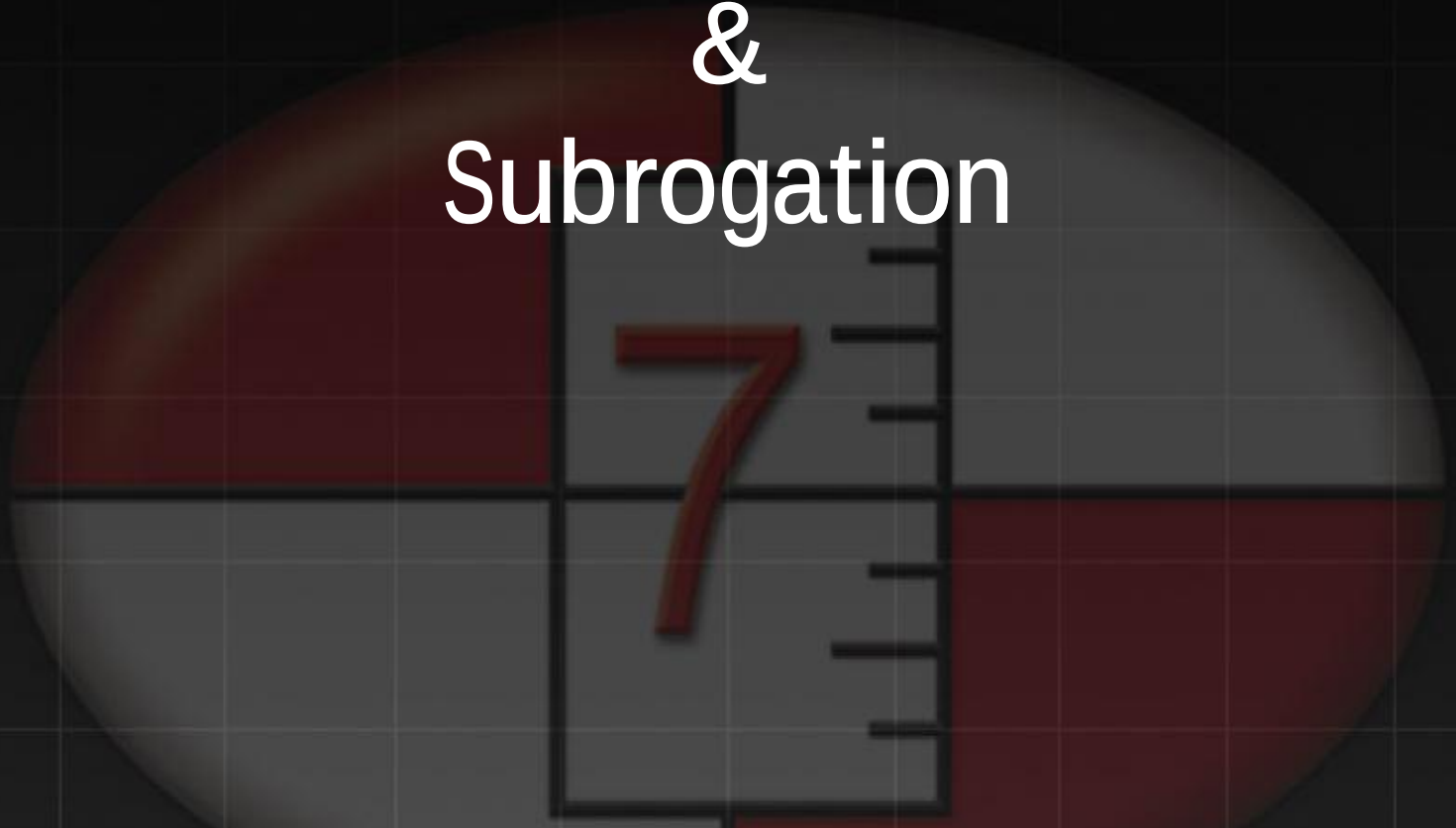
Appliance Fire Investigations & Subrogation



November 17, 2011

Joseph P. Schuh, CFI, CFEI, CVFI
Fire Investigator
Donan Engineering Co., Inc.

Background

- Donan Engineering – Fire Investigator
- Tri Fire Consultants
- Barker & Herbert Labs
- NIST – Fire Research Lab
- EKU
- Various volunteer Fire Depts.

Certifications

- IAAI - Certified Fire Investigator
- Certified fire & explosion investigator
- Certified vehicle fire investigator
- Certified fire investigation instructor

What's Covered

- What to needs to be done
- Identification
- Resources
- Common failures

To Do:

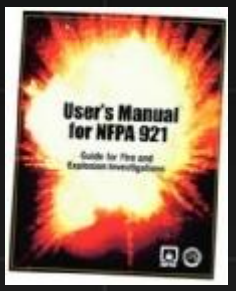
- 1st
  - Call Donan Engineering!!!

To Do:

- Identify Origin
- Identify potential ignition sources
- Identify Manufacturer & Age
- Identify potential parties
- Secure site / evidence
- Joint site study
- Evidence Study
- Identify Cause

Resources

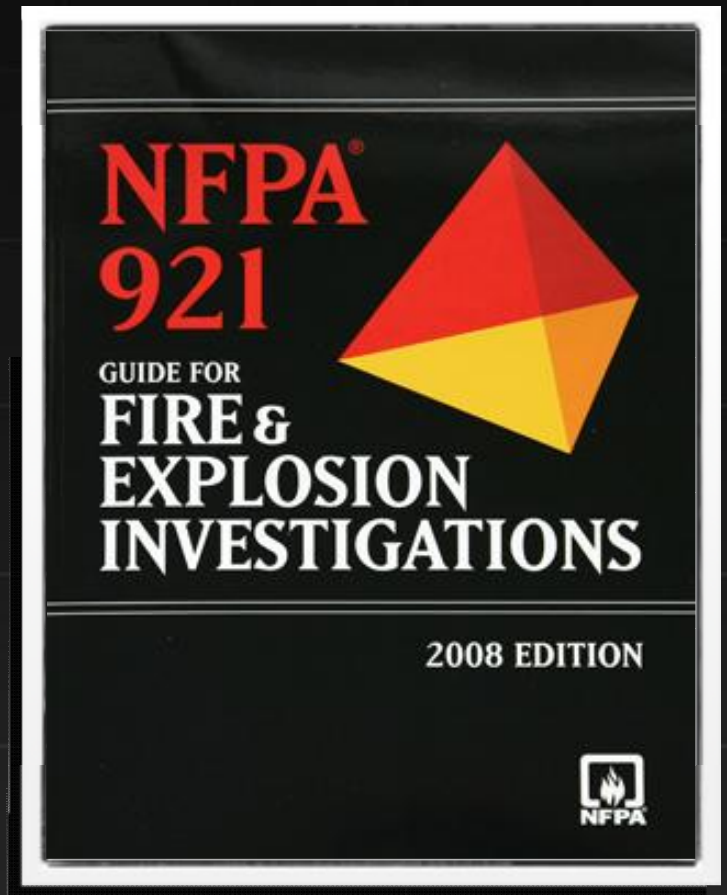
- NFPA 921
- Kirk’s fire investigation
- NFPA 54 & 70
- ASTM standards
- Local codes & requirements
- Other investigators



Resources

- Witnesses
- User Care Manuals
- Receipts / Invoices
- Photographs
- Websites

NFPA 921


NFPA
921
GUIDE FOR
FIRE &
EXPLOSION
INVESTIGATIONS
2008 EDITION
NFPA

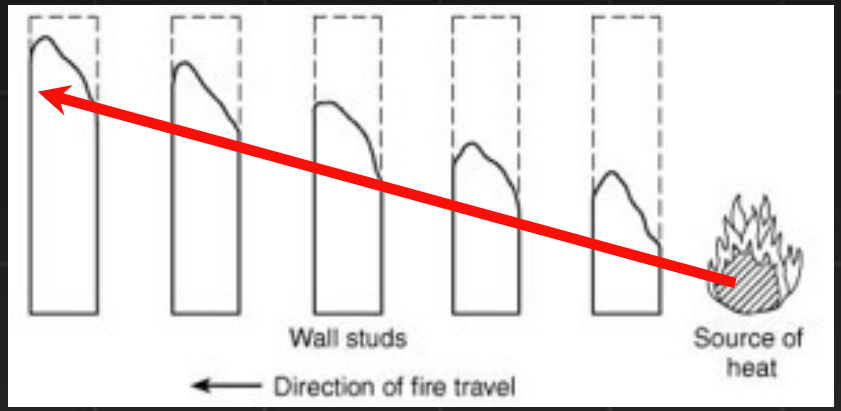
NFPA 921

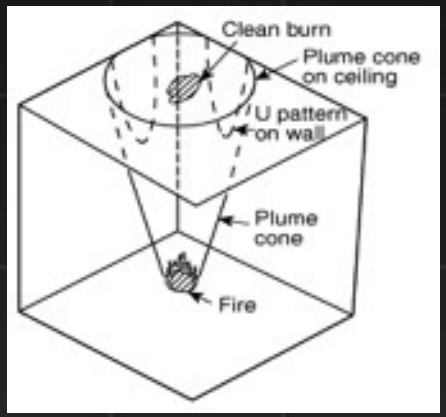
NFPA 921

- One should establish that the appliance in question is in the area of fire origin
  - Things aren't always what they seem
  - Don't judge too quickly = tunnel vision

NFPA 921

- Fire patterns (directional, Linear, truncated cone) should be carefully used in establishing point of origin



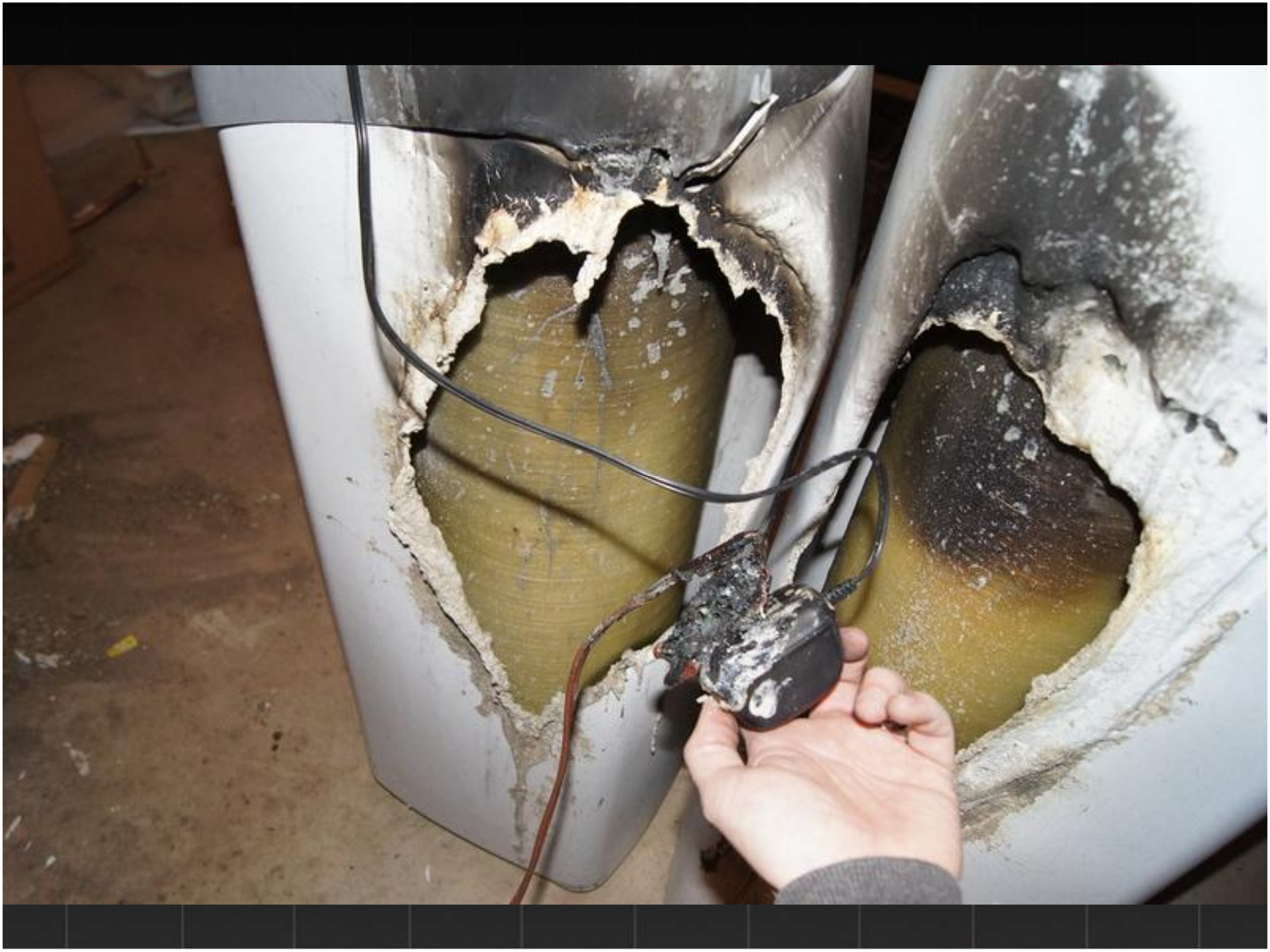


- DEFINITE and UNAMBIGUOUS fire patterns help show area of fire origin
  (Sometimes we get lucky)

NFPA 921

- Patterns on appliance may indicate source of ignition

- Patterns on nearby surfaces may provide information on the ignition source



ID Ignition Sources

- After Origin is determined
  - –Identify all potential ignition sources in the Area

ID Ignition Sources

- Determine manufacturer

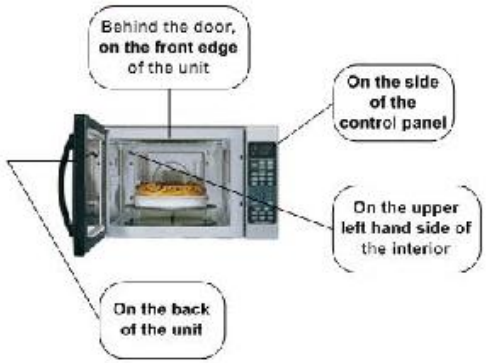
ID Ignition Sources

- Determine manufacturer
- Determine Age
  - Identification labels/plates
  - User manuals
  - Invoices / Receipts
  - Physical dimensions
  - Insured’s statements

Locating Your Refrigerator's Model Number

Though there are many different styles of refrigerators, we have listed the most common model number locations for all types: side-by-side, freezer on top, and freezer on bottom.

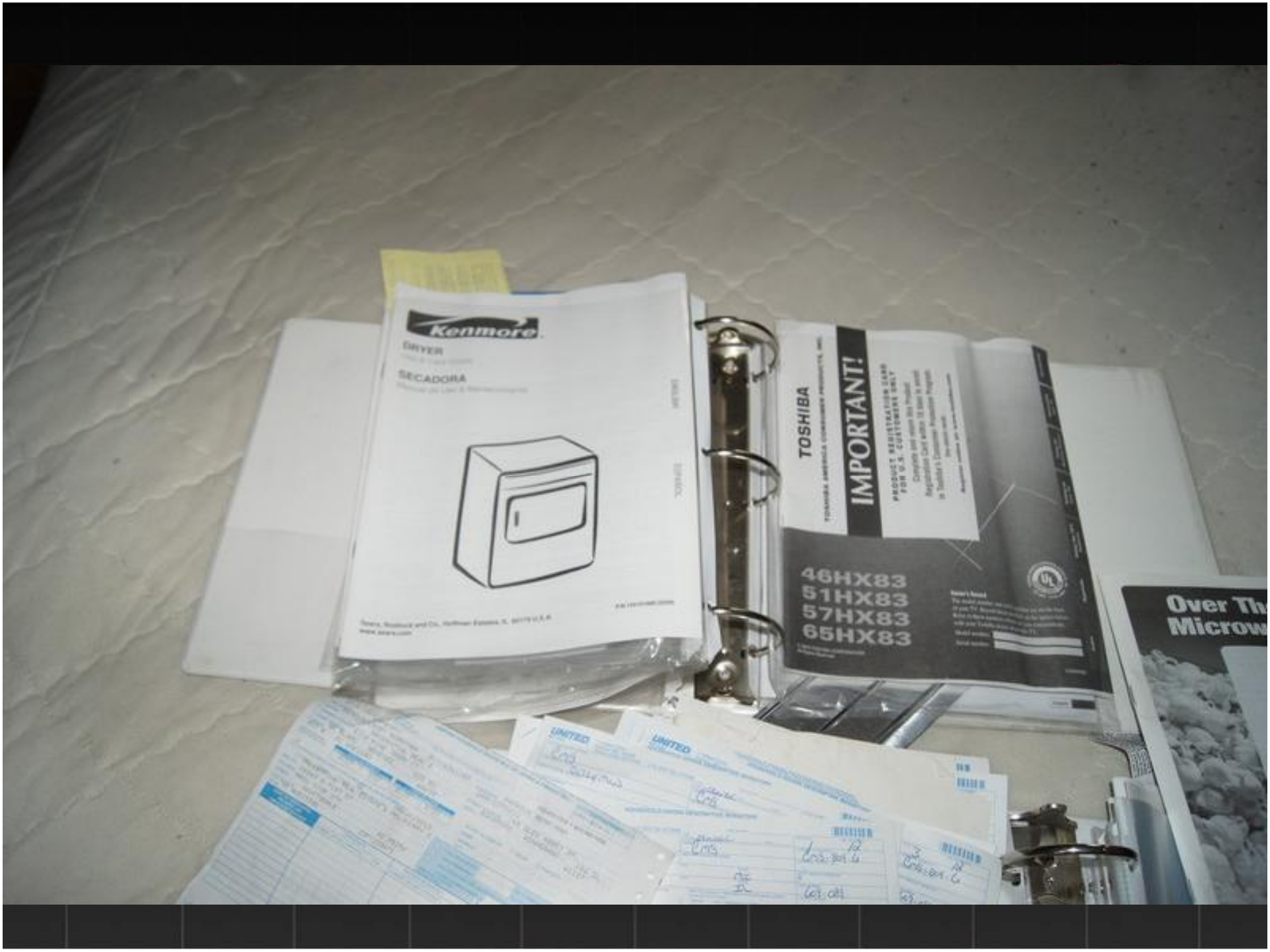
Locating Your Microwave's Model Number




Clock
Bake time
Timer On/Off
Start time
Oven
Preheat
Door Locked
Self-Cleaning Oven
Bake
Broil
Clear /Off
Clean
Controls
Frigidaire

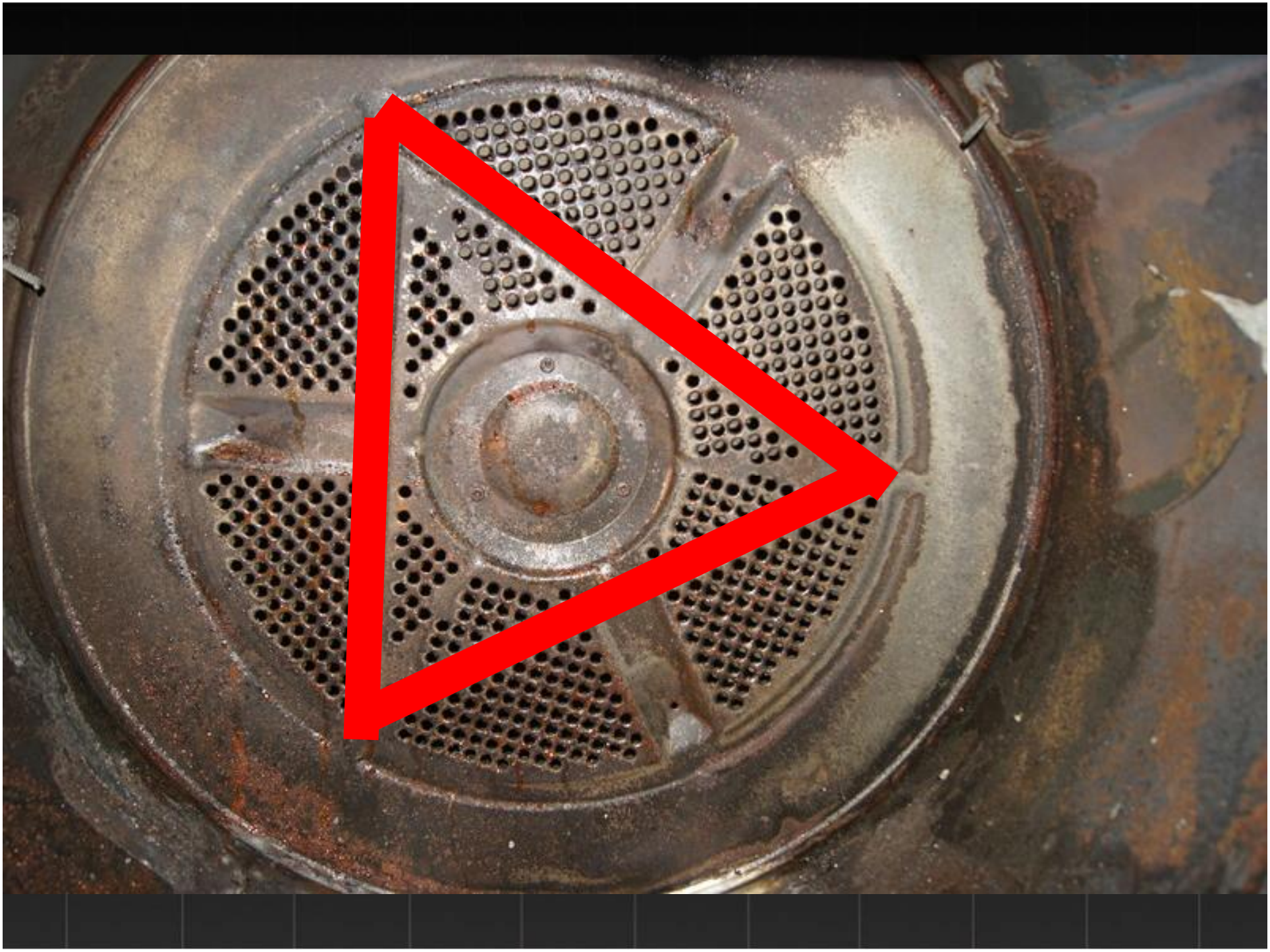
ID Ignition Sources

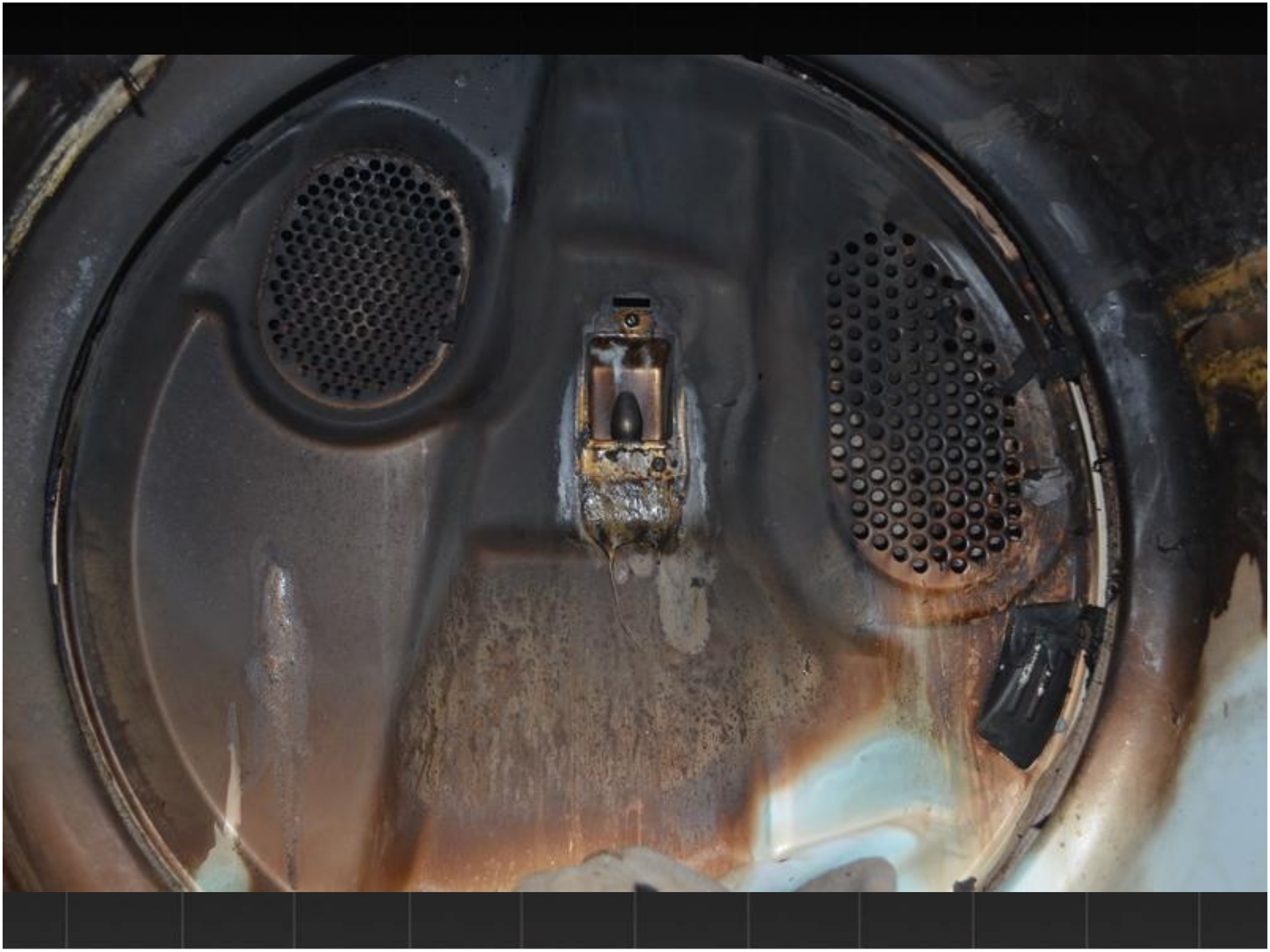
- When no labels present
  - Ask Insured for User Manuals
  - Receipts
  - Memory


Kenmore
DRYER
SECADORA
TOSHIBA
IMPORTANT!
46HX83
51HX83
57HX83
65HX83
UNITED
UNITED

ID Ignition Sources

- Can use Manufacturer specific markings/parts





Brands of the Big Four Appliance Manufacturers

In 1996, Whirlpool purchased Maytag.

Whirlpool
- Kitchen Aid
- Roper
- SinkGuard
- Estate
- Inglis (Canada)
- Norcold
- Partners Plus
- Conquest
- Coolerator
- Crystal Tips
- Hampton Bay
- Jordan
- Sub-Zero

Maytag
- Admiral
- Amana
- Caloric
- Crosley
- Glenwood
- Hardwick
- Imperial
- Jenn-Air
- Maycor
- Magic Chief
- Menumaster/Litton
- Neptune
- Litton
- Modern Maid
- Norge
- Speed Queen
- Sunray

Electrolux
- Frigidaire
- Gibson
- Kelvinator
- Philco
- Tappan
- White-Westinghouse
- White Consolidated Industries (WCI)

General Electric
- Hotpoint
- RCA

On all major appliances, part of the serial number contains the date it was manufactured.

Date Codes:

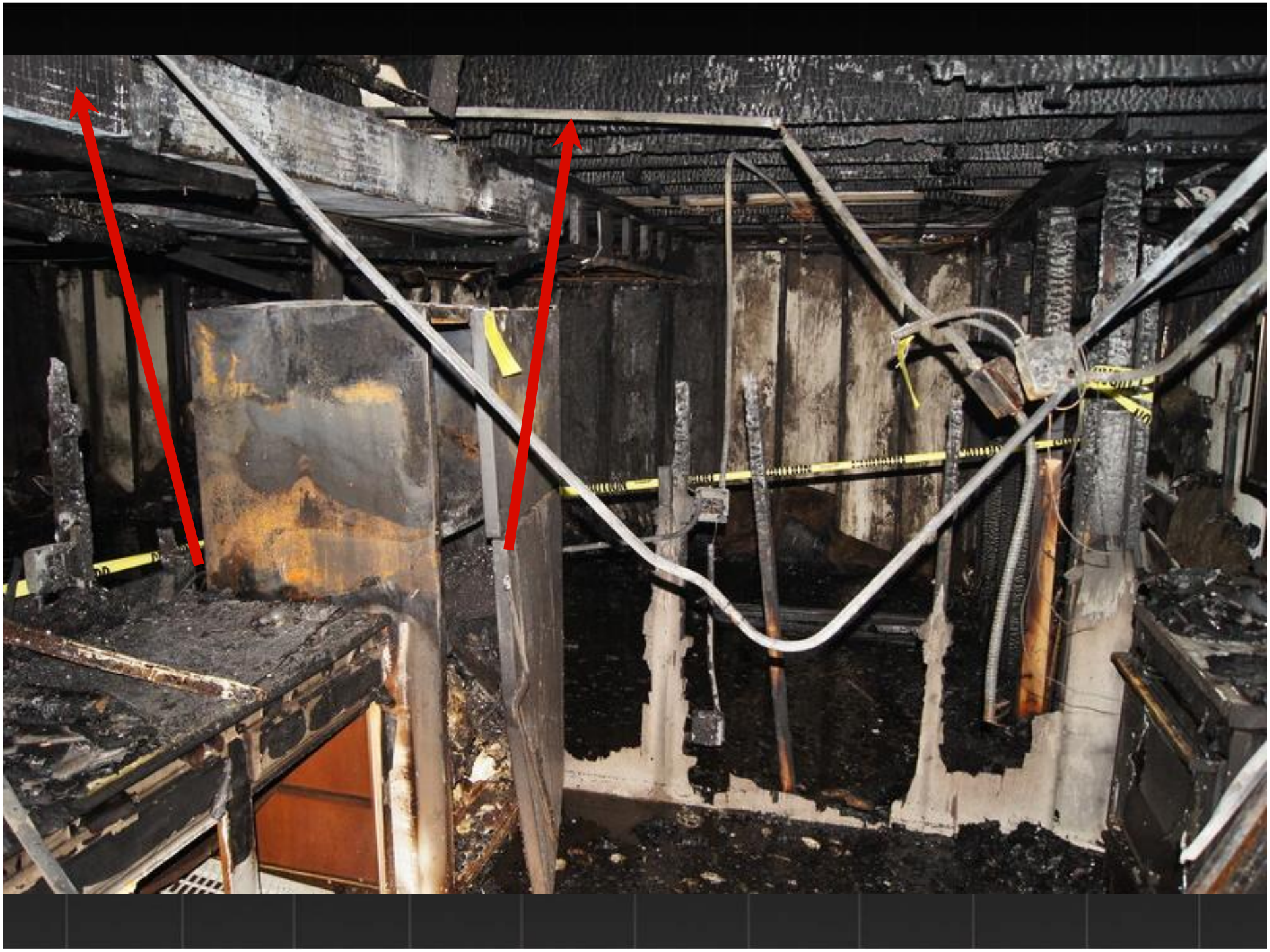
Whirlpool Maytag Electrolux General Electric

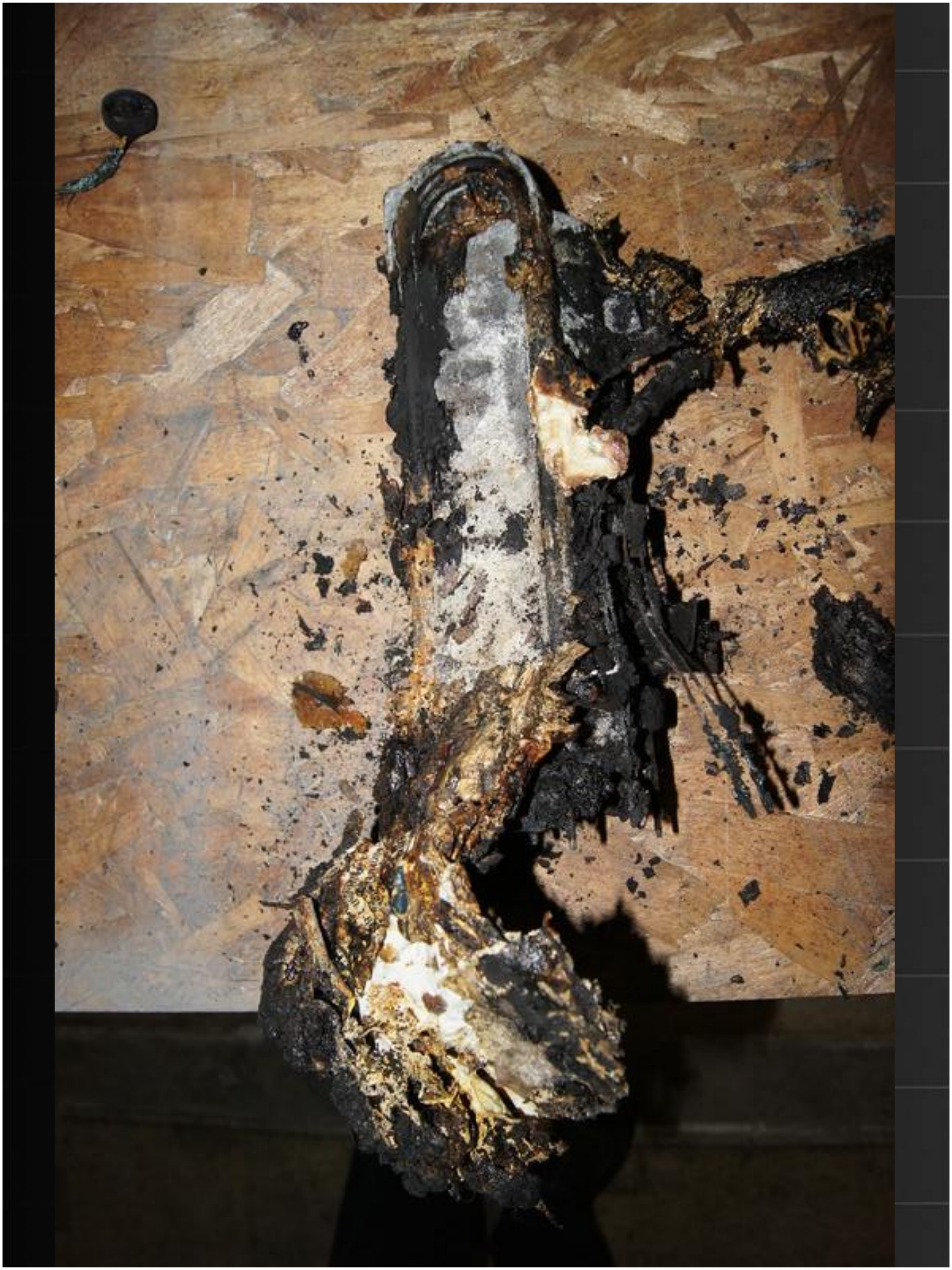
Sears- Kenmore Brand

Sears doesn't manufacture any appliances. The first three digits of the model number specifies the manufacturer.

NFPA 921

- When disassembly is necessary, each step should be documented with photography
- This should not be done haphazardly
- Document artifact at start of each stage of disassembly






98


Oster

Spoliation

Spoliation

- NFPA 921 = Loss, destruction, or material alteration of an object or document that is evidence or potential evidence in a legal proceeding by one who has the responsibility for its preservation

Spoliation

- All parties have the right to look at the evidence in the same state without it being altered or destroyed

- Altered evidence may slow faulty products from being recalled and can destroy subrogation efforts

Potential Spoliation

- Moving and breaking evidence
- Excessive overhaul
- Improper storage of evidence
- Severing electrical circuits

Potential Spoliation

- How to avoid
    - Protect the evidence
        1. Tarp
        2. Board-up
        3. Limit access

Other Resources

- Websites (Electrolux)
  - www.emaservicetips.com/OnlineTechnicalInfo-2-SelectProductLine.php
    - User name: Service
    - Password: Tips

Logout

Other Resources

- Websites
    - Recalls.gov
    - CPSC website – cpsc.gov
        - Recalls
        - Safety bulletins

Failure Modes

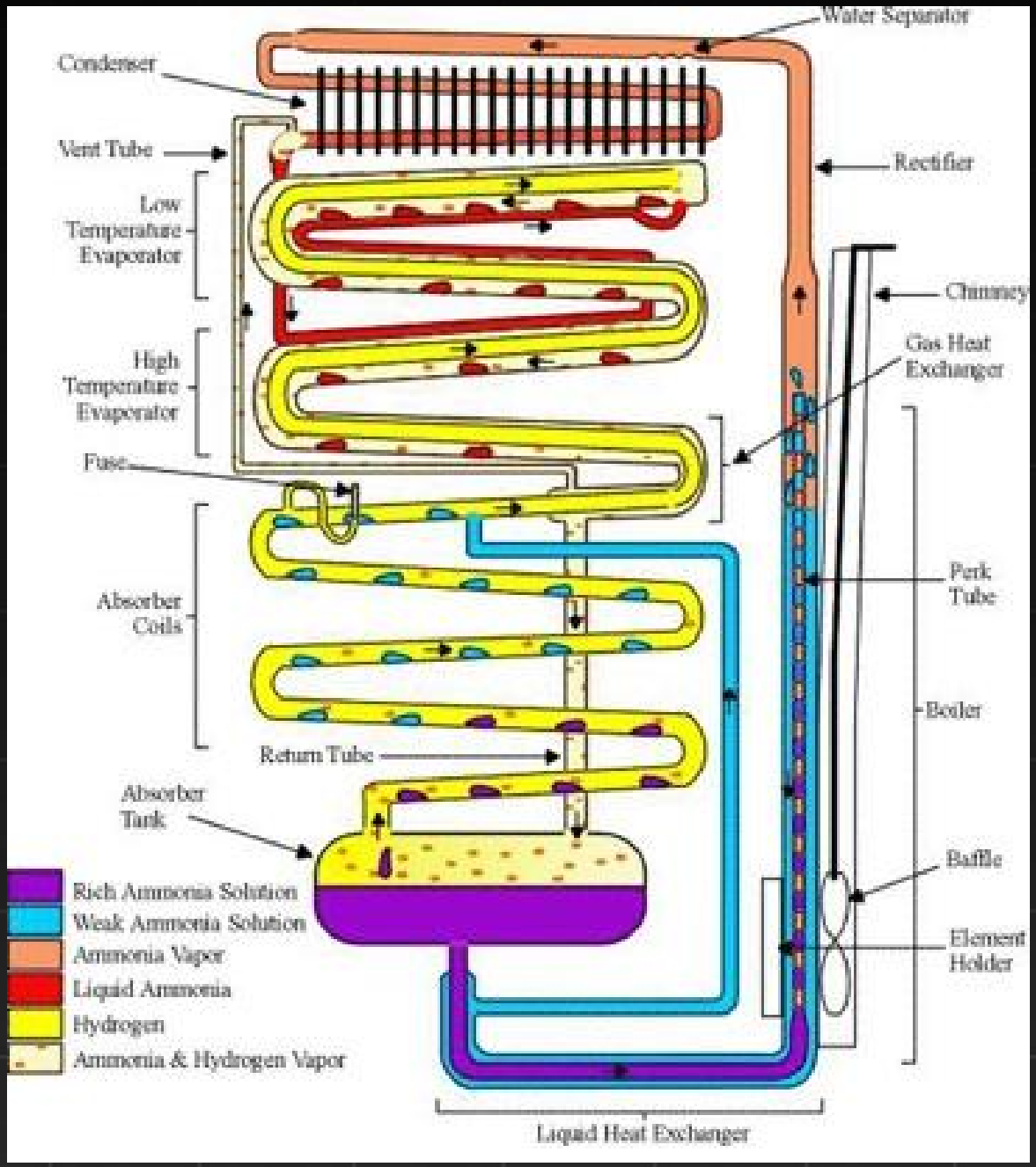
- Mechanical
  - Bearing failures
  - Fatigue cracks
- Electrical
  - Arcing
  - Overload
  - High Resistance
- User Error / Misuse

Bearing Failure

- Bearing Ball Fracture
- Bearing Bracket Failure
- Results in a Loose Spinning Drum

DONAN CTL
Component Testing Lab

Fatigue Cracks


Water Separator
Condenser
Vent Tube
Rectifier
Low Temperature Evaporator
Chimney
Gas Heat Exchanger
High Temperature Evaporator
Fuse
Absorber Coils
Perk Tube
Boiler
Return Tube
Absorber Tank
Baffle
Element Holder
Rich Ammonia Solution
Weak Ammonia Solution
Ammonia Vapor
Liquid Ammonia
Hydrogen
Ammonia & Hydrogen Vapor
Liquid Heat Exchanger

Types of Electrical Failures

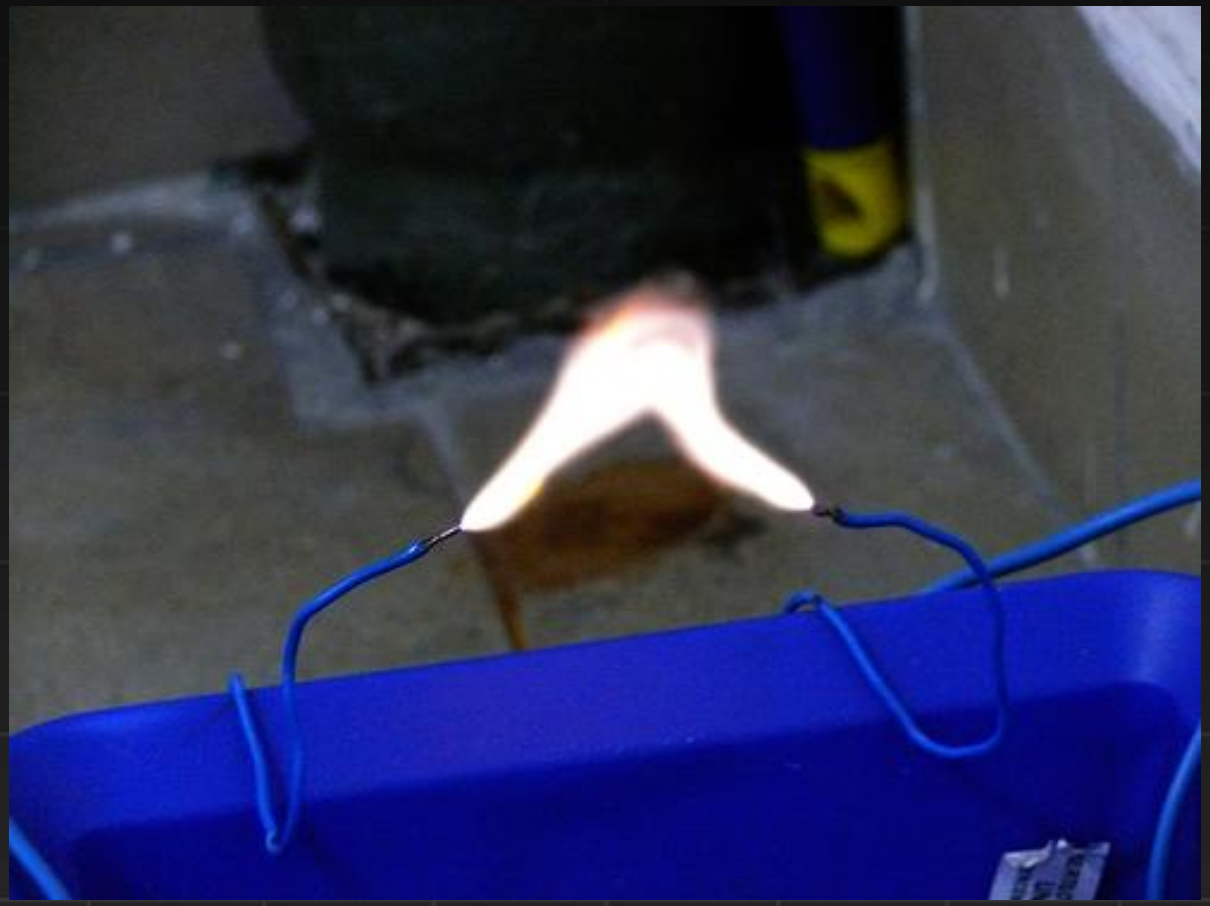
- Arcing
- Arc Tracking
- Overcurrent / Overload
- High Resistance Faults
- Floating Neutrals

Electrical Fire Ignition Events

- Manufacturing Defects
- Improper installation or use
- Use in unapproved application
- Accidents
- Failure of safety devices

Misapplication

Arcing



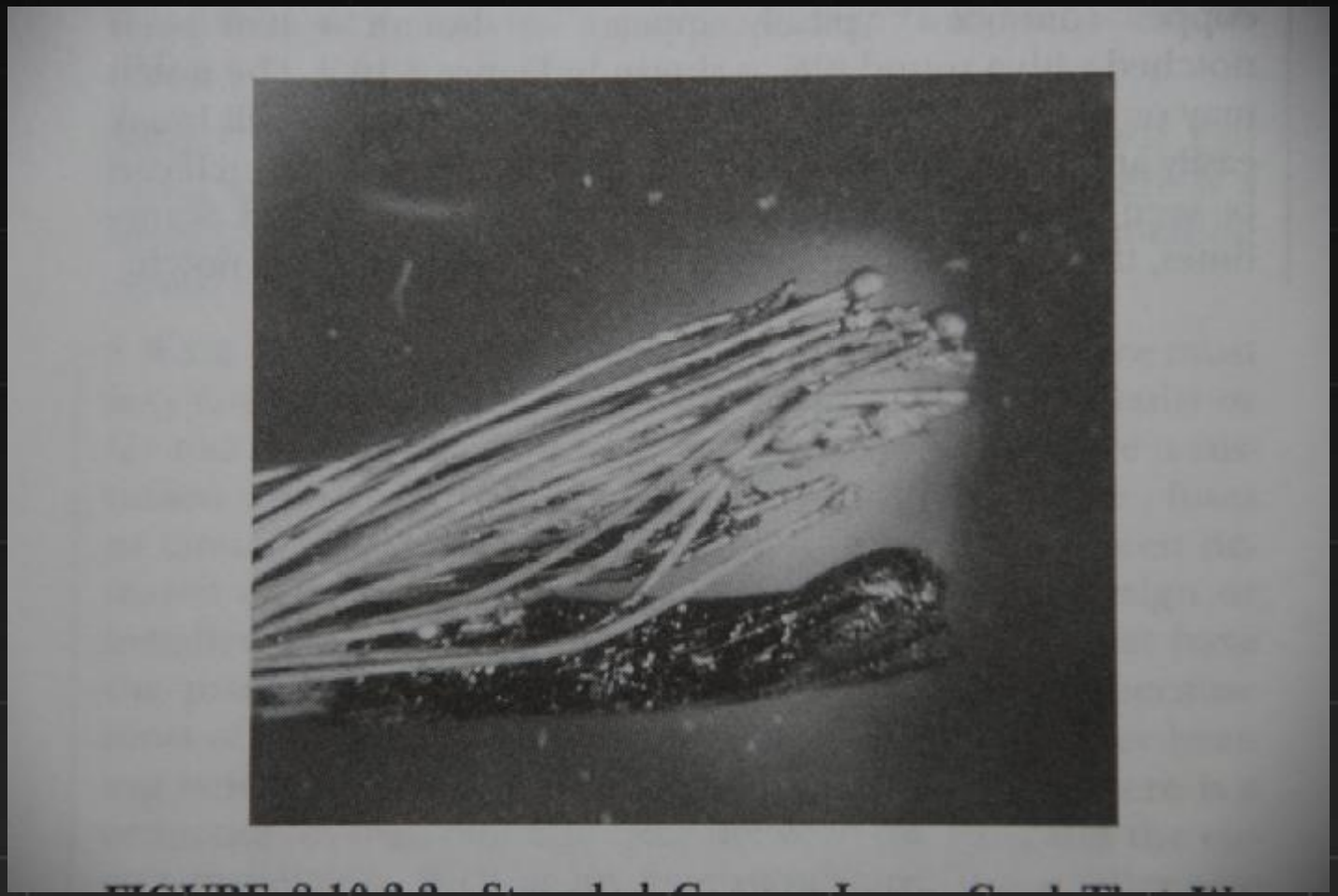
Arcing

- The flow of current through a gas such as air
- Current jumping a gap - luminous discharge
- Requires very high voltage OR very small gap between conductors
- Requires approx. 6,000 volts to bridge 1/4 inch gap in dry air

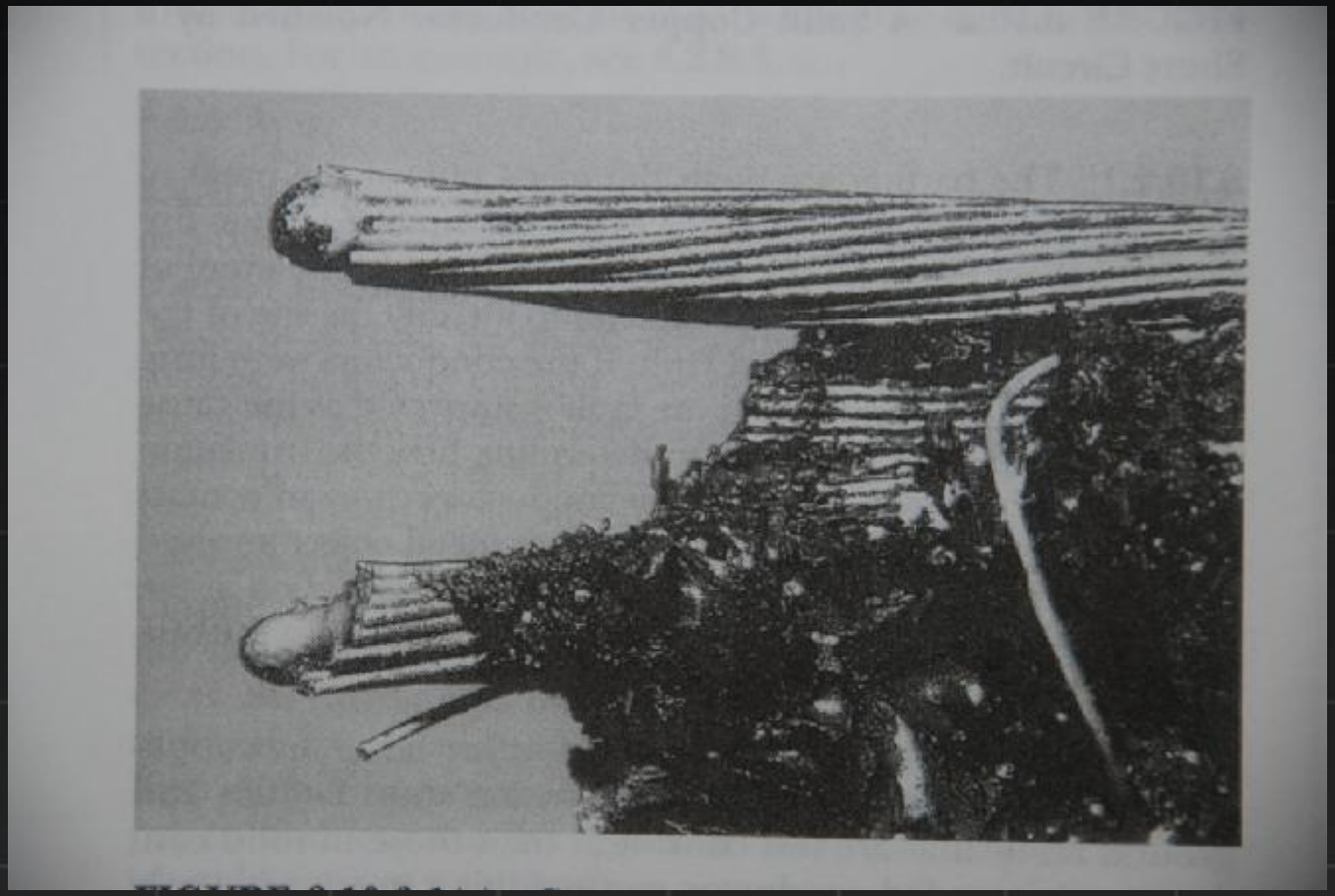
Arcing

- Arc creates very high temperatures
- Melted metal is scattered, cools, and condenses
- Arc splatter is several thousand degrees
  - Short duration = cool quickly
  - Usually lack thermal capacity to ignite solids

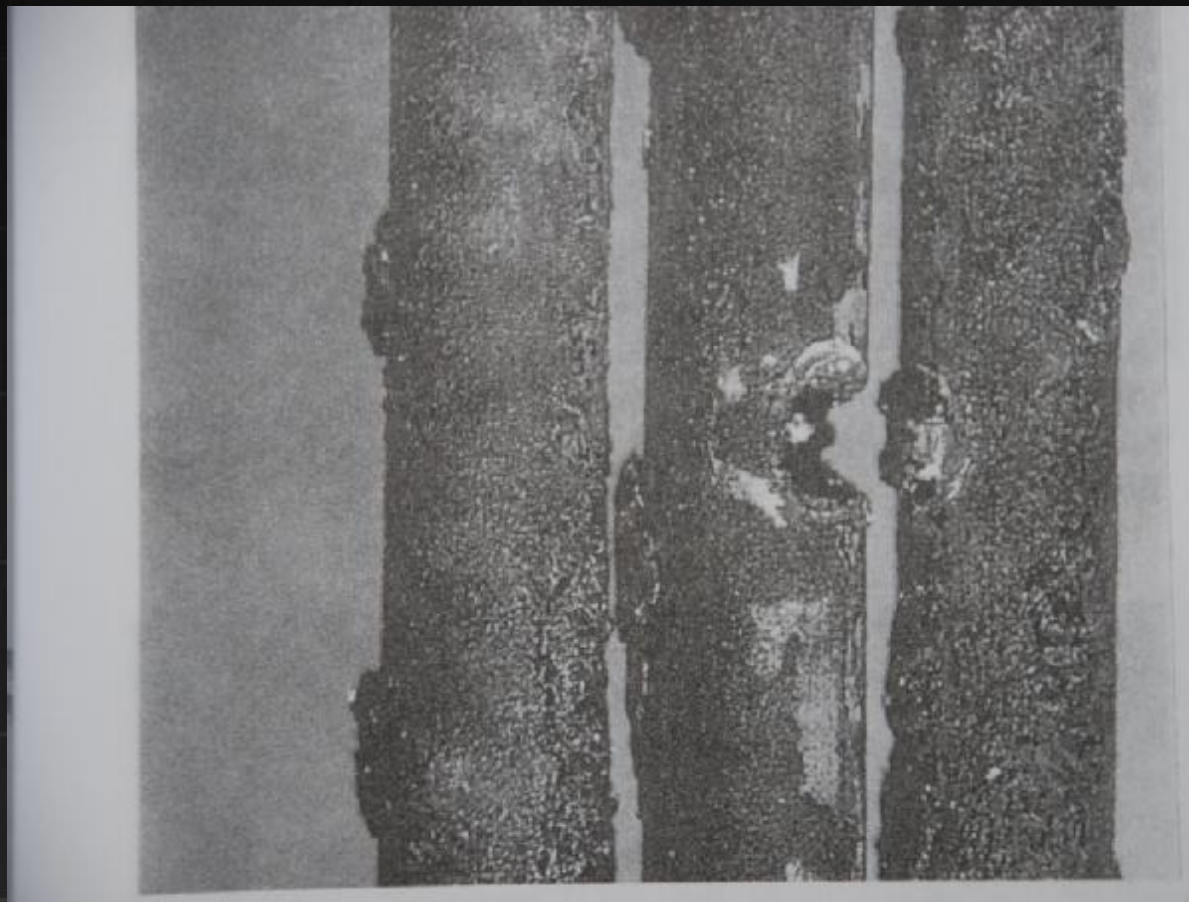
Arcing Artifacts



Arcing Artifacts



Arcing Artifacts



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Melting Artifacts

Arcing

- Cause or Effect
    - Can be caused by fire impingement
    - If mid-span = usually result of fire
- If present = conductor was energized
- Can sometimes help determine origin with Arc Mapping

Arcing Tracking

Arcing Tracking

- Also referred to as Arcing Through Char / Carbon Tracking
  - Degradation of organic electrical insulating materials (containing carbon) by applying heat
  - Heat causes pyrolysis or carbon char, which is an electrical conductor

Arcing Tracking

- Can also be caused by water contamination or mineral deposits forming current path

- Often seen in high voltage applications such as neon signs

Arcing Tracking

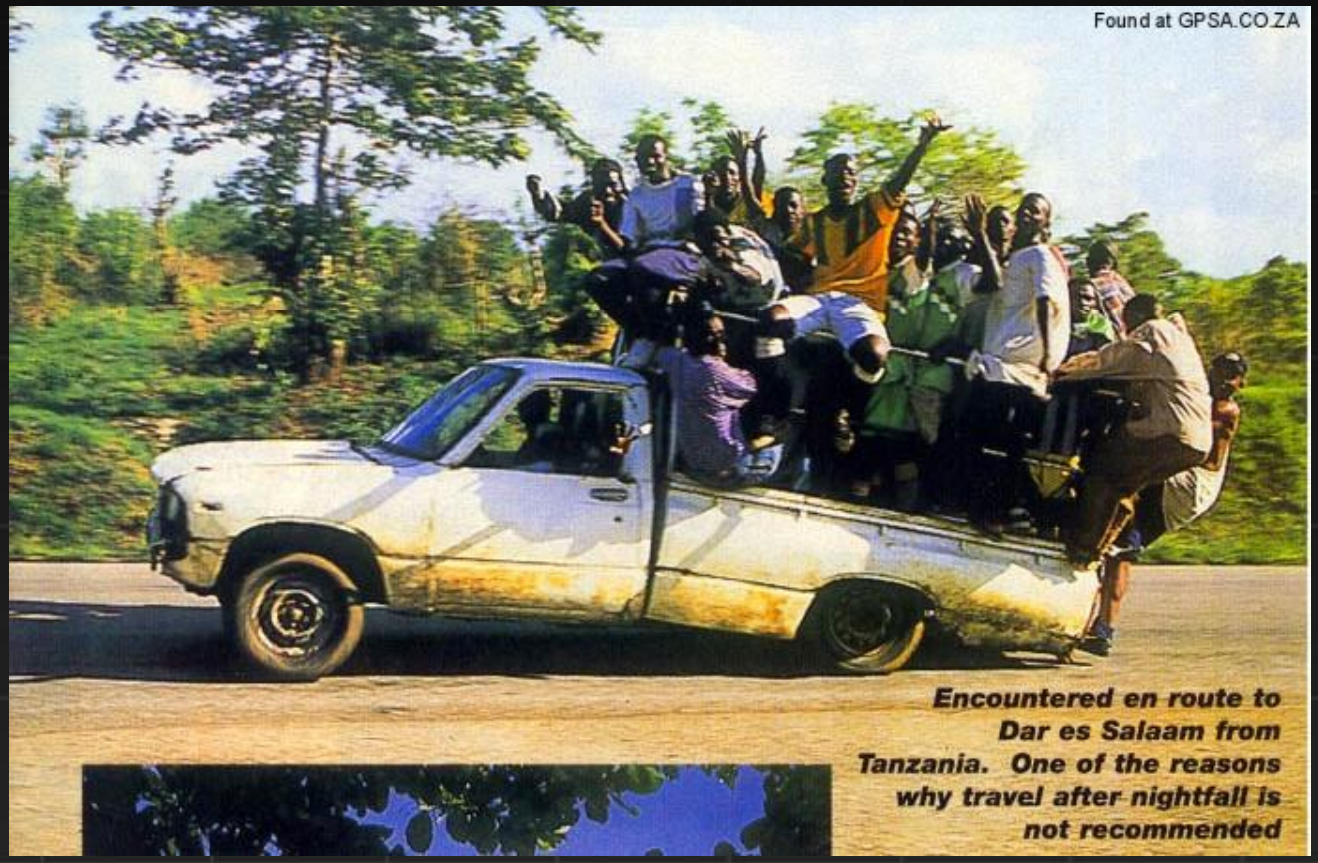
Short Circuit

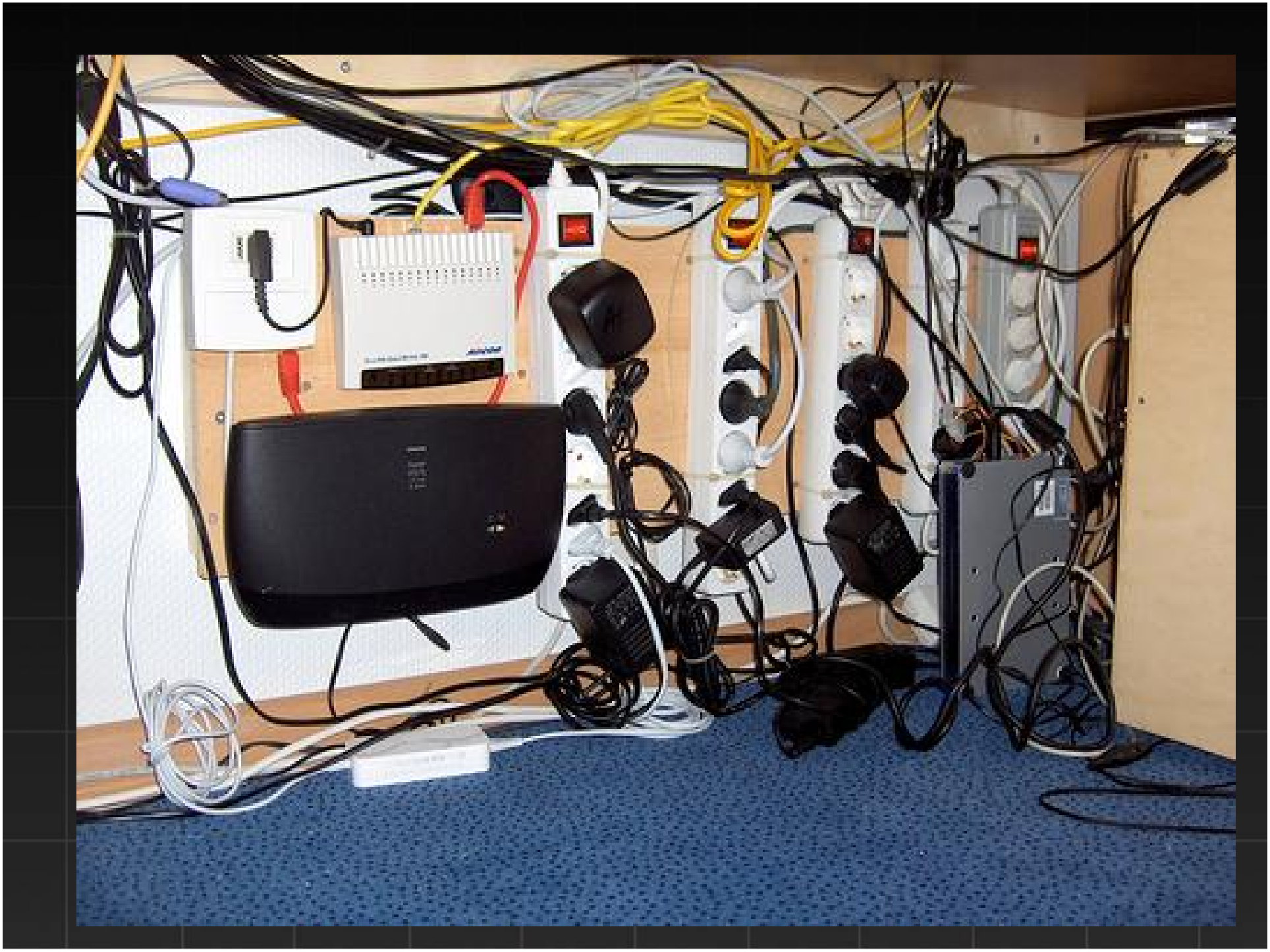
Shorted Circuits

- Result of energized conductor coming in contact with ground path
- Resistance = 0 ohms therefore Current = Infinity
- Localized damage
- Can be cause or effect


FSP
1.186
LIBERTY
IN GOD WE TRUST
UNITED STATES OF AMERICA

Overload


Found at GPSA.CO.ZA
Encountered en route to Dar es Salaam from Tanzania. One of the reasons why travel after nightfall is not recommended



Overcurrent / Overload

- Flowing current greater than capacity of conductor
- Usually have to have failure of protection device
- Uniform damage over entire length of conductor

High Resistance Faults

High Resistance Faults

- One of the most common failures

High Resistance Faults

What is it?

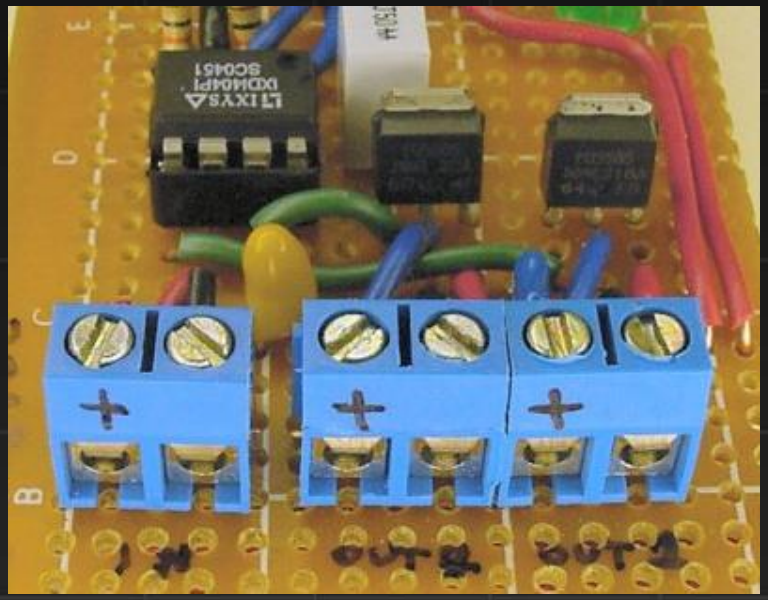
- The result of a poor mechanical connection of electrical conductors
- Poor connection = high resistance
- High resistance = more heat

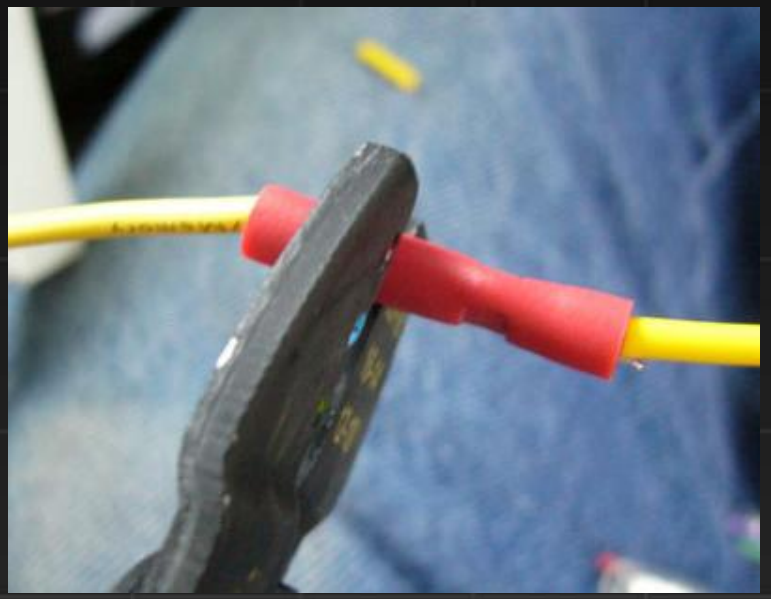
High Resistance Faults

- Damage usually localized
  - Loss of mass at connection
  - Metal displacement
  - Isolated severe damage
- Most always a cause - not effect

High Resistance Faults

- Occur anywhere with electrical connection





High Resistance Faults

High Resistance Faults

Dryers

Dryer Warning Signs

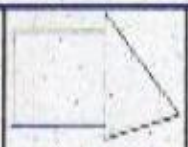
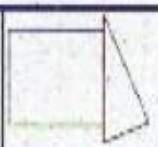
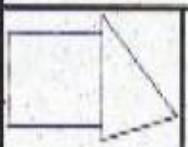
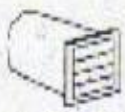
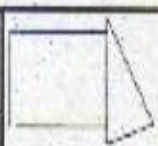
- Dryer taking longer to dry clothes
    - Multiple cycles
- Lint accumulation
- Outside vent clogged

Dryer Fires

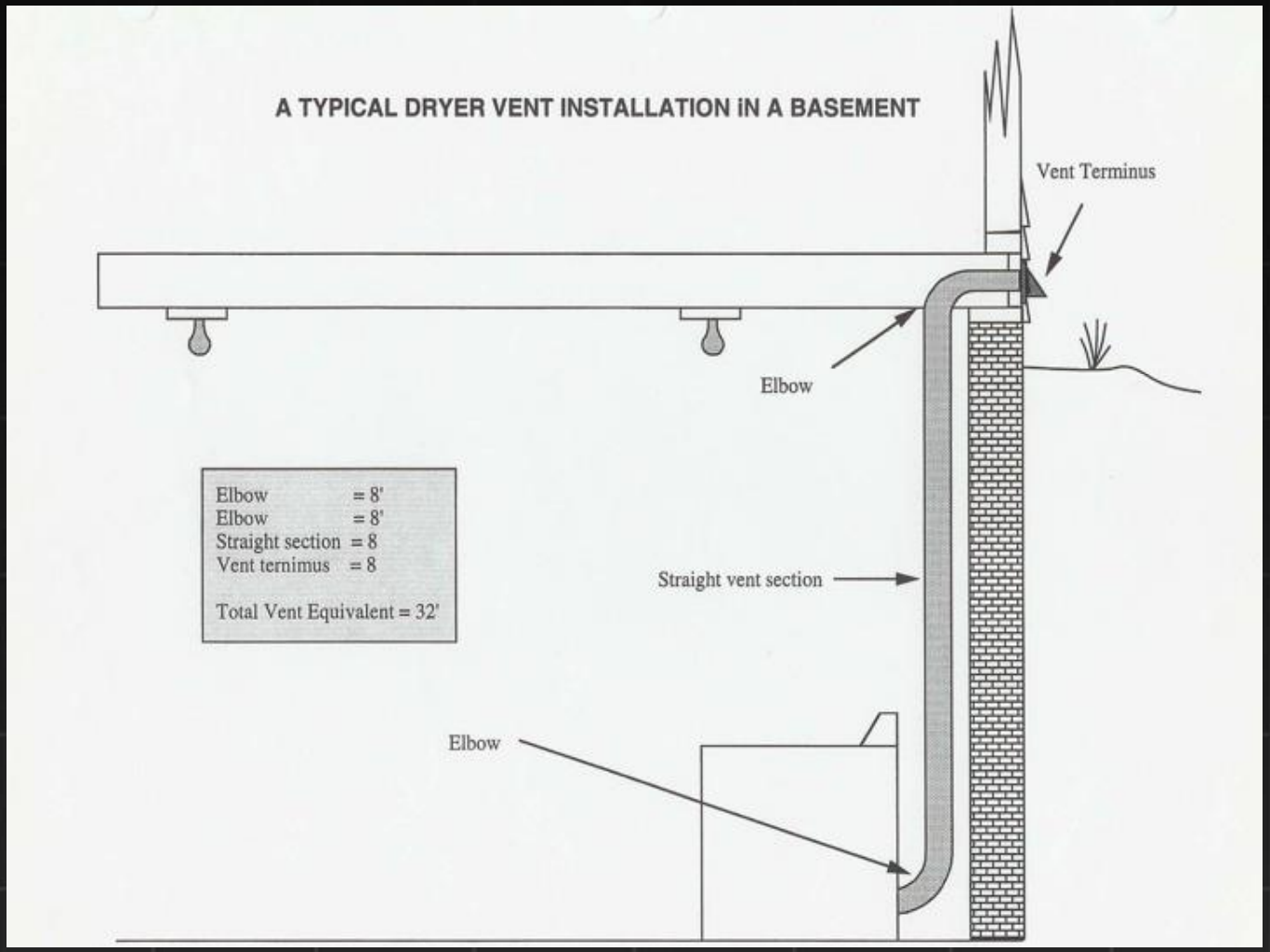
Installation Problems:

- Improper exhaust lengths
  - 30 ft flexible / 43 ft rigid
  - 90 degree bends = 8 ft

Dryer Fires

MAXIMUM LENGTH				MAXIMUM LENGTH			
of 4" (10.2cm) dia. rigid metal duct				of 4" (10.2cm) dia. flexible metal duct			
VENT HOOD TYPE				VENT HOOD TYPE			
Number of 90s	 4"	 Louvered	 2.5	 4"	 Louvered	 2.5	Number of 90s
0	43 feet	41 feet	36 feet	30 feet	29 feet	24 feet	0
1	33 feet	31 feet	26 feet	24 feet	23feet	18 feet	1
2	23 feet	21 feet	16 feet	16 feet	15 feet	10 feet	2
3	18 feet	18 feet	not recommended	10 feet	9 feet	not recommended	3

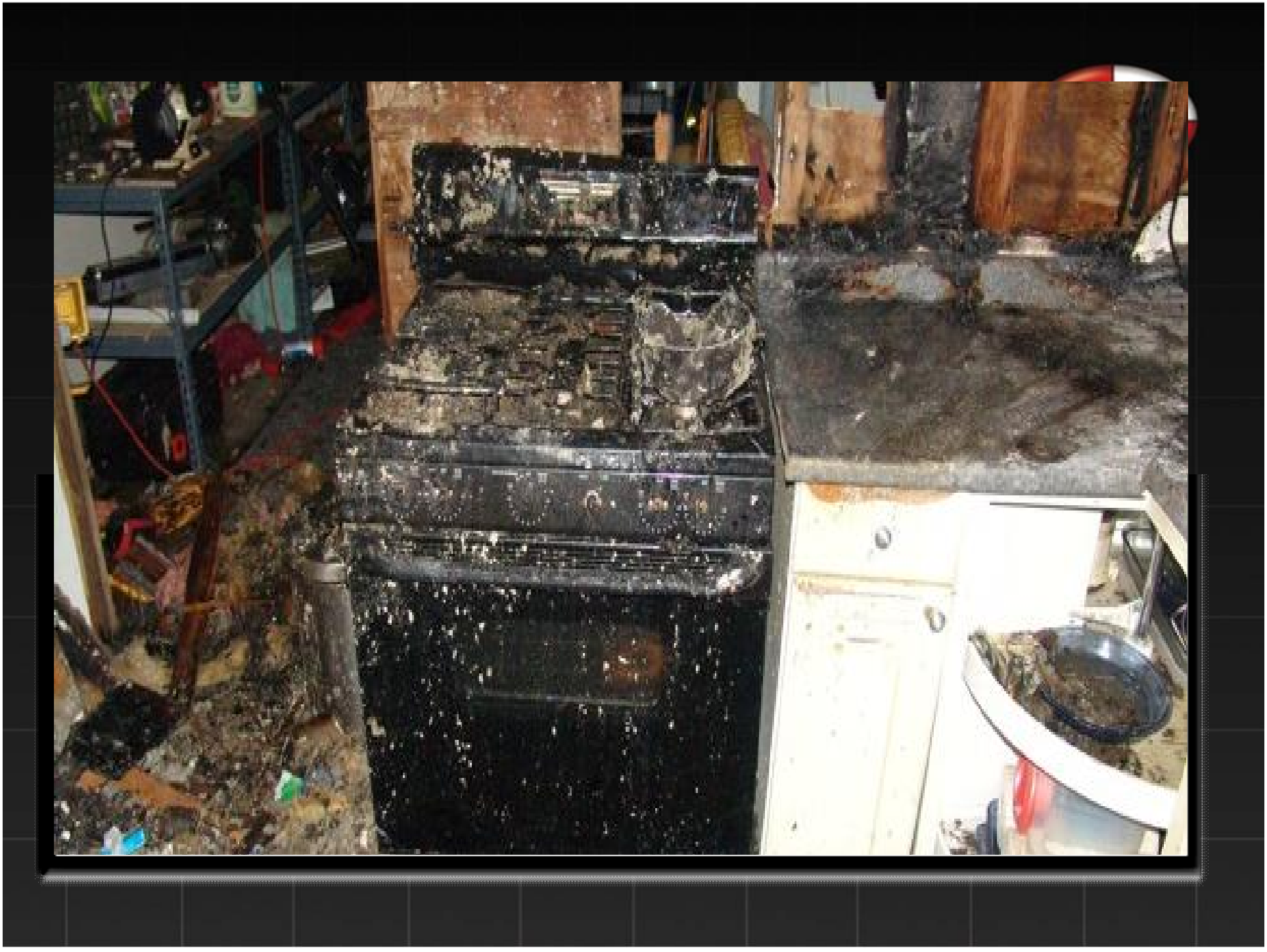
Dryer Fires

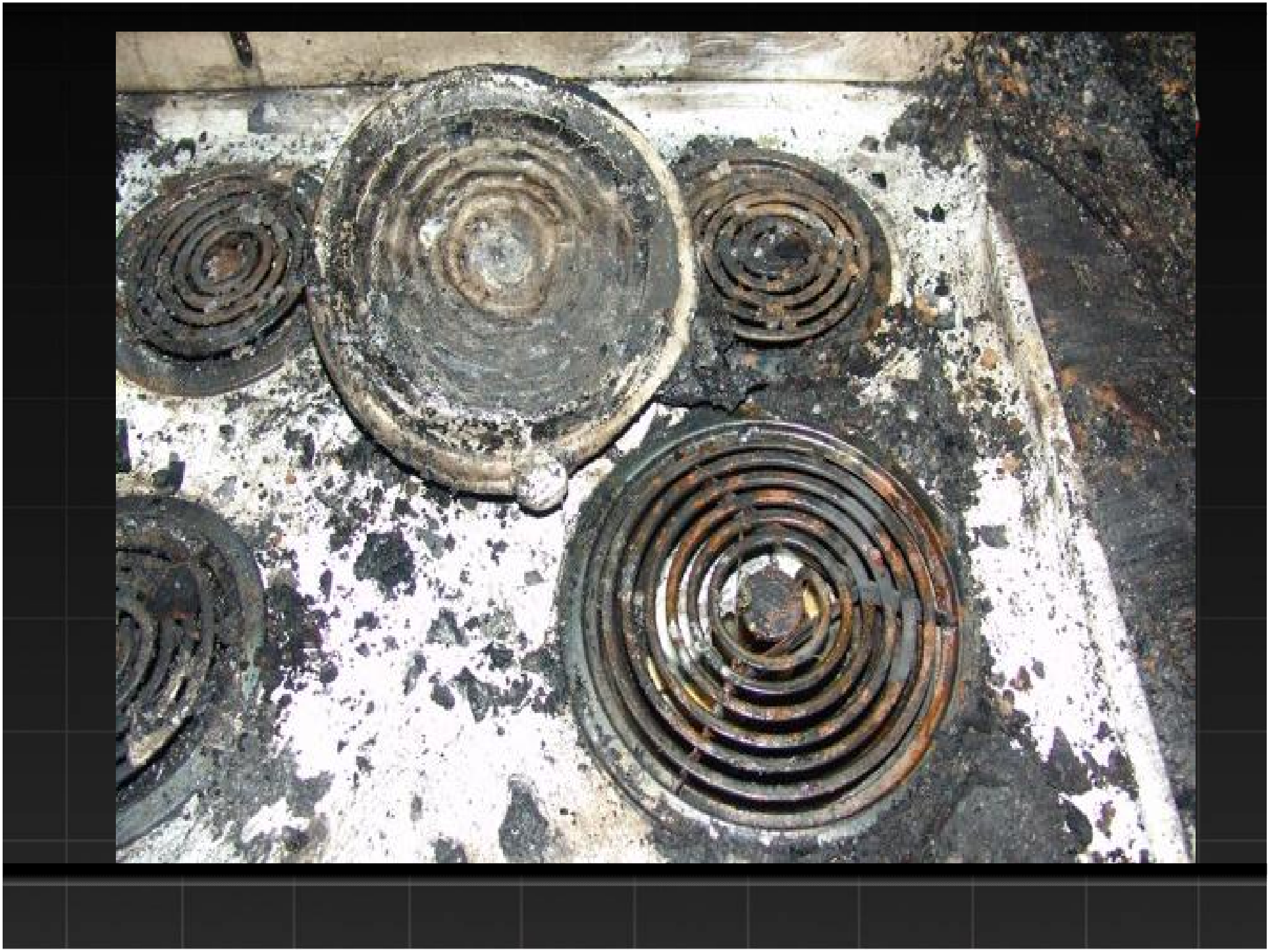

A TYPICAL DRYER VENT INSTALLATION iN A BASEMENT
Vent Terminus
Elbow
Elbow = 8'
Elbow = 8'
Straight section = 8
Vent ternimus = 8
Total Vent Equivalent = 32'
Straight vent section
Elbow

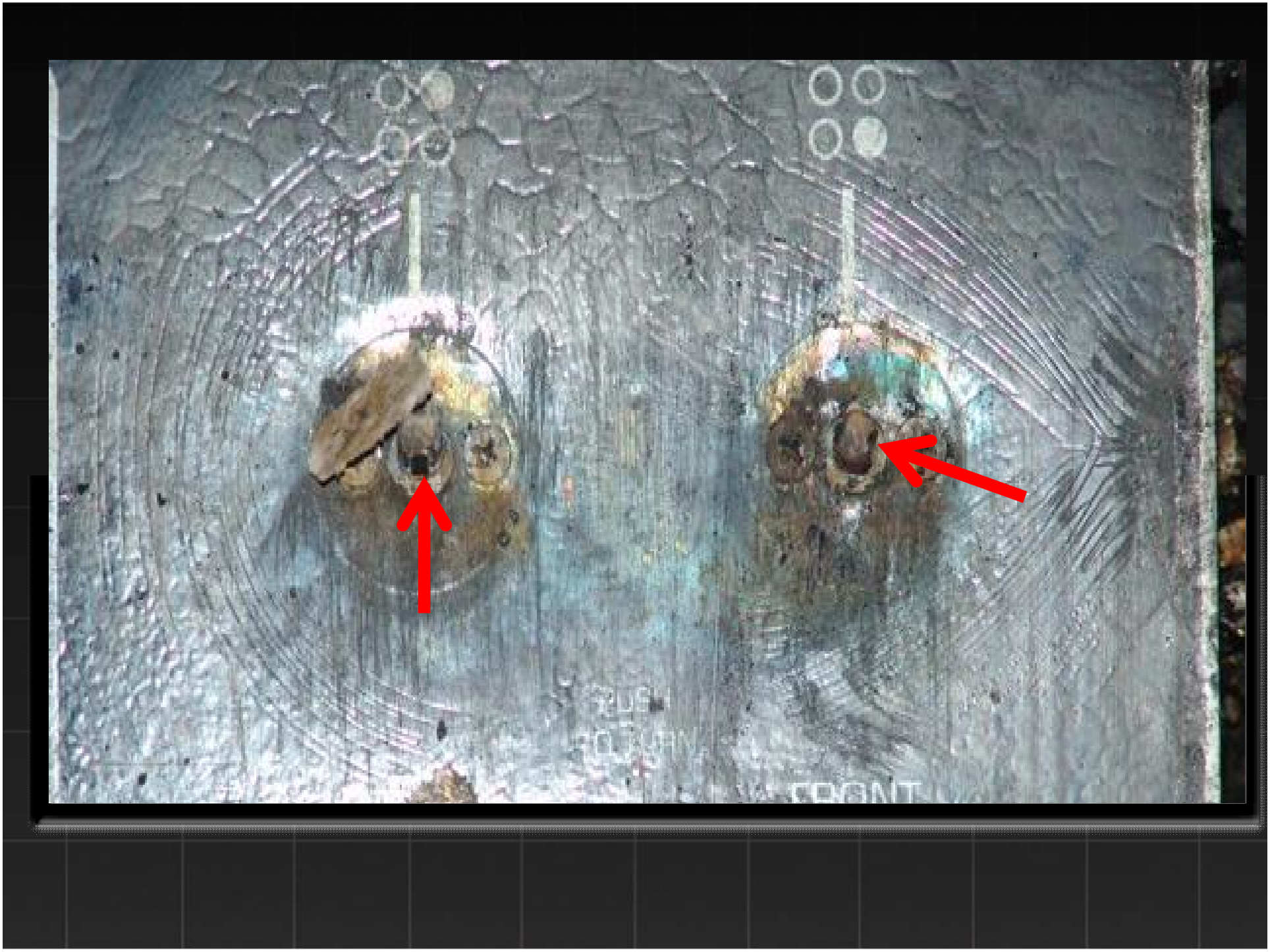
Dryers

- How they can fail
    - Lint obstructs safety’s
    - Temps higher
- Lint can accumulate near burner tube / heating element
- Electrical or mechanical failures

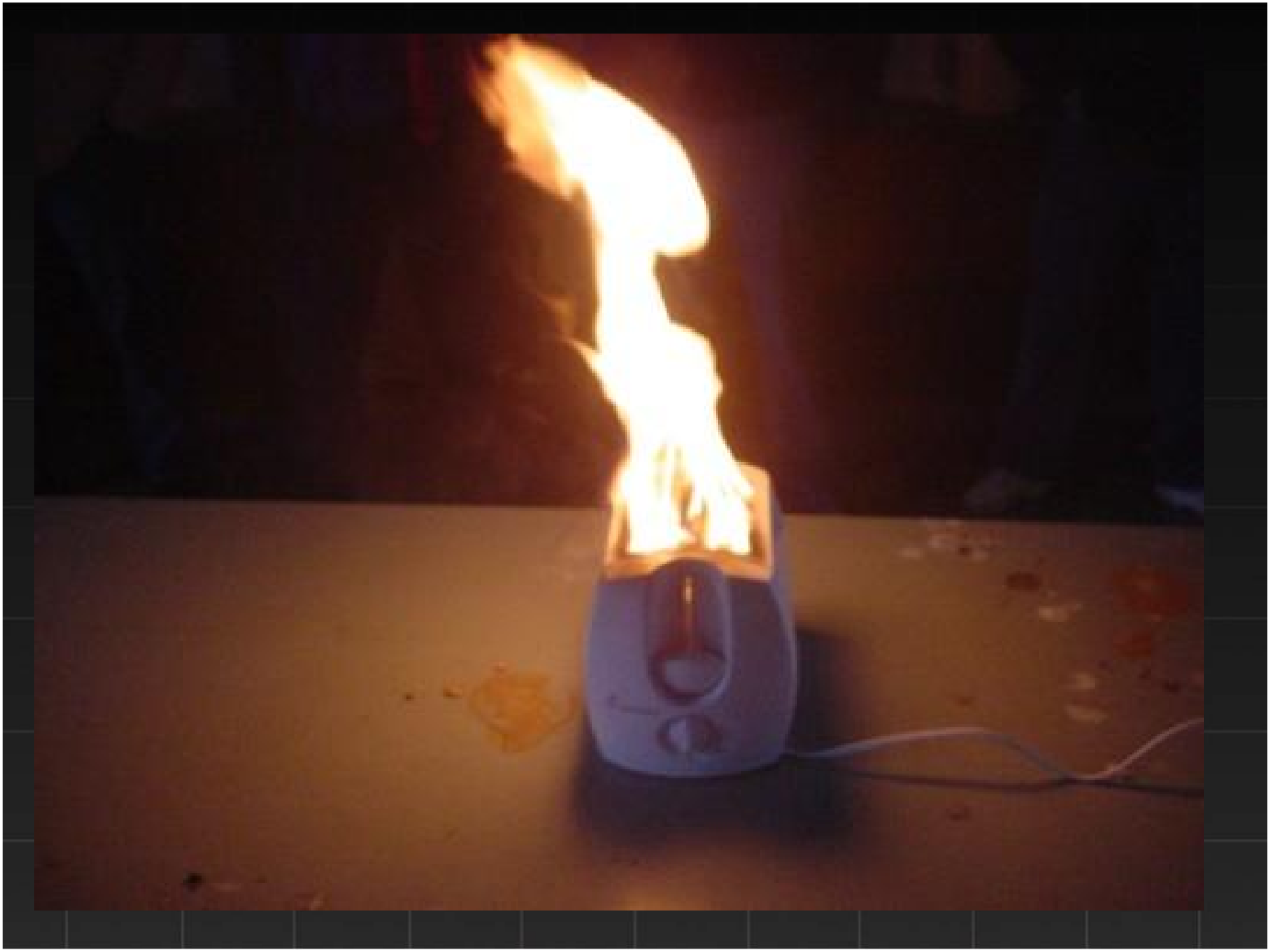
User Error / Misuse







DUAL/SINGLE
COOKTOP ON



Any Questions?

Thank you!

Joseph Schuh, CFI, CFEI, CVFI
Donan Engineering Co., Inc.