency (AFUE): **11%**

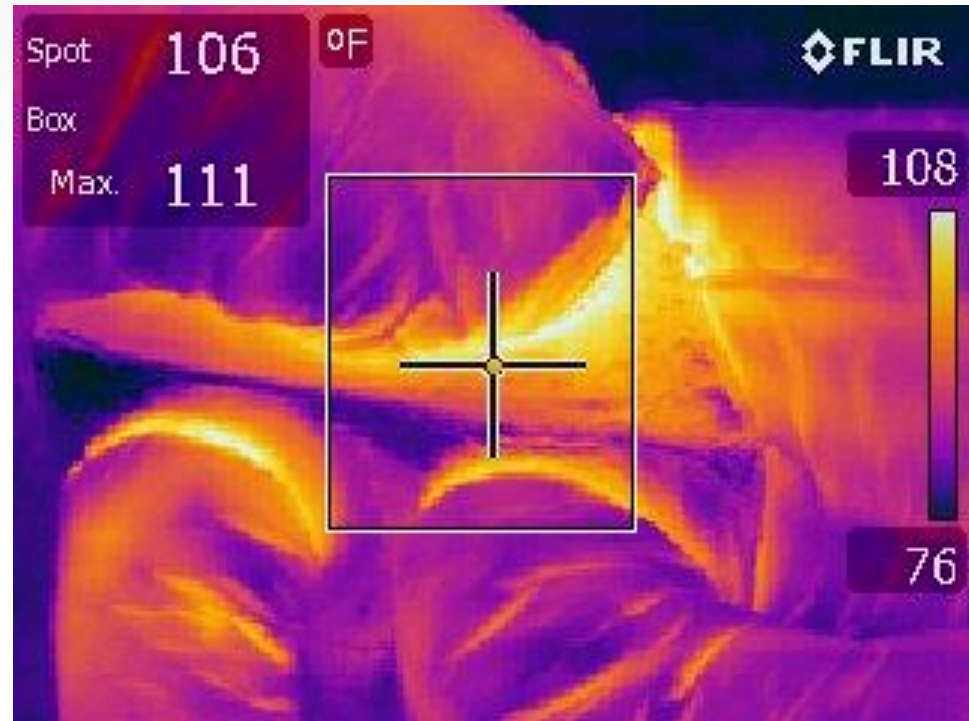
Air Conditioner SEER Rating	Actual SEER Rating	Furnace AFUE Rating	Actual AFUE Rating
24	19.0	100%	89%
22	17.4	95%	84%
20	15.8	90%	80%
18	14.2	85%	75%
16	12.6	80%	71%
14	11.1	75%	67%
12	9.5	70%	62%
10	7.9	65%	58%
8	6.3	60%	53%

Infrared Thermal Imager

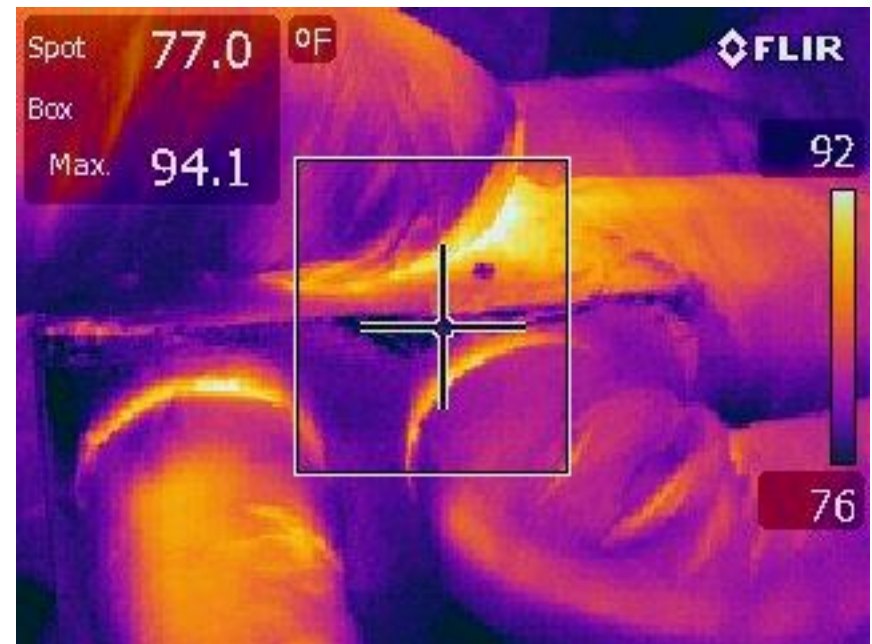
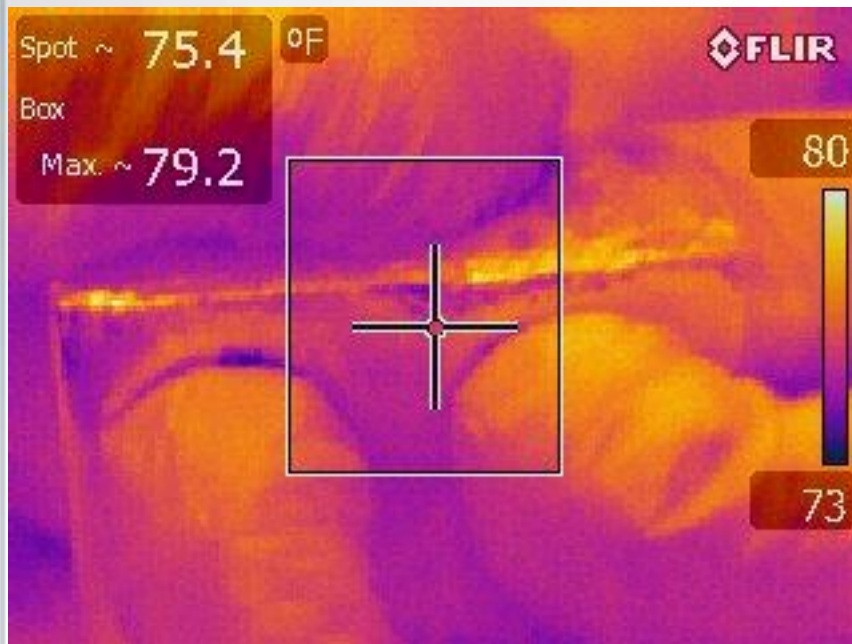
FLIRONE™



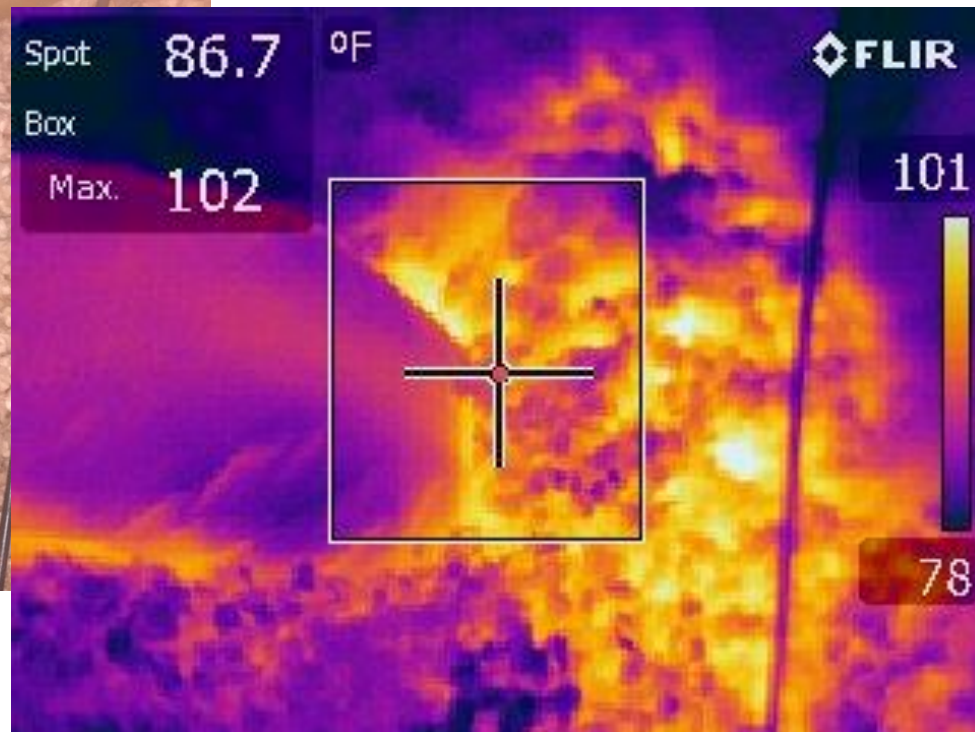
IR Camera With Furnace On



IR with Heat Off, Then Heat On



Leaky Boot-Sheetrock Under Insulat...



Leaky Metal Ducts Under Wrap



Duct Sealing or Replacement Opportunity

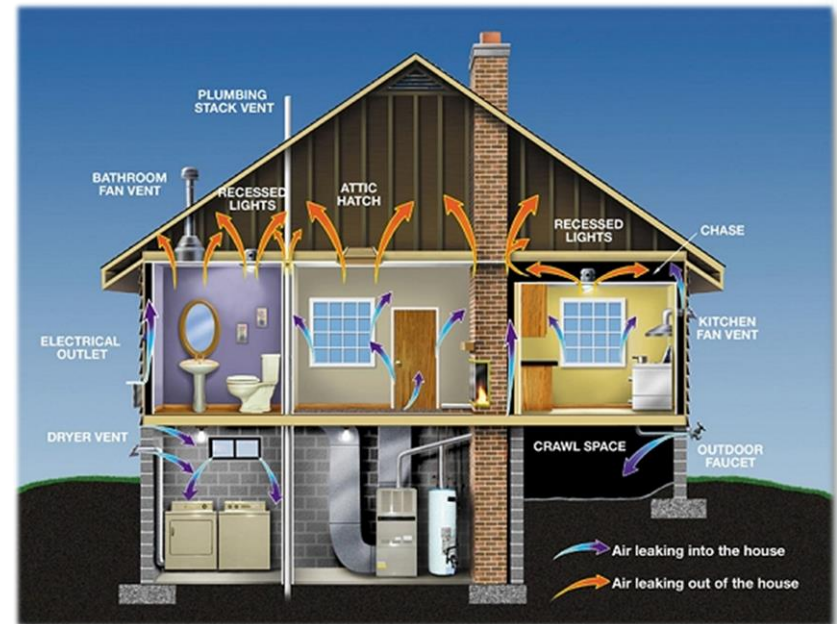
- Duct Seal
- (manually or by AeroSeal)
- Duct Replacement:



Home & Duct Performance Contracting...

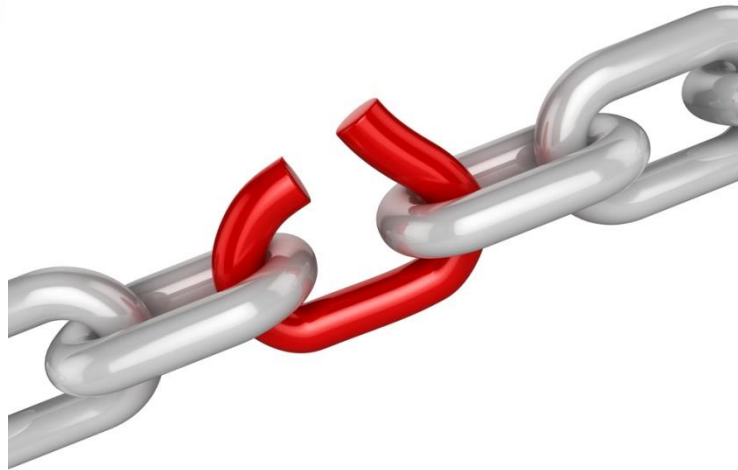
...is built on the latest research and new understanding of:

- Building Science
- How the Whole House Works as an Interactive System
- But Understanding Ducts is Imperative



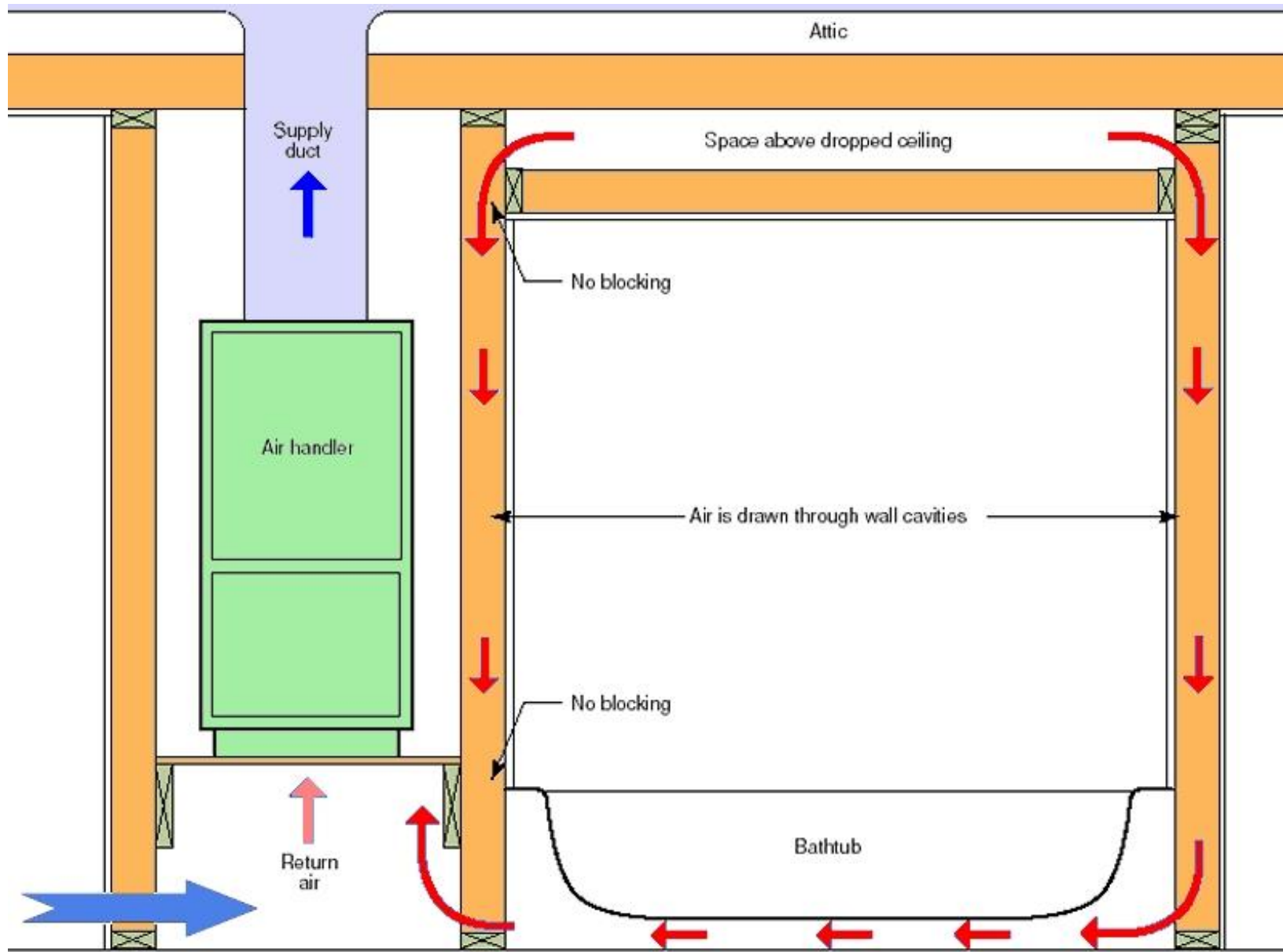
Ductwork

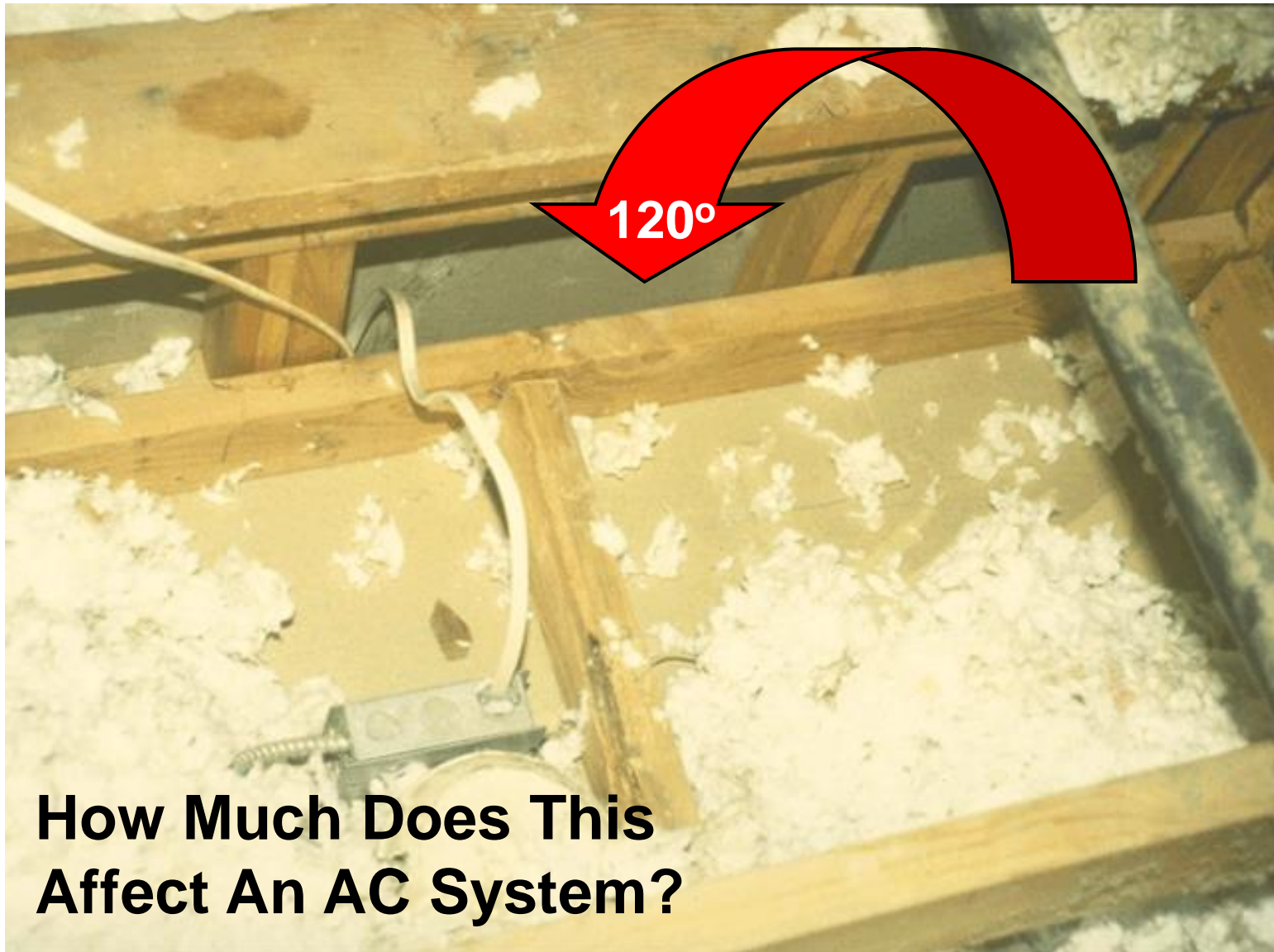
- Leaky ducts are the weakest link in the HVAC system
- 90% of problems in homes have a relation with the ducts



Building Cavities Used As Returns

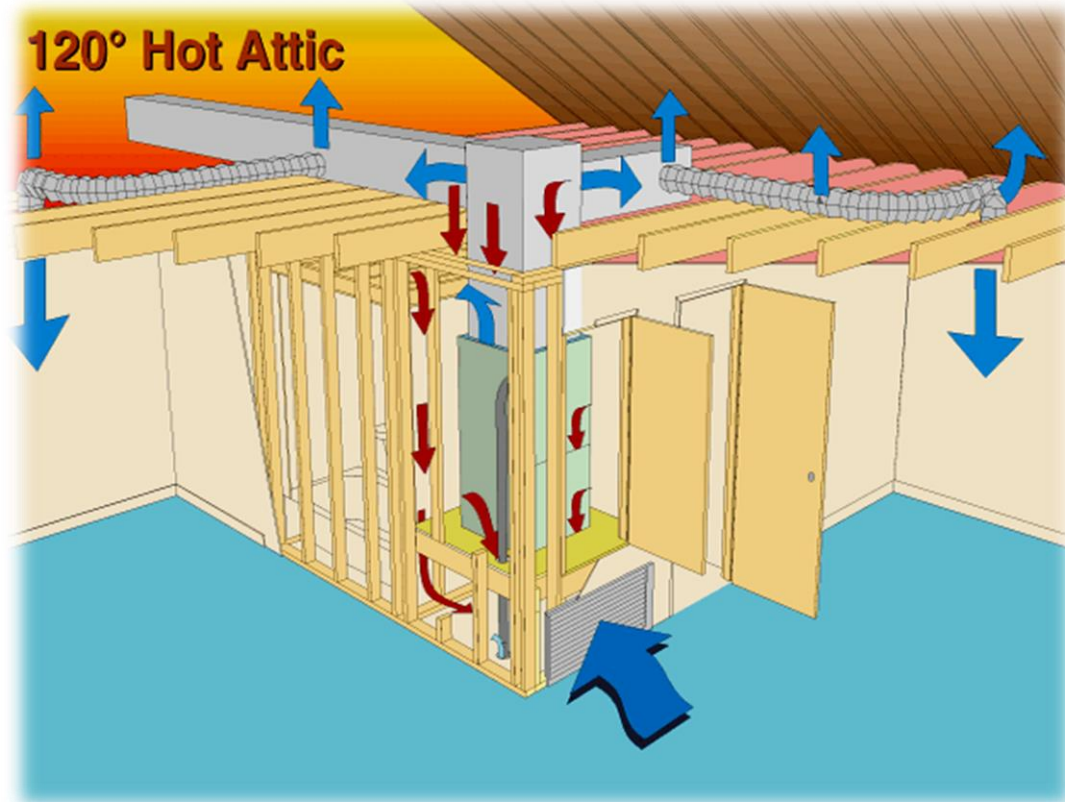






**How Much Does This
Affect An AC System?**

“10% Hot Attic Return Air Cuts AC Capacity and Efficiency



Research Report Source: FSEC-CR-397-91
Prepared for the FL Governor's Energy Office

Basement House: The Overlooked Return Air Source



Leaking from the attic



Return Leakage In Basement System Home

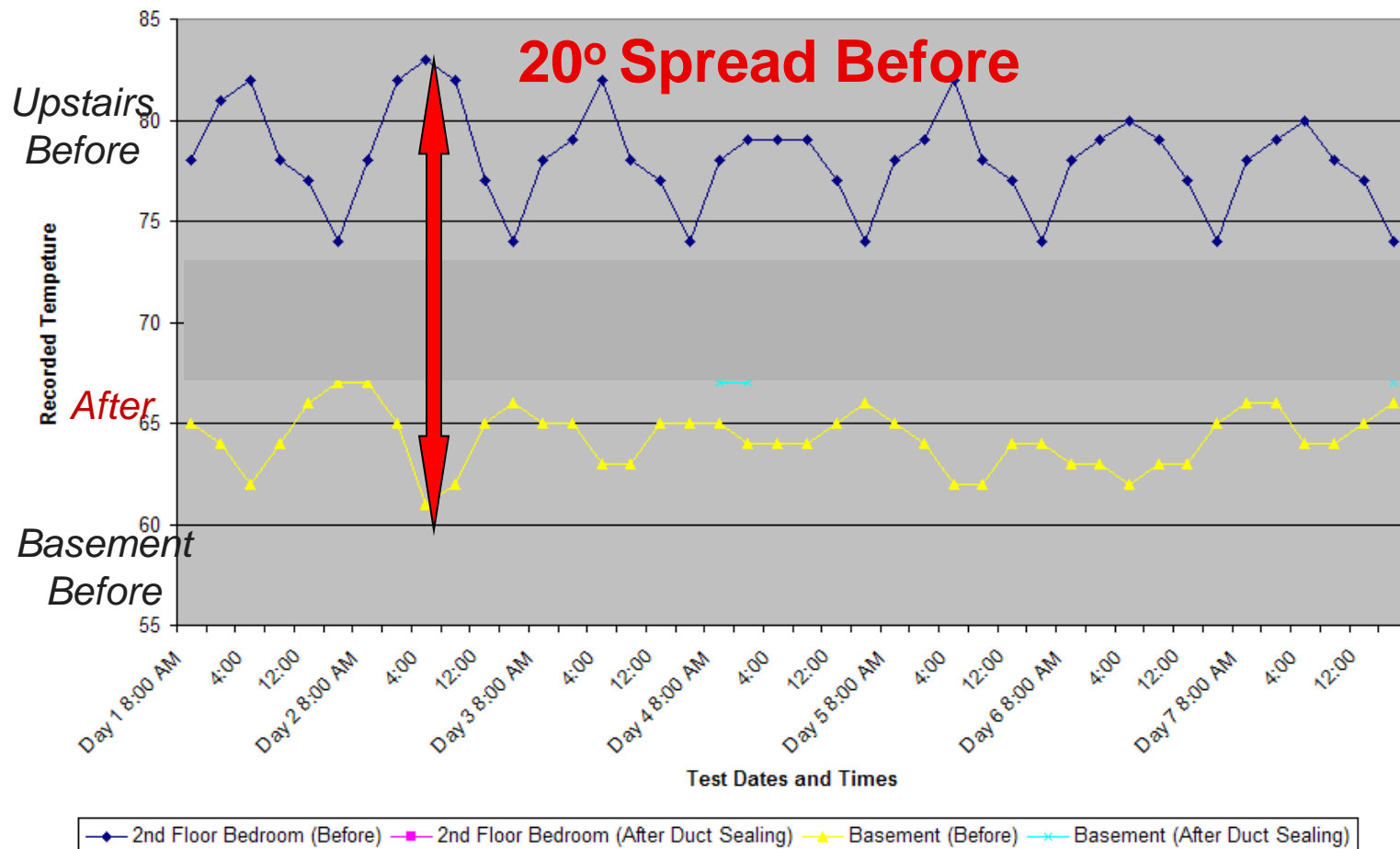


Is It Worth Sealing Supply Leaks In Basements or Between Floors?

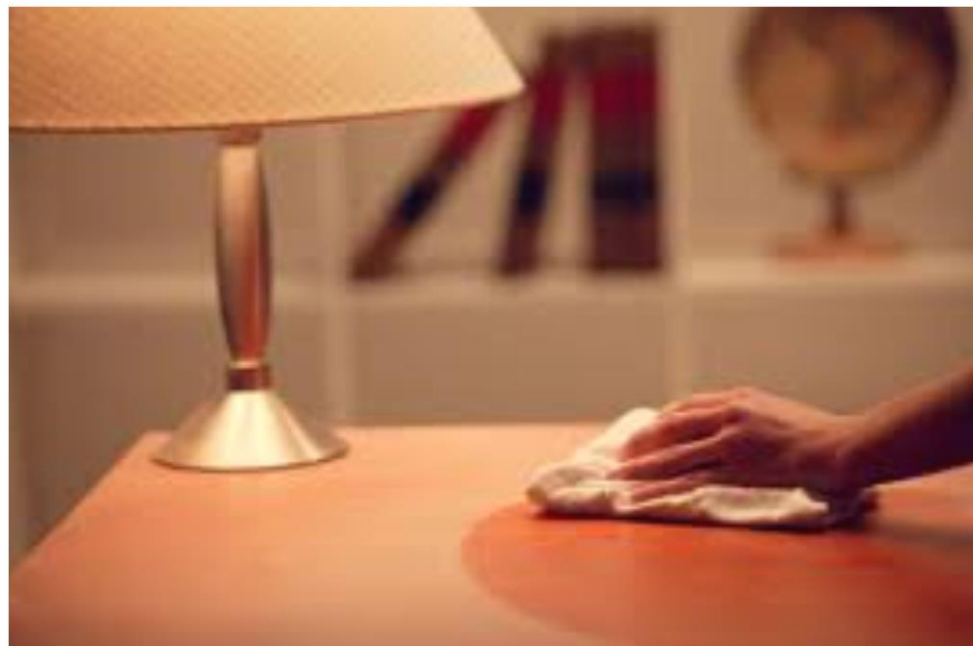


2nd Floor Comfort Improvement From Basement Supply Duct Sealing & Some Attic Fix

Two Story Wheaton Area Home with Finished Basement

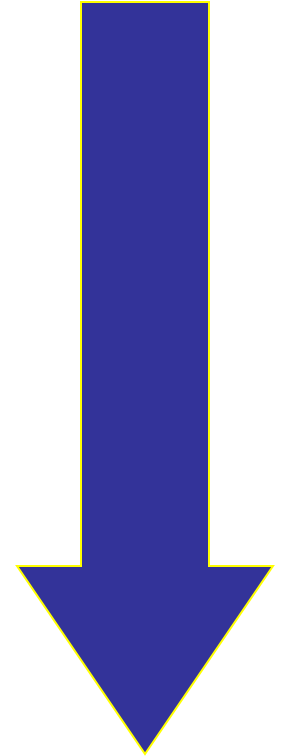


Air Cleaners a great Opportunity



Time To Settle Three Feet

Type	Diameter Microns	Time
Fiberglass	10 to 1000	5 seconds
Human Hair	100 to 150	
Skin Flakes	20 to 40	
Common Pollens	15 to 25	
Mite Allergens	10 to 20	5 Minutes
Common Spores	2 to 10	
Bacteria	1 to 5	
Cat Dander	.5 to 1.5	10 hours
Tobacco Smoke	.1 to 1	
Viruses	under 0.1	10 days



Spengler, Harvard School Of Public Health

Basic Rules Of Airflow:



Amount of Airflow Depends On:

1. Size of hole
2. Amount of pressure

What Else Is Coming In With The Air?





Negative Pressure: Other Causes

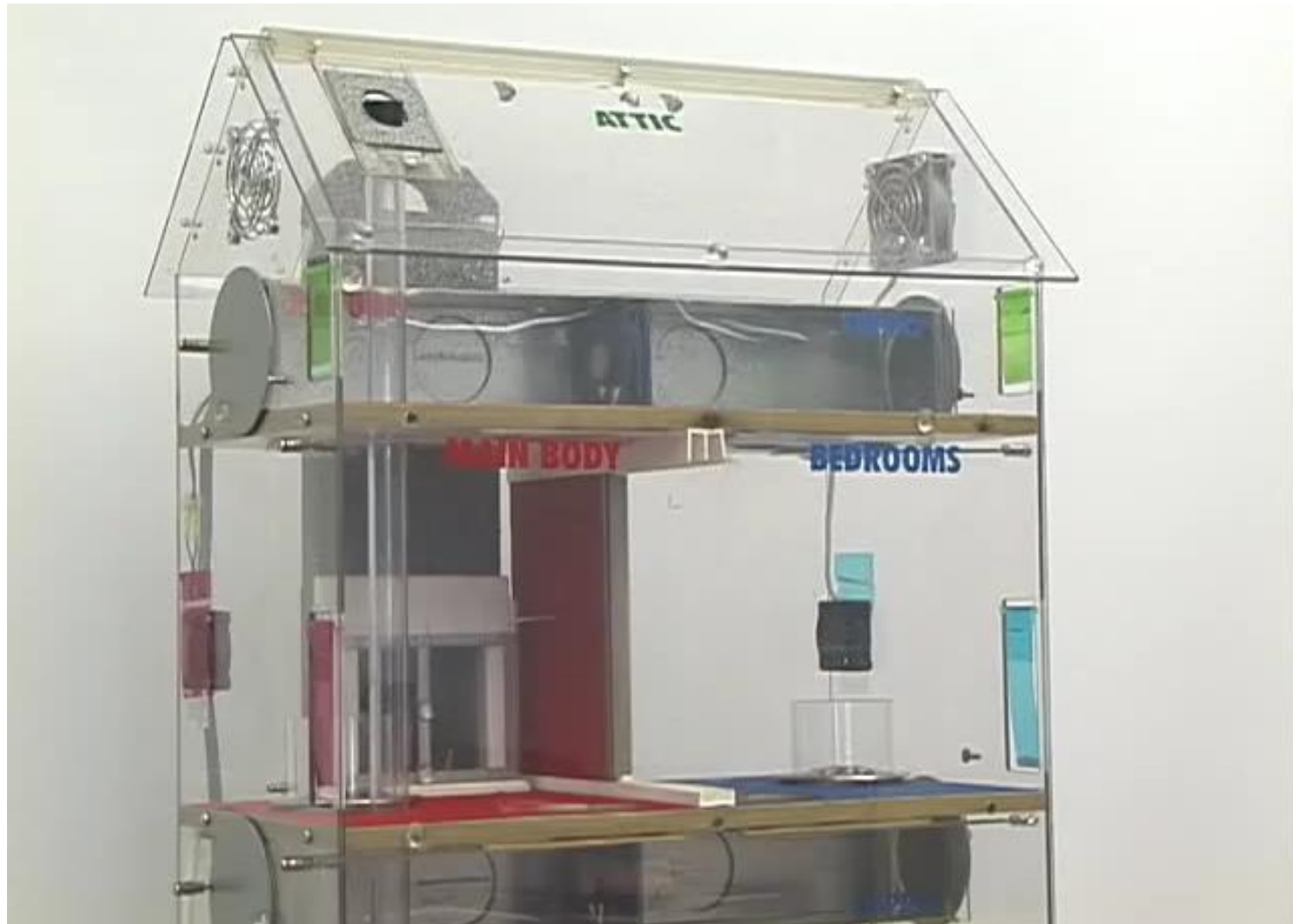


> Supply Duct Leakage

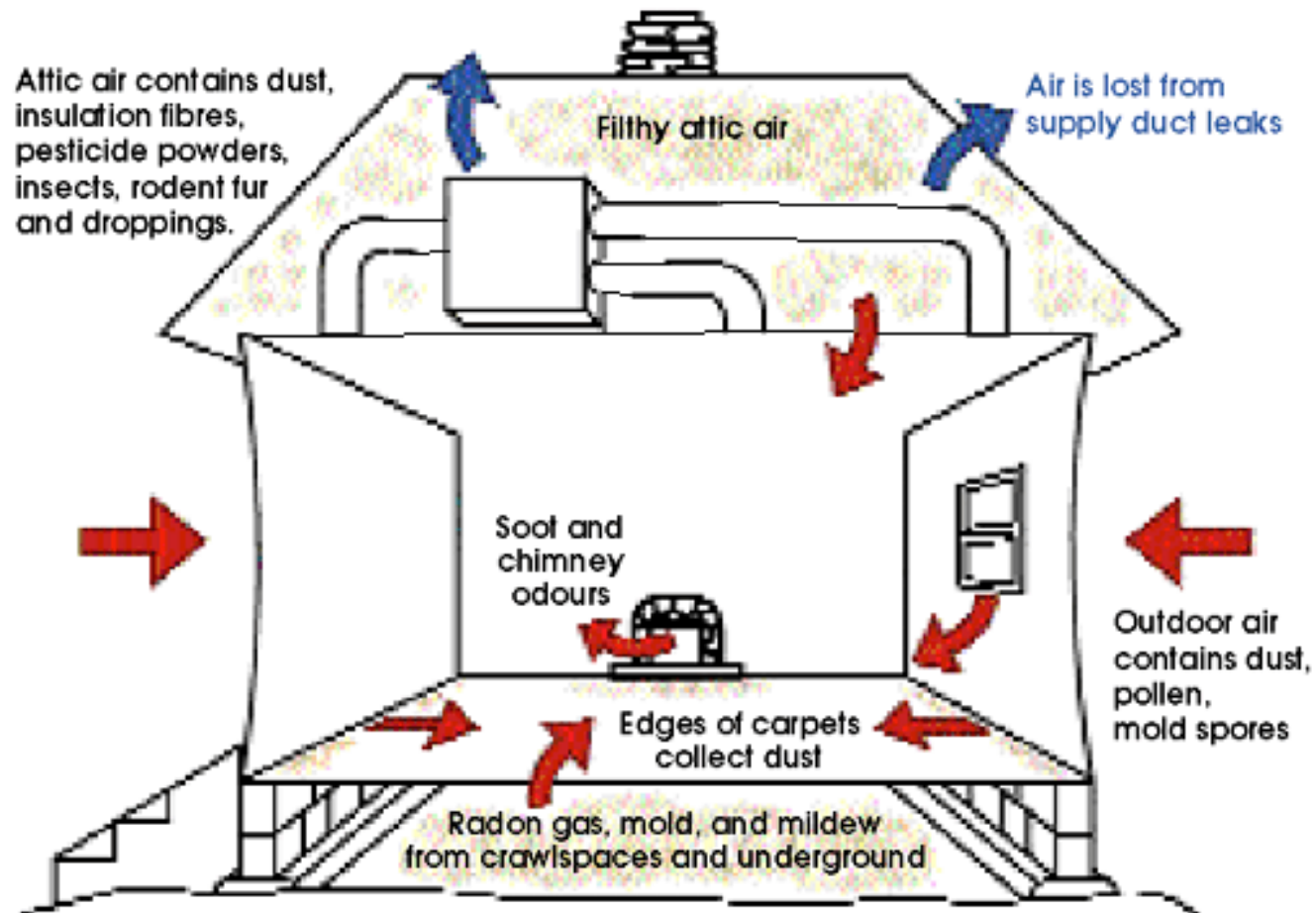




Supply Duct Leakage Example



How Supply Duct Leaks Bring In Dust



Supply Leaks "Depressurize" Your Entire House

Seal the Hole & get Rid of The Driving Source



An Easy Lead To Convert To HPA (over phone by CSR or Tech in home):

Duct Cleaning & IAQ Accessory Prospects



What A Lot Of HVAC Companys Say



***“Do you guys do
duct cleaning?”***

***“No, we aren’t into
that. We don’t think
it works.”***

***“Sold Steve a Carpet
Cleaning Job***



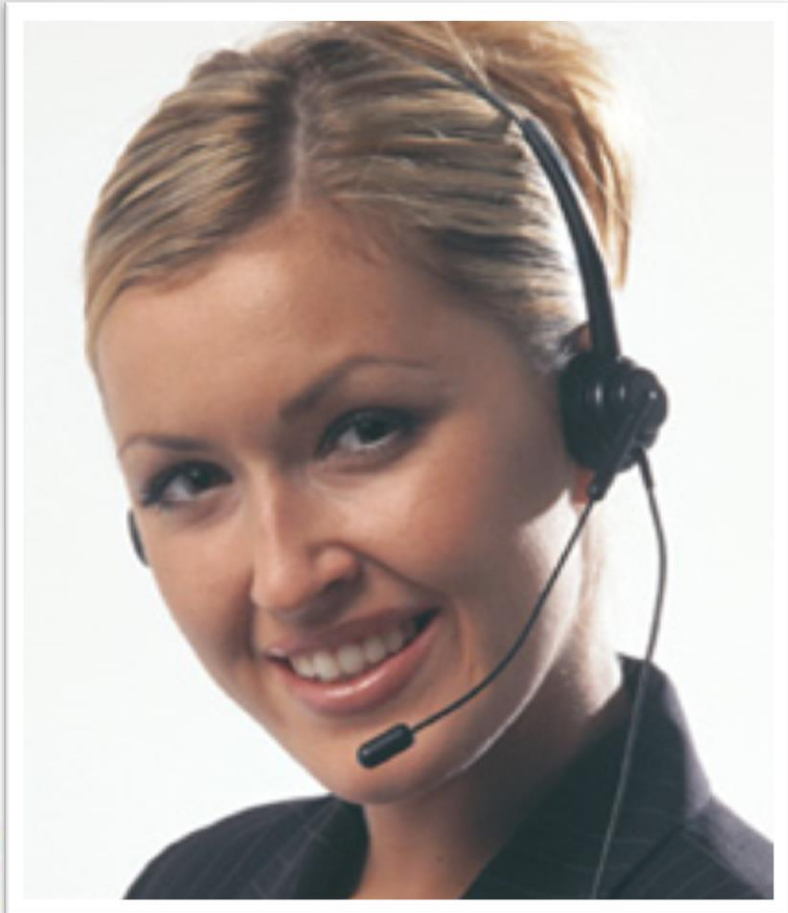
Company Choices

Try to give price over phone

Book a on site free duct inspection



What Other Opportunities Could We Offer Home & Duct Performance Testing To?



Living Home & Home Performance



IAQ LEADS

- > “Mold or dirt on our ceiling vents”
- > “Getting a lot of dust”
- > Air Cleaner bid request
- > UV Light bid request
- > Humidifier or Dehumidifier bid request
- > Odor complaint
- > Carbon Monoxide Alarm goes off

Comfort Issues

- > Hot or Cold Room or Level - Cry for Help
- > “Can You Check the Airflow?”
- > “Think a Duct Fell Off”
- > Extra Duct Run request
- > Zoning Bid Request
- > Booster Fan Bid request
- > Powered Attic Fan Bid request
- > “It runs all the time and doesn’t keep up”

Call-Ins: When to Bring Up Testing

- > Energy Saving/Utility Bill Questions
- > “We already have a new high efficiency unit, what else can we do to save energy?”
- > “Do you guys do attic insulation?”
- > “Do you guys do solar?”
- > “What do you think of radiant barrier?”
- > “Solar screens?”

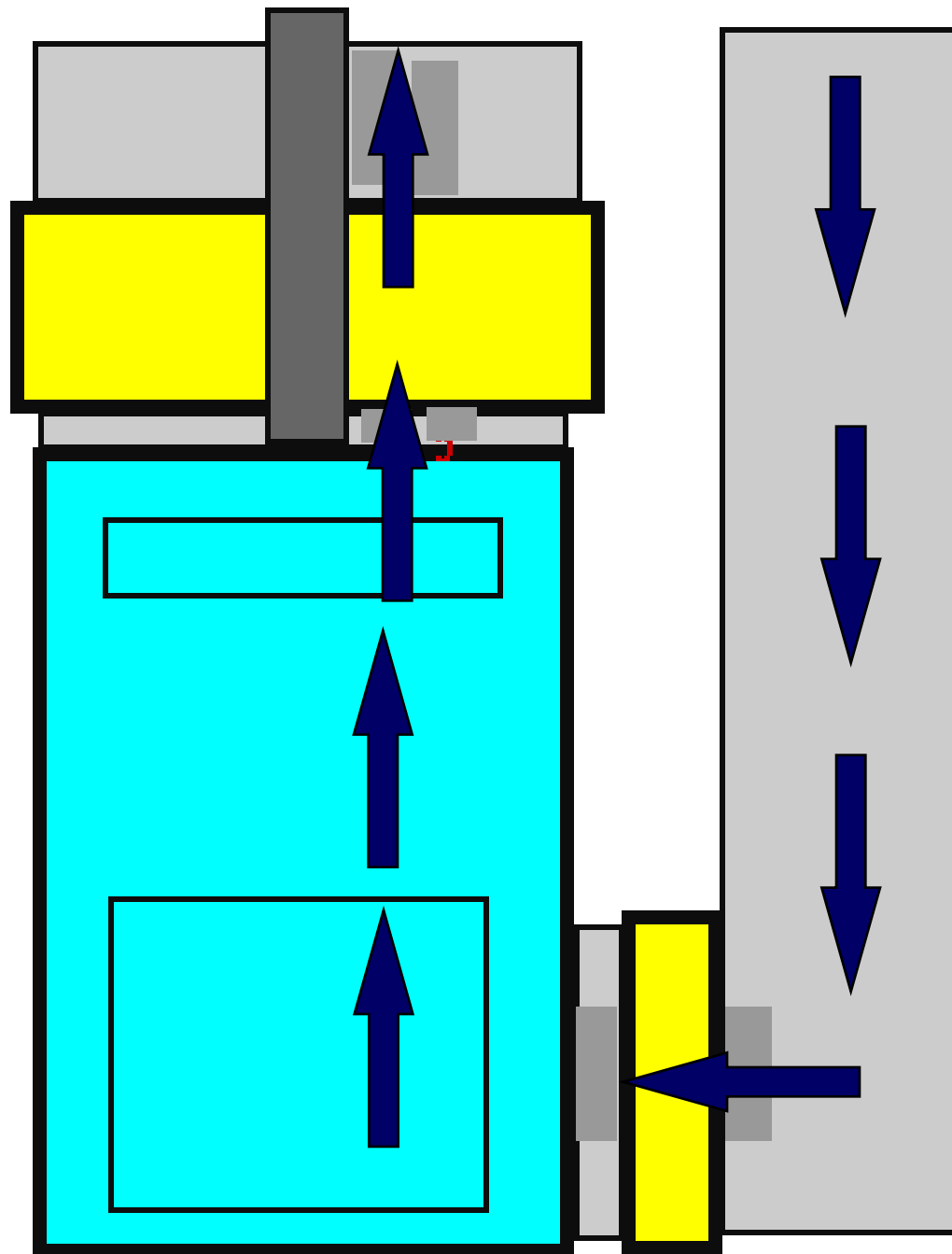
Static Pressure Gauge Kit

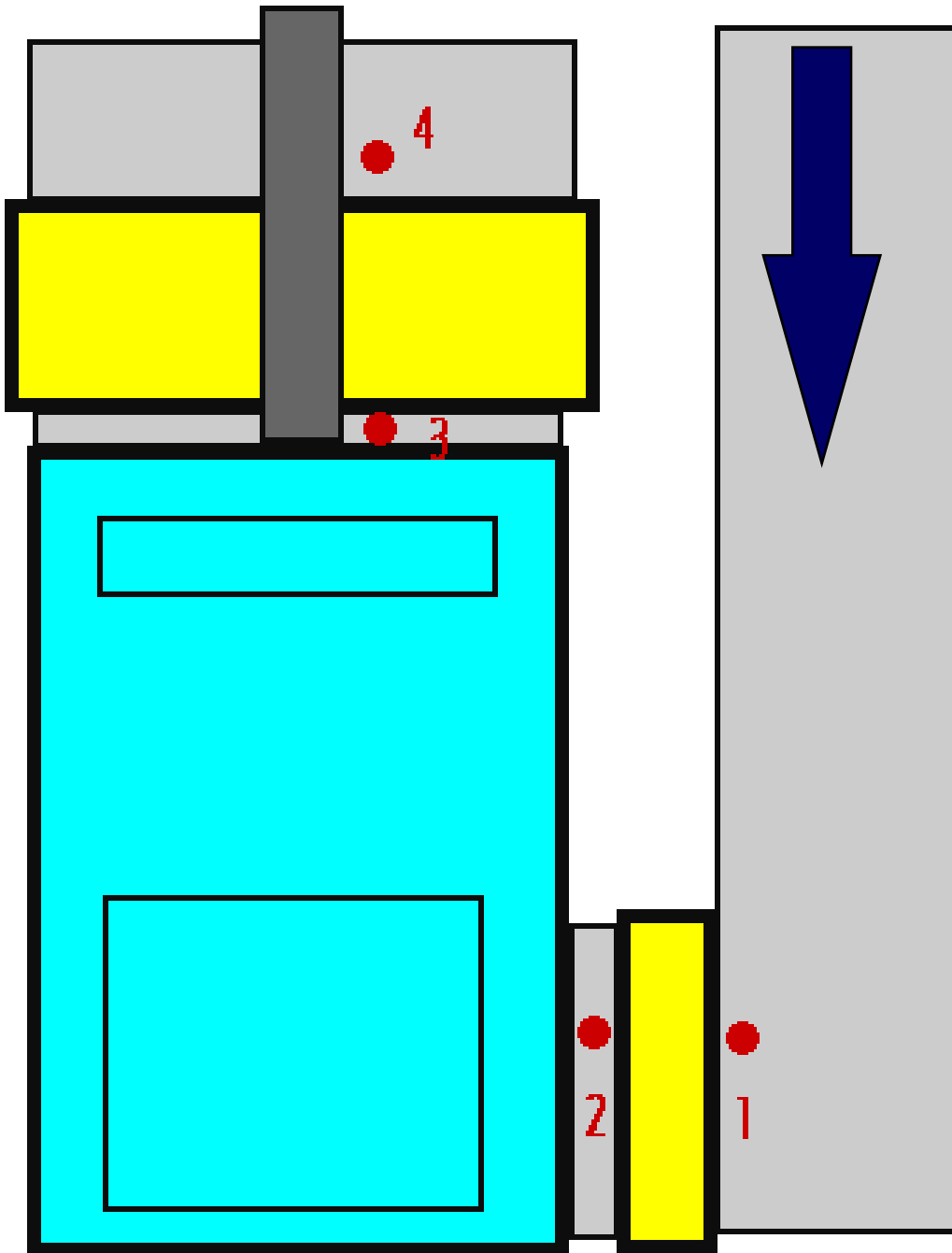
- TPI 621 Digital Manometer
- (2) Static Pressure probes
- (2) 6' Silicone tubing
- Drill bit with drill stop
- (25) Stainless steel plugs
- Carrying case



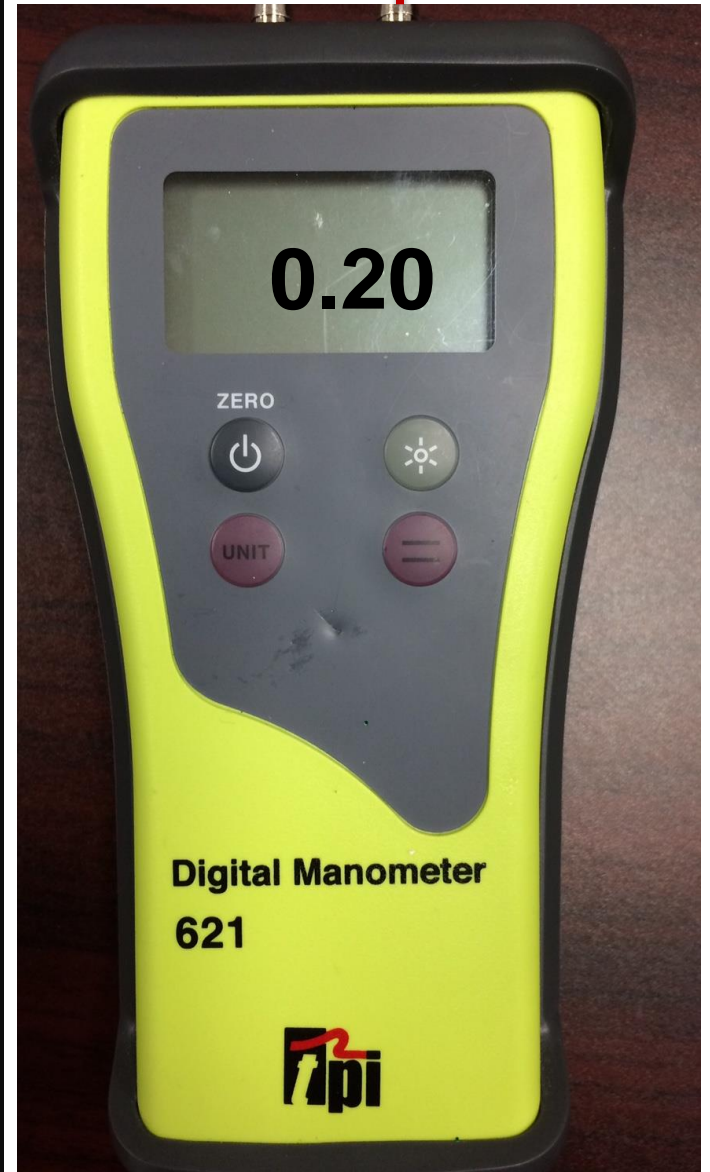
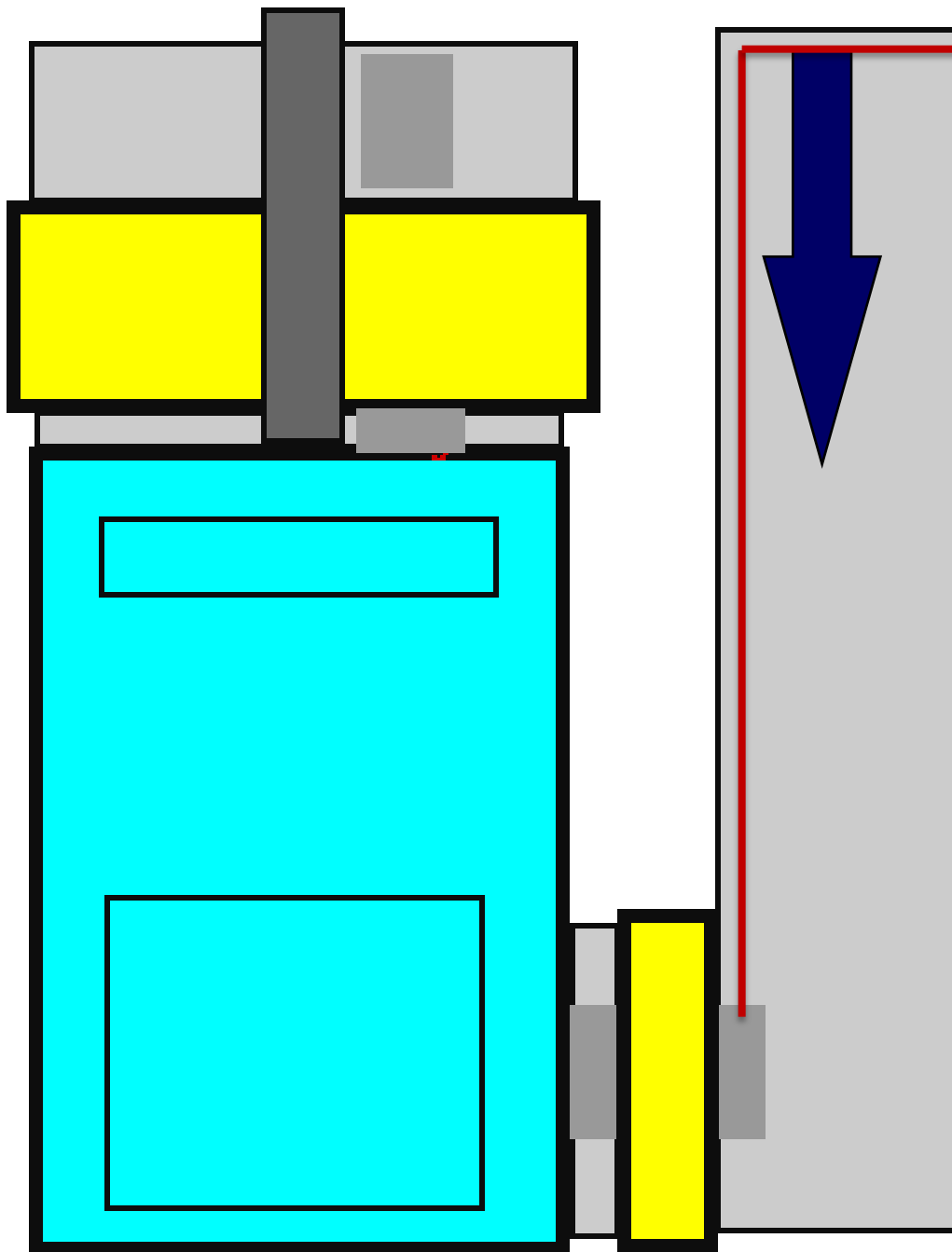
TPI 621 Gauge

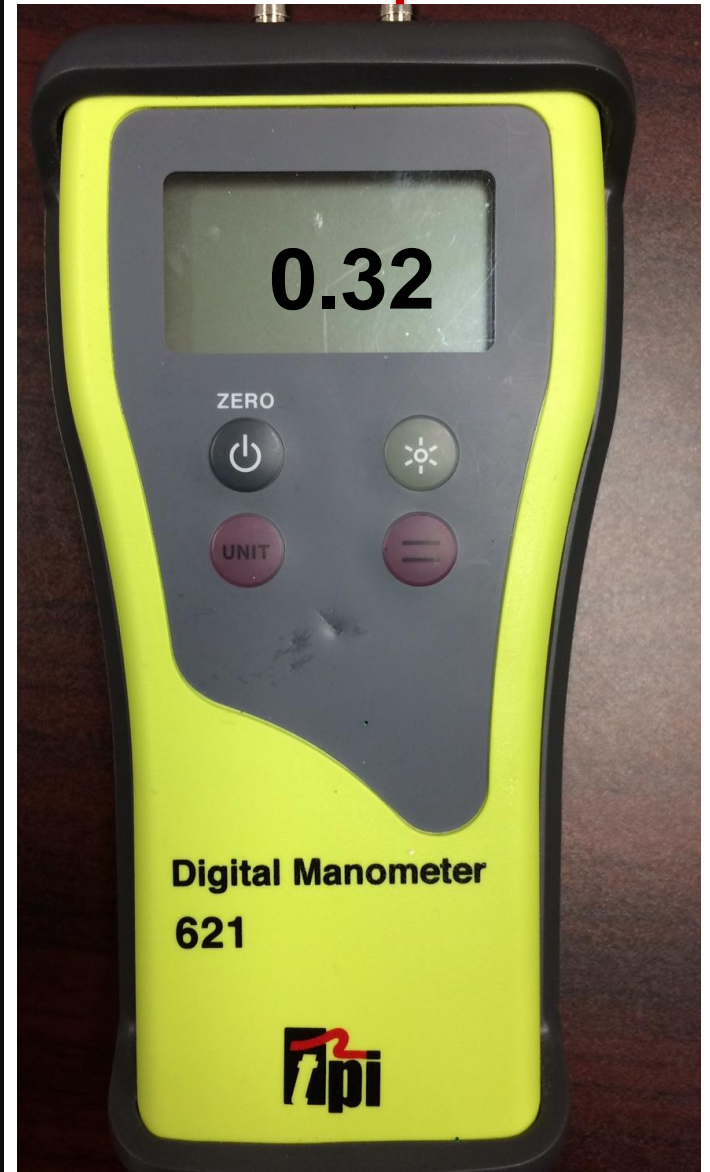
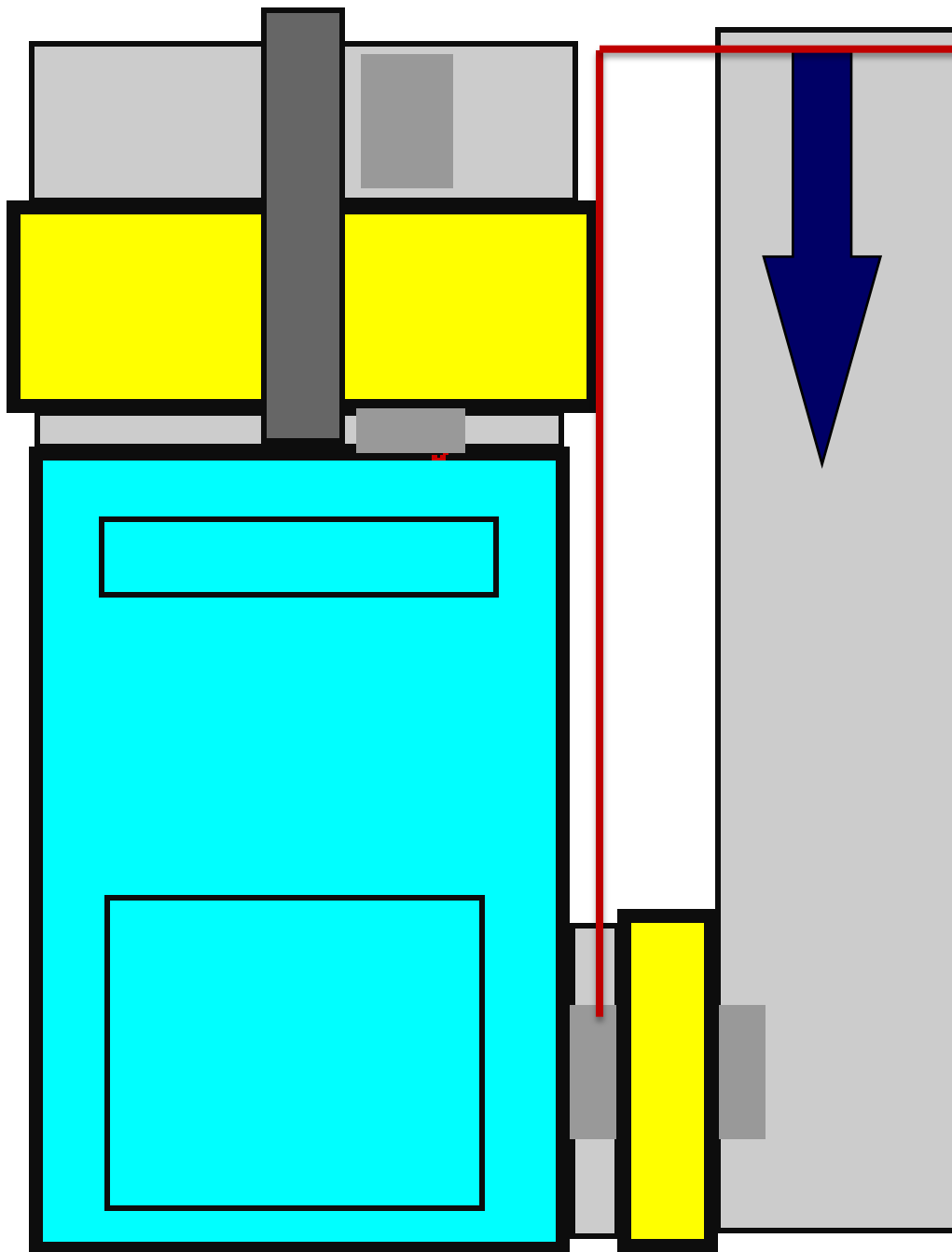


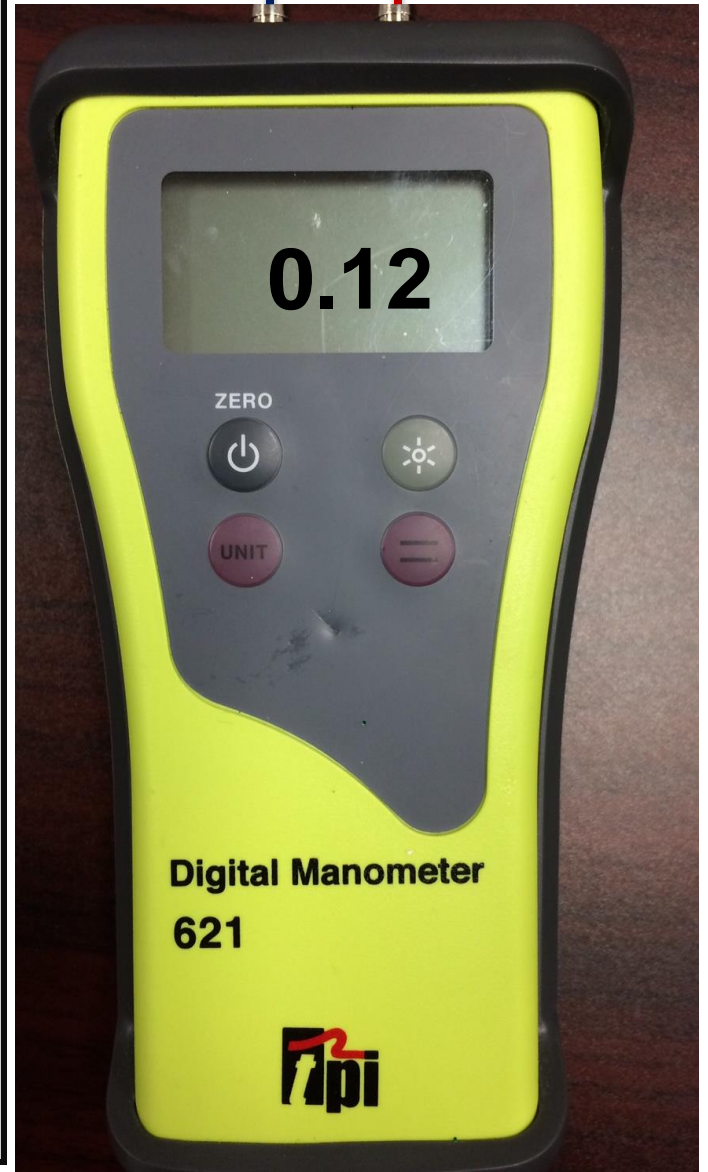
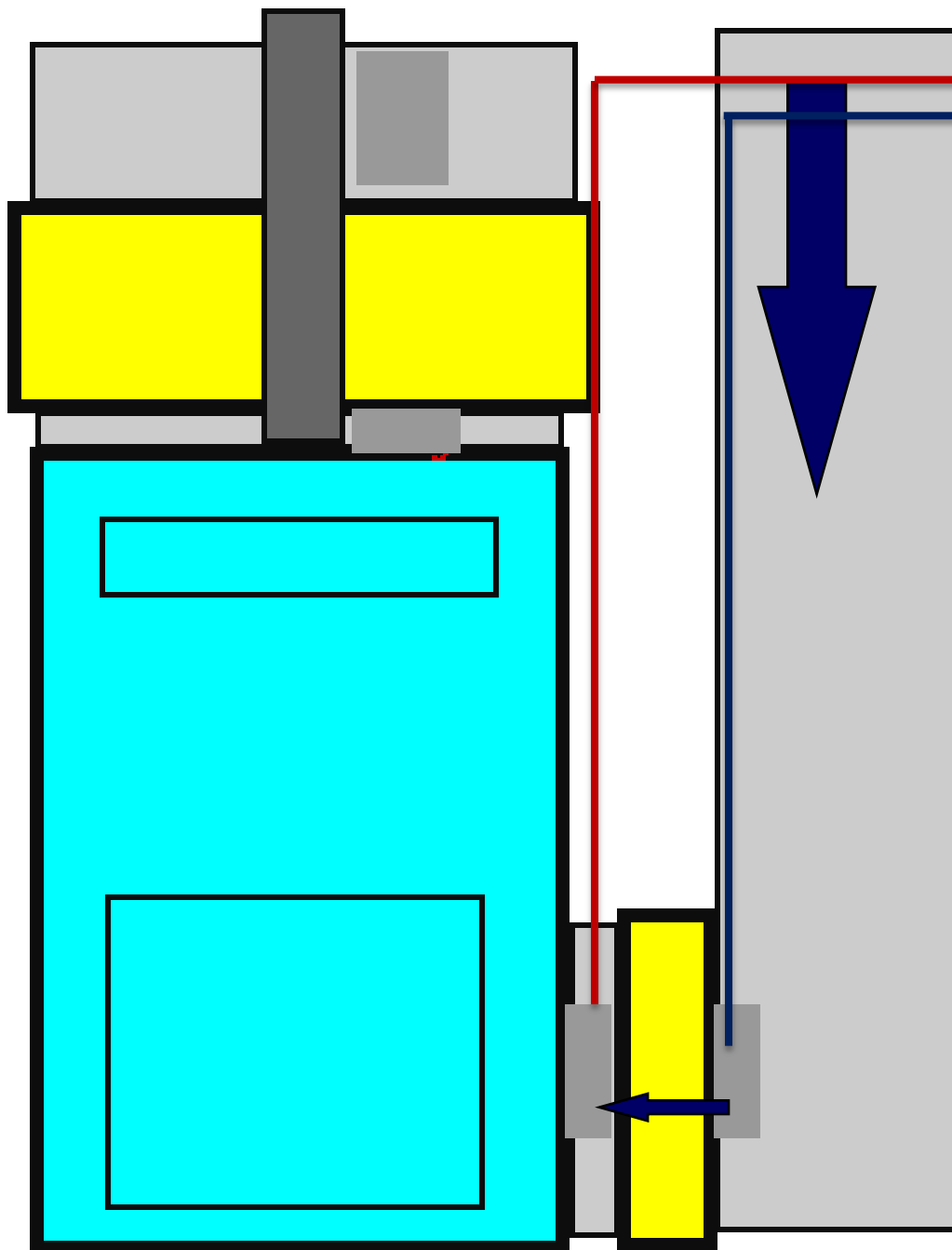


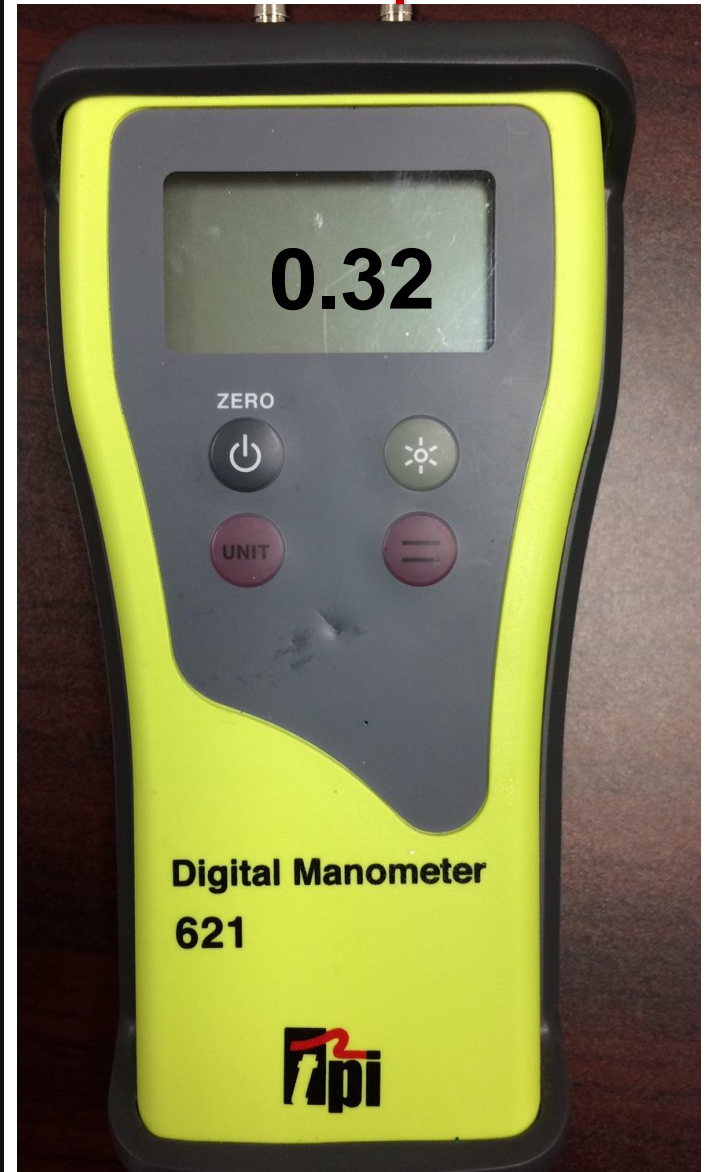
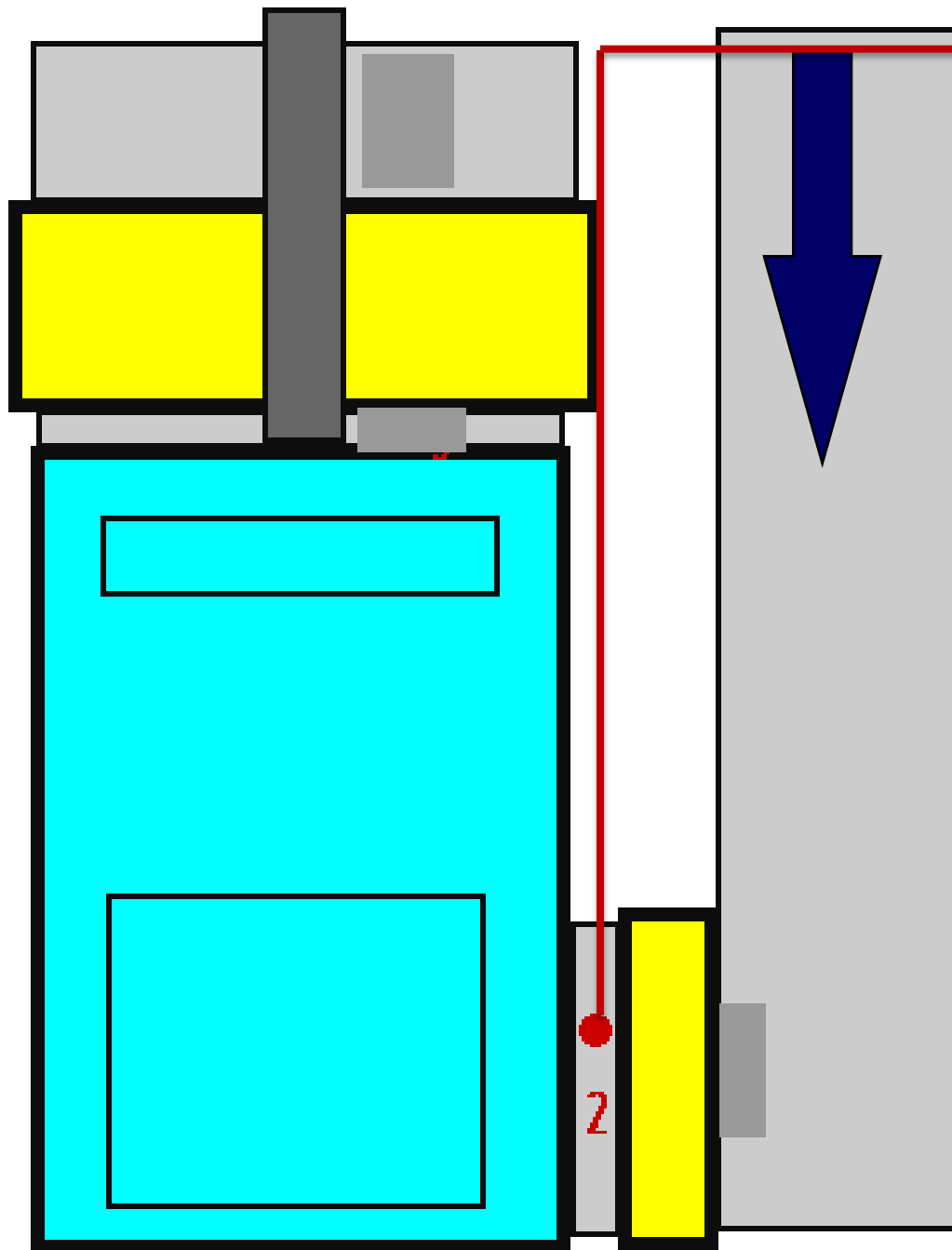


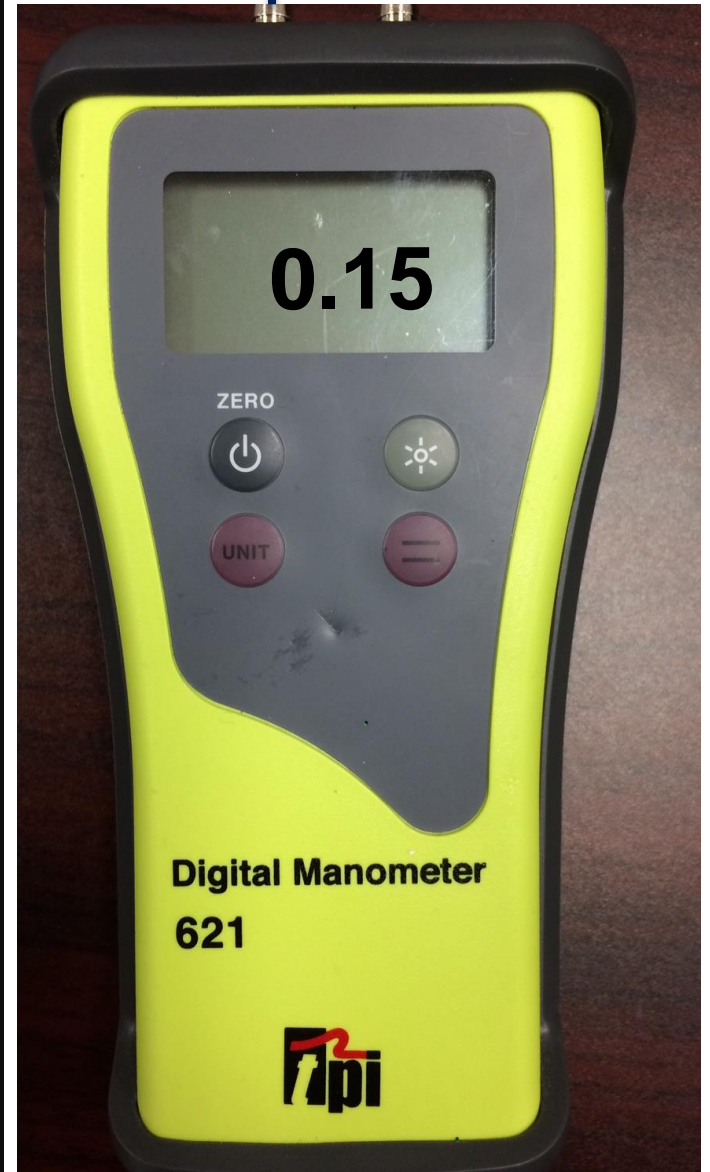
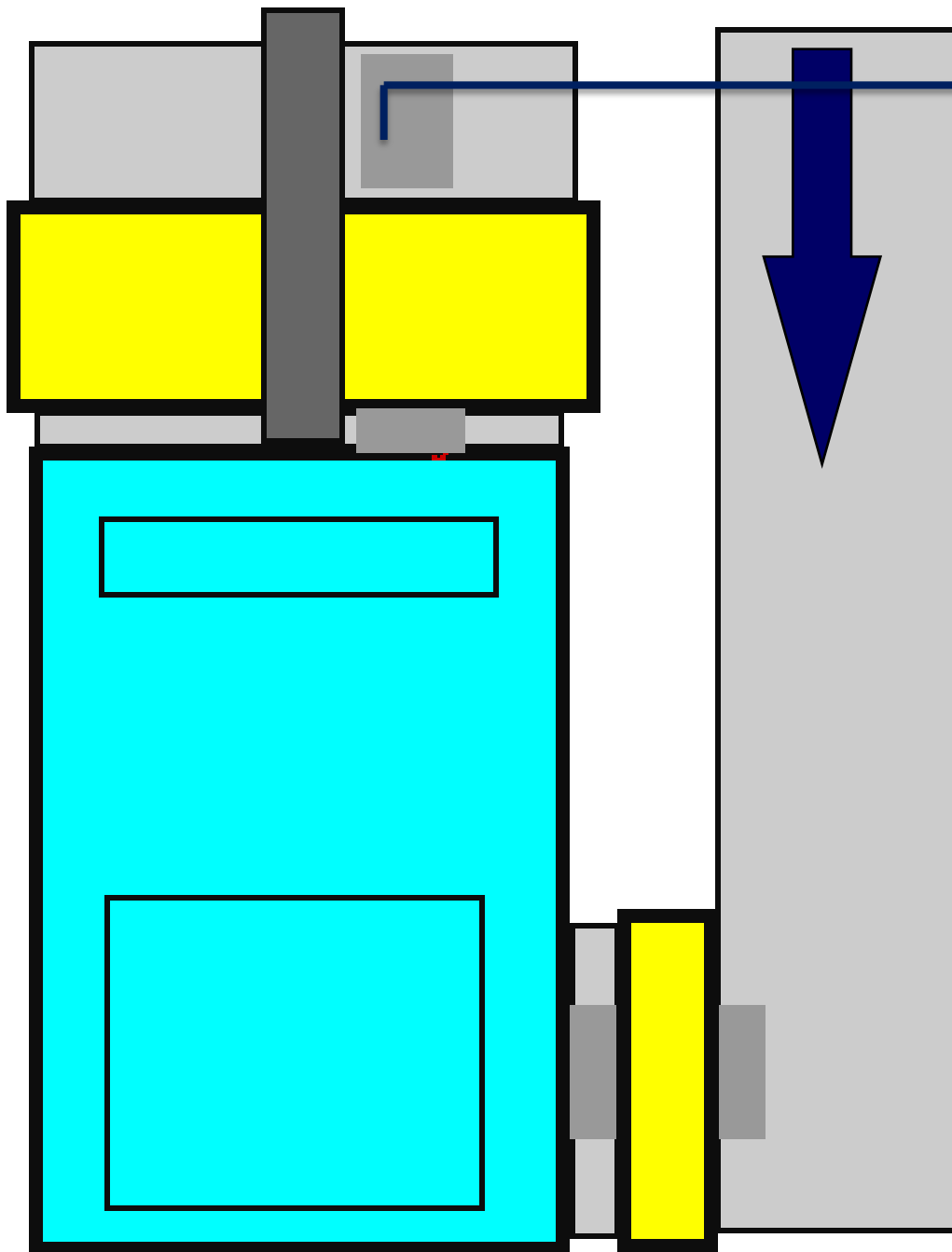
Drill (4) holes

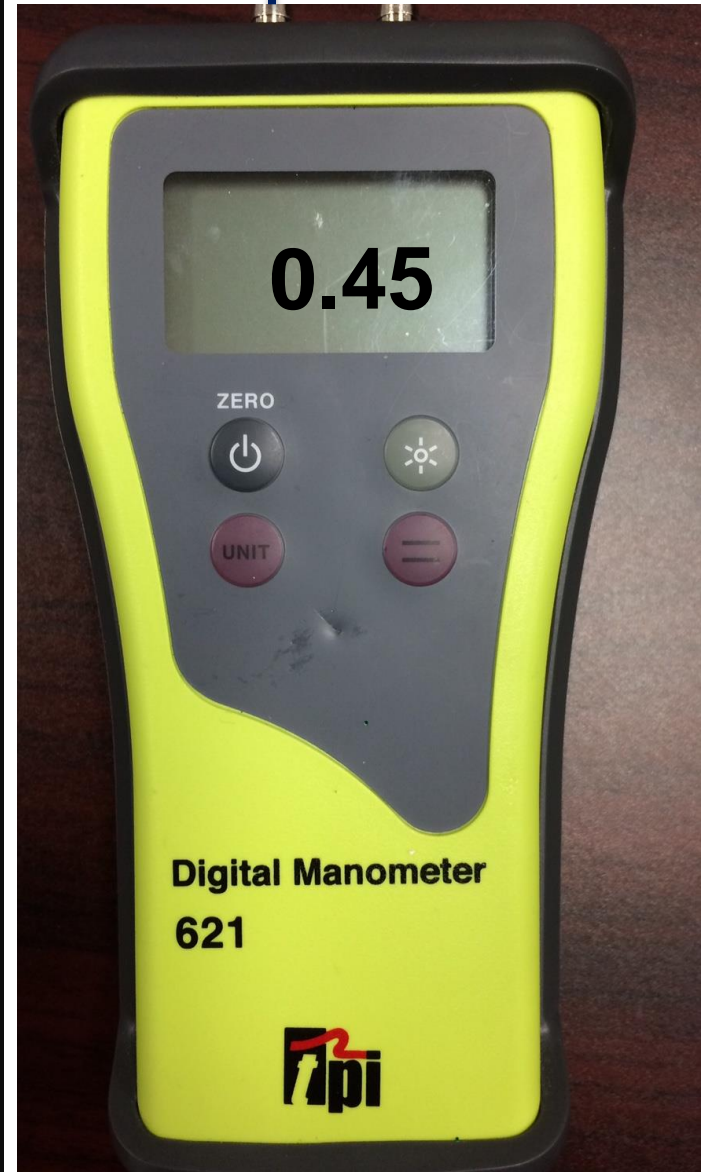
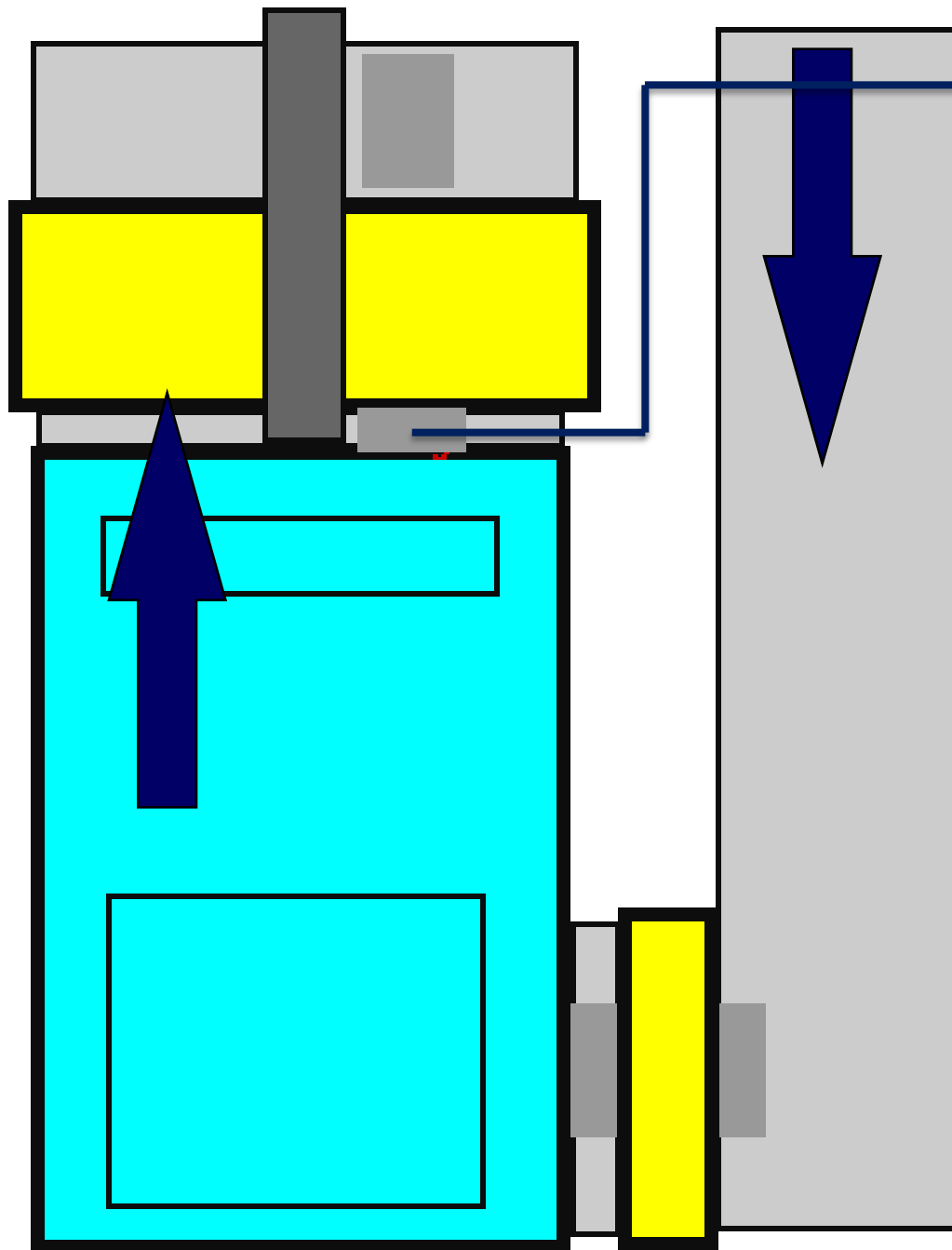


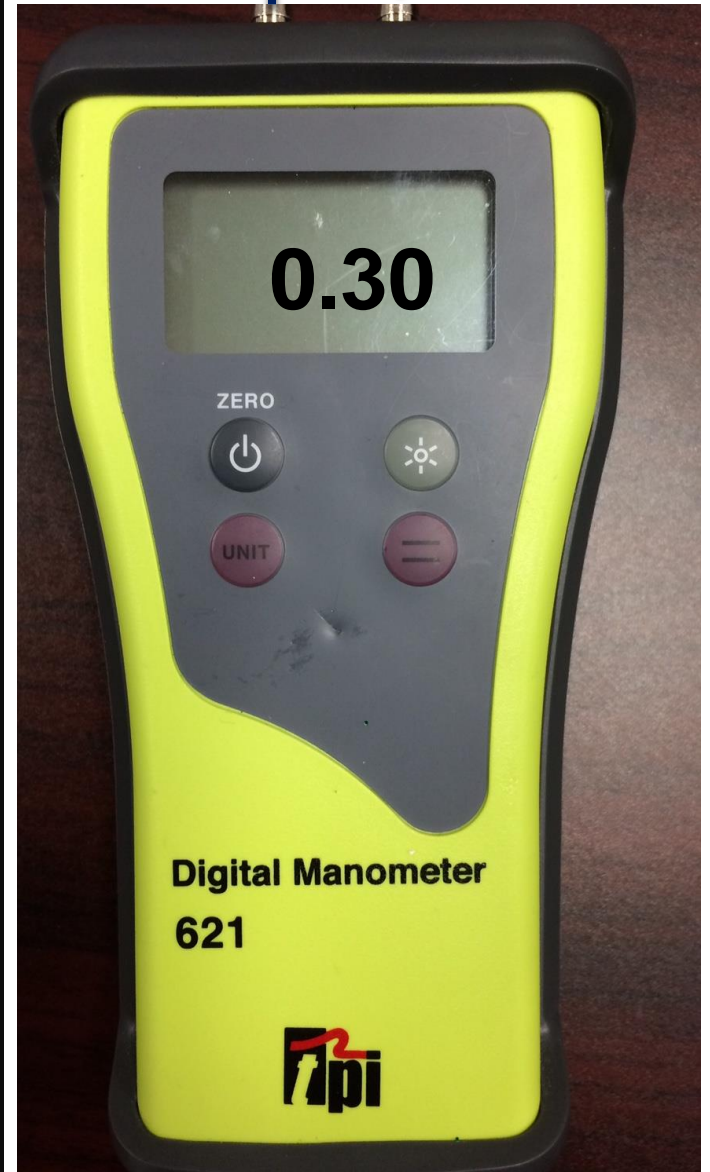
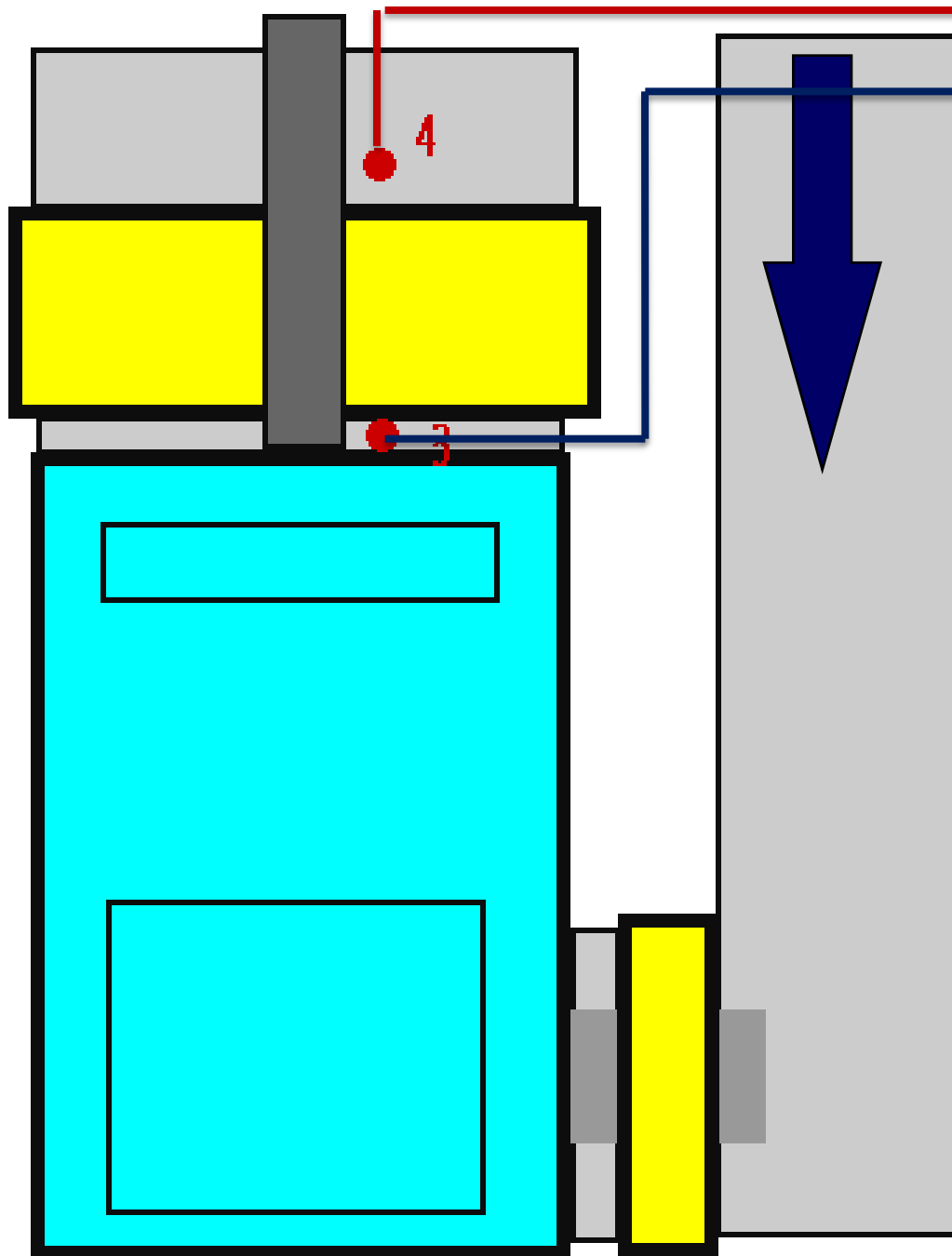


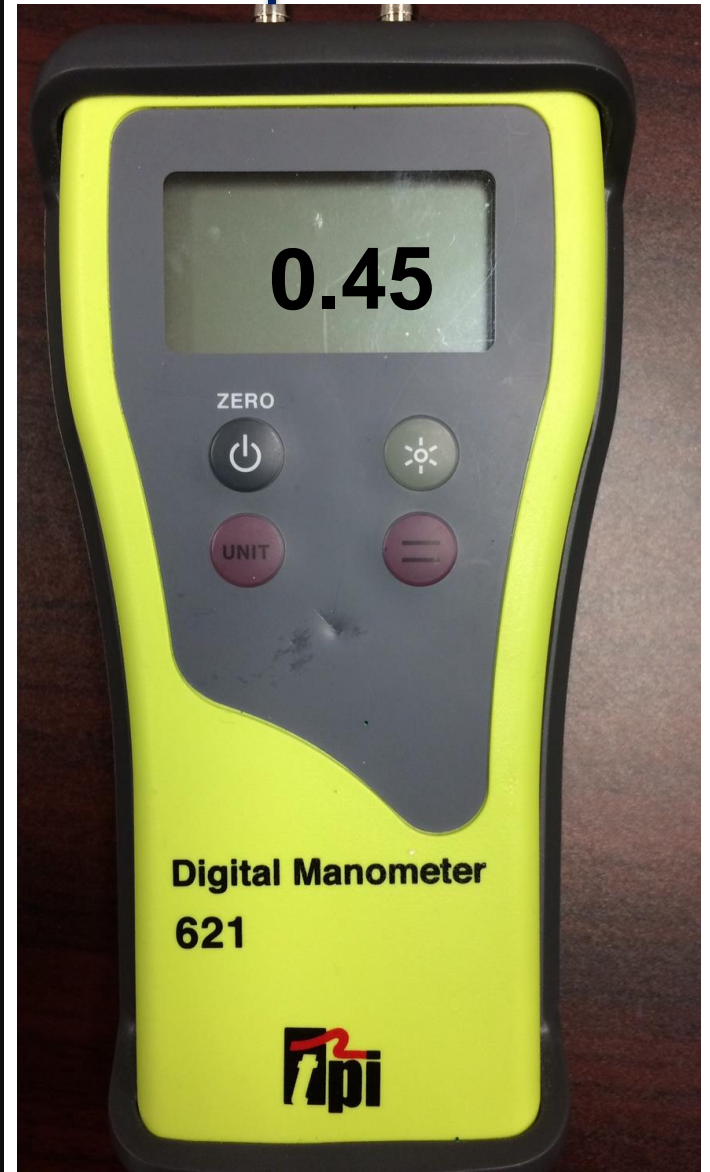
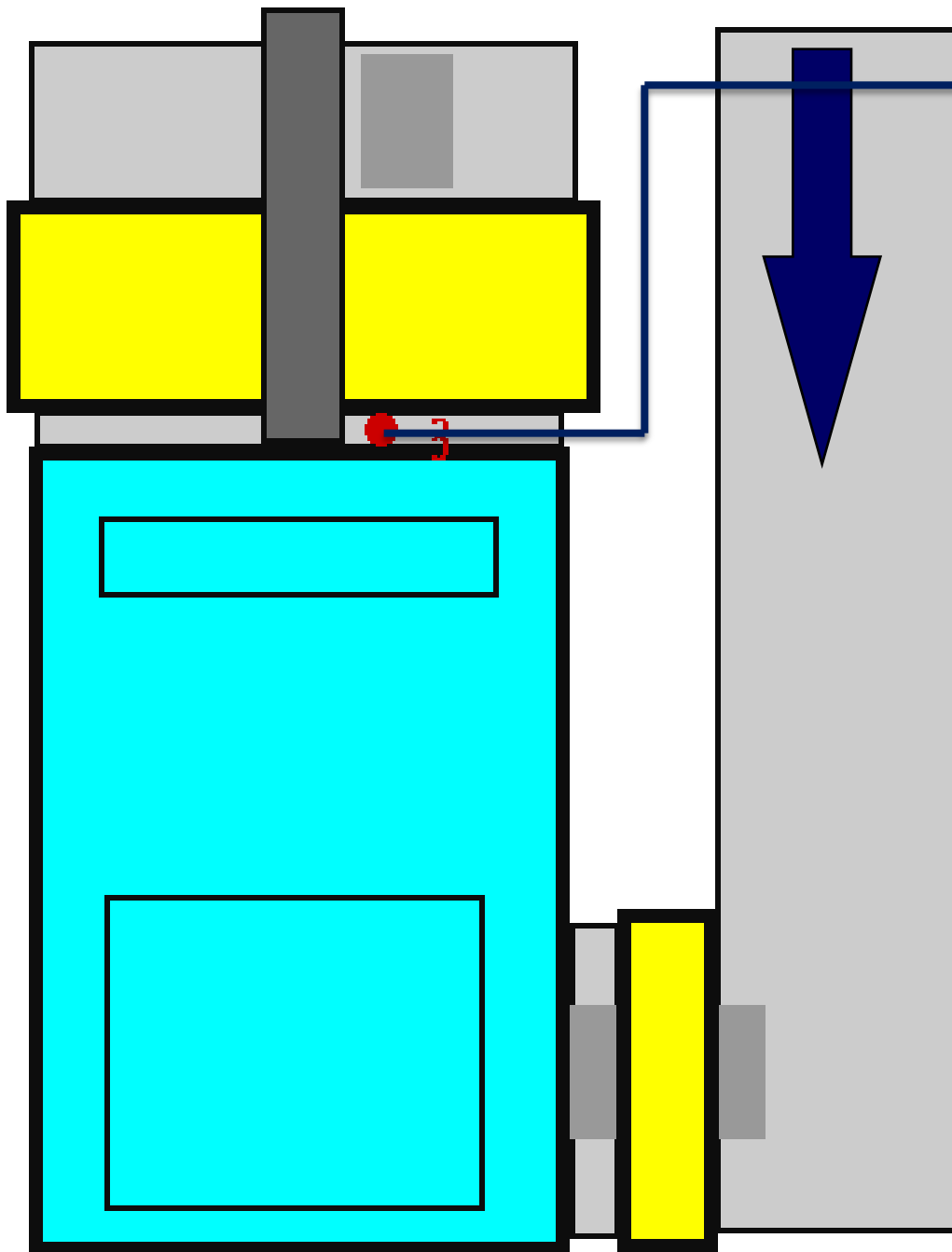


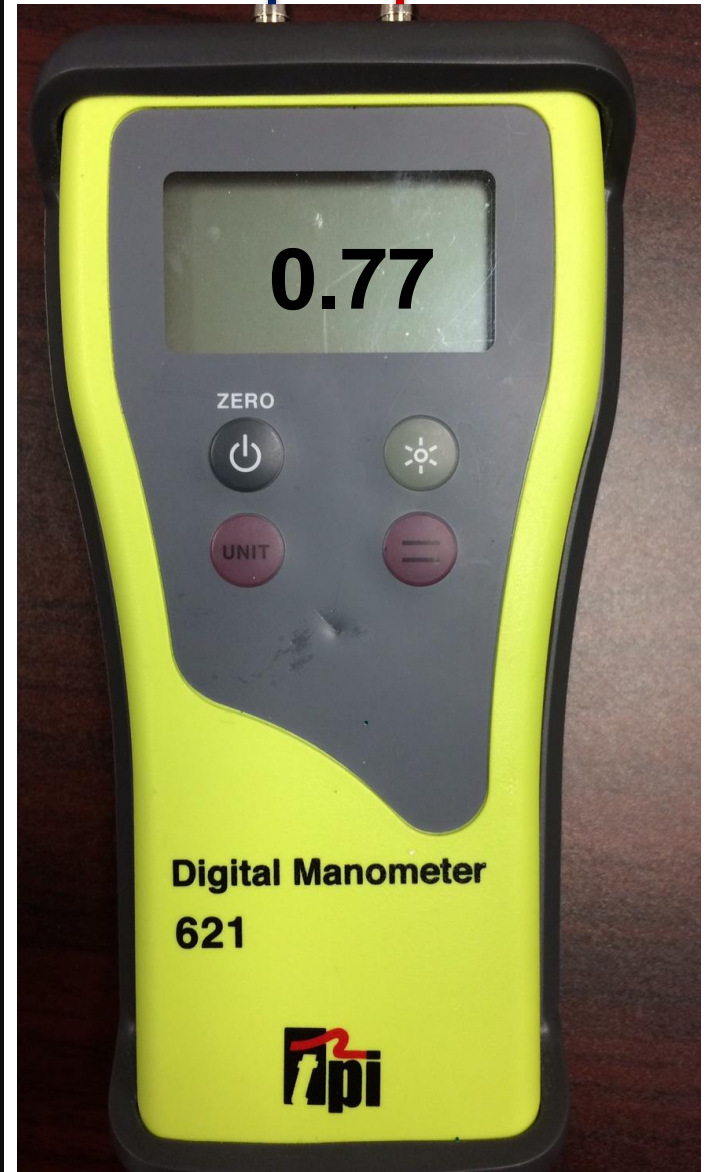
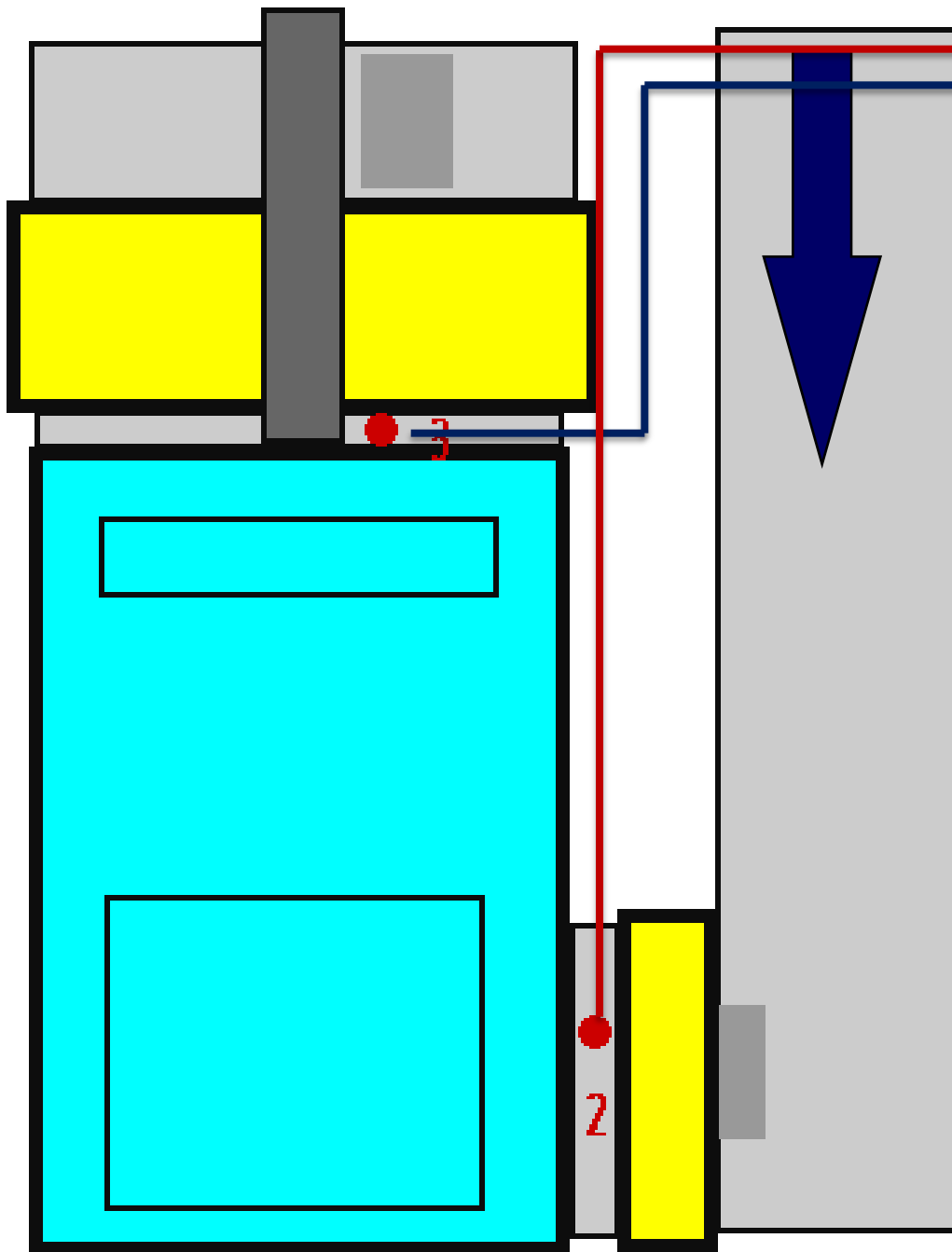












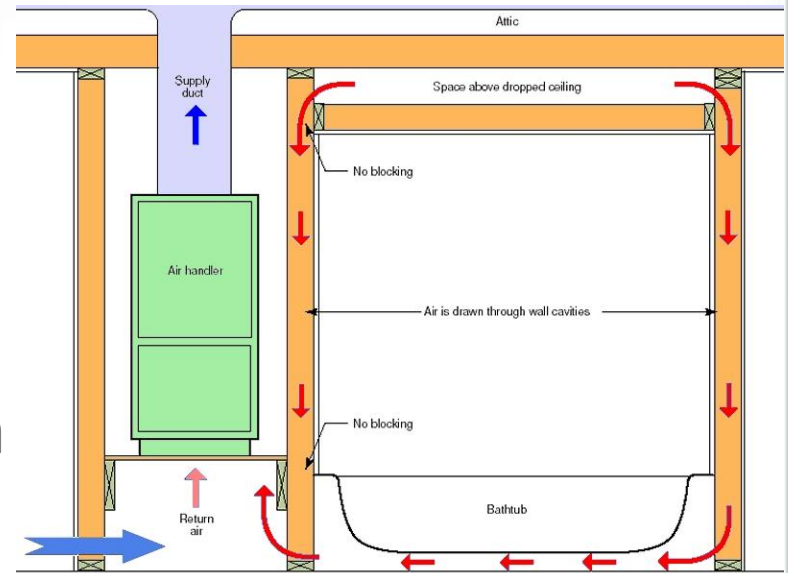
Results of Duct Repair

On Static Pressure



Examples Of Before and After

- 2.5 ton AC system
- Should get 2.5×400 cfm/ton = 1000 cfm
- Major return leakage from attic
- 100% seal performed on return



Example #1

PSC Motor, Normal Static

BEFORE

- 800 CFM From House
- 200 CFM From Attic
- 1000 CFM through coil

(.5" SP)

AFTER

- 0 CFM From Attic
- 900 CFM From House
- 900 CFM through coil

(.6" SP)

Example #1 Interpretation

- Airflow was OK before sealing
- Static went up a bit
- Airflow went down 10%
- Net effect still really positive
- Probable increase in air noise at grille
- Should add return or enlarge grilles to avoid air noise complaint and gain minor efficiency improvement but not critical

Example #2

ECM Motor, Normal Static

BEFORE

- 800 CFM From House
- 200 CFM From Attic
- 1000 CFM through coil

(.5" SP)

AFTER

- 0 CFM From Attic
- 1000 CFM From House
- 1000 CFM through coil

(.9" SP)

Example #2 Interpretation

- Airflow was OK before sealing
- Static went up a lot: ECM ramped up
- Airflow stayed the same
- Net effect still positive ... but ...
- Definite increase in air noise at grille and higher motor RPM
- Higher motor watt consumption
- Must add return or enlarge grilles etc

Example #3

PSC Motor, Already High Static

BEFORE

- 600 CFM From House
- 150 CFM From Attic
- 750 CFM through coil

(.7" SP)

AFTER

- 0 CFM From Attic
- 600 CFM From House
- 600 CFM through coil

(.9" SP)

Example #3 Interpretation

- Airflow was already low before sealing
- Static went up to unacceptable level
- Airflow went down even more to only 240 cfm/ton
- Entering danger zones of freezing coil, sweating ducts and loss of efficiency
- (No increase in air noise at grille)
- Adding return or enlarge grilles should have been part of the duct renovation work scope (maybe even more)

Example #4

PSC Motor Before, new system has ECM

BEFORE

- 600 CFM From House
- 150 CFM From Attic
- 750 CFM through coil

(.7" SP)

AFTER

- 0 CFM From Attic
- 900 CFM From House
- 900 CFM through coil

(1.4" SP)



Example #4 Interpretation

- Airflow was low before sealing
- Static went way up: ECM ramped up beyond OK levels
- Airflow improved but not to target of 400 cfm/ton
- Massive increase in air noise at grille and higher motor RPM
- Higher motor watt consumption, risk of ECM burnout
- Adding return (maybe supply) should have been part of scope

Duct Sealing or Duct Renovation?

- Although sealing is most important, there are usually other problems as well
- Always measure static pressure and velocity, and evaluate airflow and duct sizing before quoting job
- Airflow may already be low, AC system only “worked” because of hot attic return leaks
- Enlarging returns etc. usually needed
- Rechecking refrigerant charge needed
- Duct replacement often makes more sense than a renovation but still needs to be sealed as well

Home & Duct Performance Contracting:

No Matter What Level You Choose

