

Static Electricity

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SerenaGroup
Building the Nation's Leading Wound Care Team

 **Deborah**[®]
Heart and Lung Center

Overview

- The fire triangle is a simple way to understand the ingredients needed to cause a fire.
- Three components make up the triangle: heat (ignition source), fuel, and an oxidizing agent such as oxygen.
- As oxygen concentration increases, the risk of fire increases.
- Sparks caused by the discharge of static electricity act as ignition sources in fires.
- Fire prevention rests on removing or reducing the impact of one or more of the sides of the triangle.
- In the high oxygen hyperbaric environment, the focus is on reducing the amount of available fuel and eliminating ignition sources. Most fires in a hyperbaric chamber are caused by the introduction of an ignition source (e.g. hand warmers, cigarette lighters).
- Static electricity is ubiquitous.
- Anyone who has touched a doorknob after walking across a carpeted floor has experienced static electricity.
 - In a monoplace chamber a static discharge will lead to disaster.

I finally managed to get rid of that
nasty electrical charge I've been
carrying.
I'm ex-static!



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The Fire Triangle

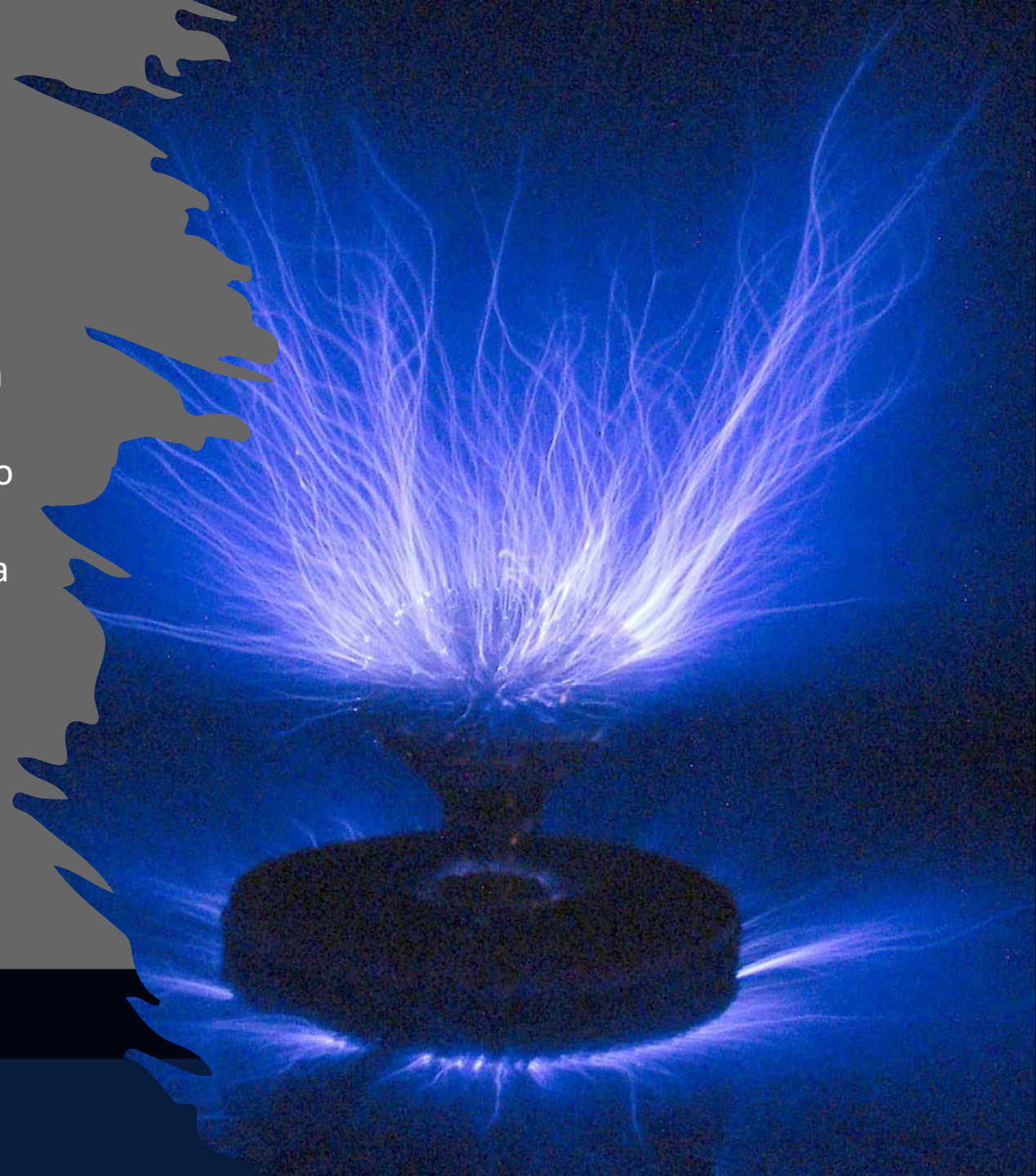


The 3 Legs Of The Fire Triangle

- 1. FUEL**-Some sort of fuel or combustible material
- 2. IGNITION SOURCE**-any kind of combustible material. It's characterized by its moisture content, size, shape, quantity and the arrangement in which it is spread over the landscape. The moisture content determines how easily it will burn.
- 3. OXYGEN**-Air contains about 21 percent oxygen, and most fires require at least 16 percent oxygen content to burn. Oxygen supports the chemical processes that occur during fire. When fuel burns, it reacts with oxygen from the surrounding air, releasing heat and generating combustion products (gases, smoke, embers, etc.). This process is known as oxidation.

Static Electricity

- Briefly, electrons accumulate on the surfaces of objects including the human body.
- The result is a difference in voltage between objects such as your finger and the doorknob.
- A spark is created when electrons flow from one object to another.
- Grounding reduces the potential for sparks by providing a pathway for electrons to flow to the earth.
- For this reason, the patient in the hyperbaric chamber always wears a ground.
- In addition, it is recommended that the relative humidity levels in the hyperbaric suite exceed 40%. This further reduces the risk of static discharge.



Grounding Requirements

- **The grounding requirements for hyperbaric chambers and occupants are found in the National Fire Prevention Agency Manual (NFPA) Chapter 19, NFPA 99 or Chapter 20, NFPA 02.**
- A grounding system must be in contact with the patient's skin and provide a conductive pathway.
- Grounding straps used in hyperbaric chambers are usually attached to the patient's wrist.
- If the patient is properly grounded a static discharge or spark is exceedingly rare.
- Grounding the patient eliminates a potential ignition source.

Procedure

Daily inspection of the hyperbaric chamber includes inspection of the grounding wire attached to the rear of the chamber. All patients must wear a grounding wrist band before entering the chamber. Inspect the following grounding areas:

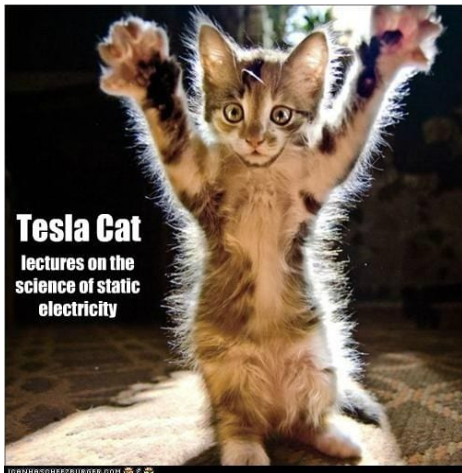
- ***Daily inspect the cable running from the chamber to grounding plate***
- ***Ensure the patient is wearing the grounding wrist band prior to and during***
- ***treatment.***
- ***Daily check that the chain at bottom of gurney is making contact with the floor.***
- ***The humidity in the hyperbaric suite should range between 30-40%.***



Prevention

What can we do to prevent and further reduce the risk of static/fire in HBOT ensuring our patient's and our own safety?

- Become familiar with the principle of the 3 legs of the fire triangle.
- Eliminate any possible source ignition and reduce the available fuel.
- Communicate and educate the patient on the importance of our safety checklist, let them become part of the process.
- **CHECKLIST EVERY PATIENT, EVERYTIME!**
- Ensure all equipment is checked and in working order daily.
- Know your grounding requirements for Hyperbaric Chambers and occupants defined in the National Fire Prevention Agency Manual (NFPA) Chapter 19, NFPA 99 or Chapter 20, NFPA 02.



Majority of Fires

Majority of fires in hyperbaric environments have been caused by the introduction by an IGNITION SOURCE such as (but not limited to):

- *Hand warmers
- *Cellphones
- *Lighters
- *Books/reading materials



Use your SerenaGroup approved HBO pre-treatment checklist EVERYTIME to ensure a safe and effective and ignition source free... patient experience.

Testing & Measuring Ground Continuity



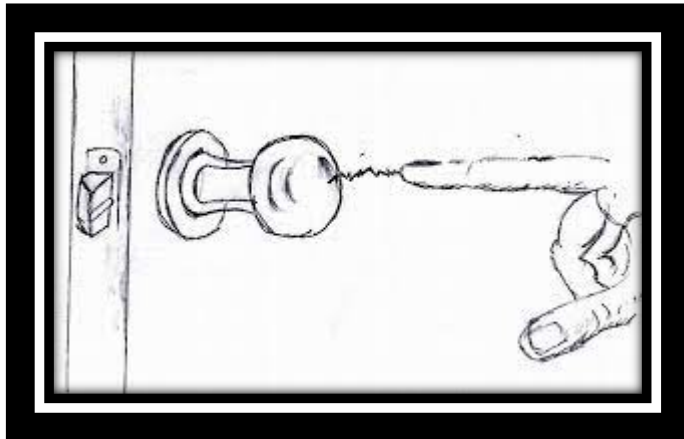
- A multimeter is a tool used to ensure accuracy and safety in all potential problem areas.
- Measures amount of resistance from one point to another.
- Measures the continuity of the circuit being created by the patient's skin, wrist strap and grounding wire cord.
- Any remaining contact points in ground paths.
- Test your equipment daily!

Get Grounded!

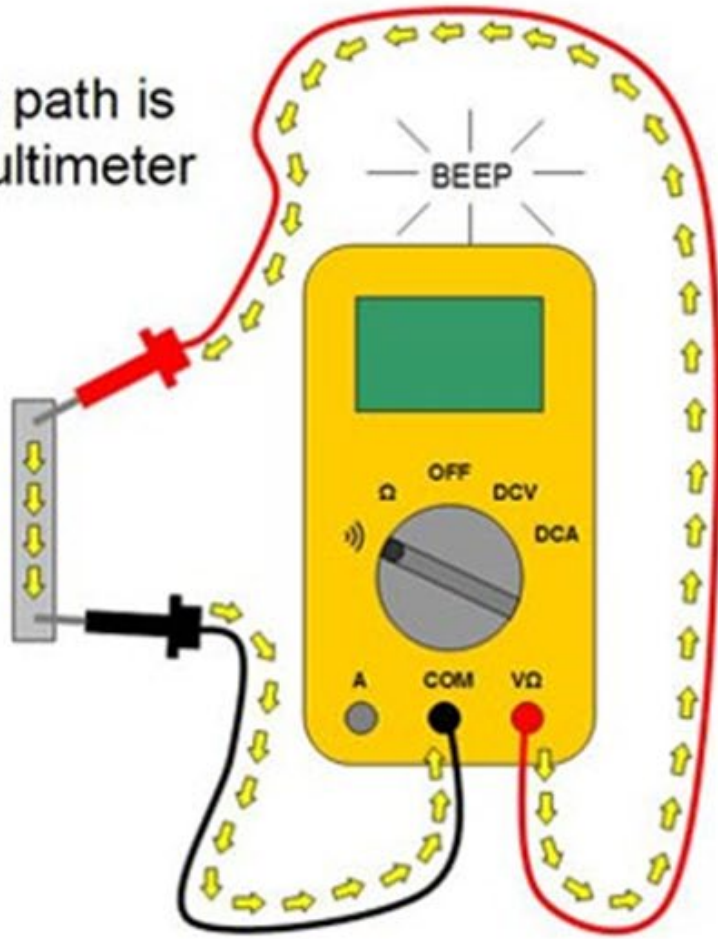
Understand your grounds and GET GROUNDED! Static electricity electrons are freed by friction tearing them from their atoms which are in the air and even on our bodies that can accumulate and may result in significant voltage potential under the right circumstances however, these voltages may flow unnoticed through proper conductive pathways which brings us to...Grounds. Requirements state that a grounding system must provide a high impedance conductive pathway to flow through.

Some examples of grounding that we use in HBOT are (BUT NOT LIMITED TO):

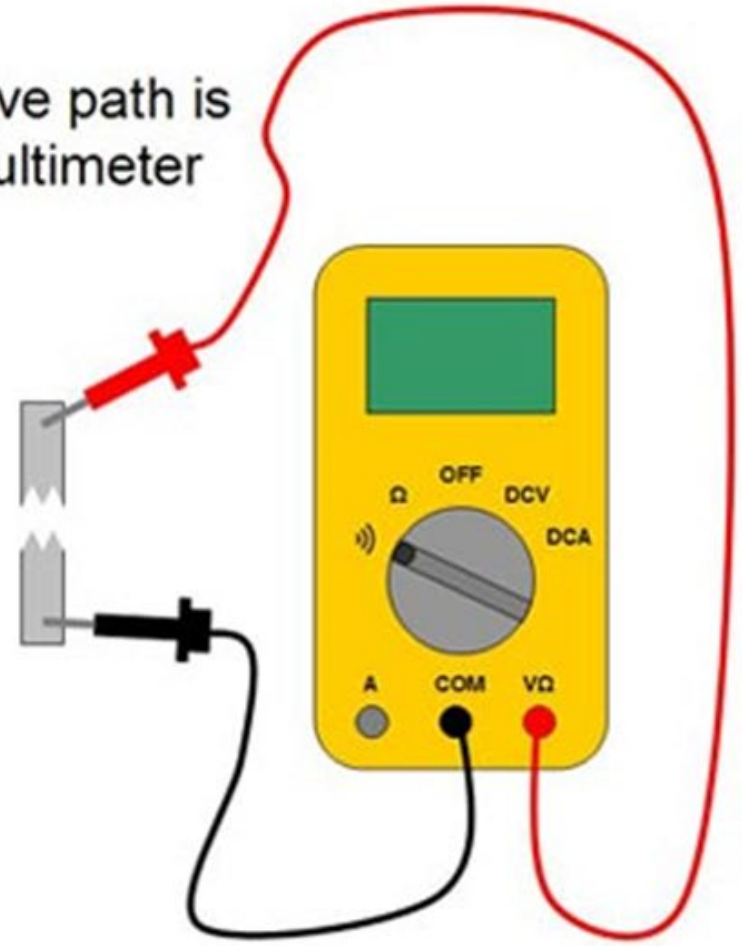
- Grounding straps – attached to the patient's wrist or to an adhesive ECG monitoring pad.
- Grounding chains, cables and/or wires Conductive footwear, approved appropriately cleaned patient attire
- Elevated relative humidity levels (>40-50%) can provide an appropriate path to ground in order to dissipate the accumulated charge.
- Steel and aluminum materials used to build the chambers that are electrical conductors/ acrylics on chambers are also insulators
- Ventilation system within chambers



If a conductive path is formed, the multimeter will beep.



If the conductive path is broken, the multimeter will not beep.



References

NFPA 99, Chapter 19 Section 2.7.4, 3.1.5.3, NFPA 03, Chapter 20
Section 20.2.7.4, 20.3.1.5.3.2, Wilbur T. Workman,
Hyperbaric

Facility Safety:

A Practical Guide, Chapter 3, pp 523-533RE



Question 1

A spark does not generate enough charge to be dangerous in an oxygen enriched environment.

TRUE OR FALSE

Answer: 1

A spark does not generate enough charge to be dangerous in an oxygen enriched environment.

TRUE OR FALSE

“Sparks caused by discharges of static electricity have been implicated as ignition sources in fires and explosions.”

Question 2

Give two examples of grounding used in the HBO Suite:

Answer: 2

Give two examples of grounding used in the HBO Suite:

Grounding wrist straps

Grounding chain that touches floor under chamber

Question 3

To decrease static electricity, you may need to lower the humidity in the chamber room.

TRUE OR FALSE

Answer: 3

To decrease static electricity, you may need to lower the humidity in the chamber room.

TRUE

OR

FALSE

“Ground examples are... elevated relative humidity levels (>40-50%)”

Question 4

This _____ grounding area is inspected prior to treating your first patient.

Answer: 4

This _____ grounding area is inspected prior to treating your first patient.

ANSWER:

Chamber grounding cable attached to grounding plate

Question 5

The _____ manual gives you specific grounding requirements.

Answer: 5

The _____ manual gives you specific grounding requirements.

Answer: The NFPA (National Fire Prevention Agency)

Question 6

If your patient is grounded, it is extremely rare to have a static spark.

TRUE OR FALSE

Answer: 6

If your patient is grounded, it is extremely rare to have a static spark.

TRUE

OR

FALSE

Chapter 19 NFPA 99 or Chapter 20 NFPA 02

Question 7

The human body is capable of producing significant voltage potential under the certain conditions.

TRUE OR FALSE

Answer: 7

The human body is capable of producing significant voltage potential under the certain conditions.

TRUE

OR

FALSE

“Electrons accumulate on the surfaces of objects including our body) and can result in significant voltage potentials.”

Question 8

The majority of fires in HBO Chambers
have been caused by
_____ source.

Answer: 8

The majority of fires in HBO Chambers
have been caused by
ignition source.

Question 9

The 3 legs of the fire triangle are:

1. _____

2. _____

3. _____

Answer: 9

The 3 legs of the fire triangle are:

1. fuel
2. ignition source
3. oxygen

Question 10

When the concentration of oxygen is increased, so does the risk of fire.

TRUE OR FALSE

Answer: 10

When the concentration of oxygen is increased, so does the risk of fire.

TRUE

OR

FALSE

“ When the oxygen concentration increases in an atmosphere, the risk of fire increases.”

SERENAGROUP HYPERBARIC LEADERSHIP

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HBOT Show Rate June 2021

Center	Program Director	Show Rate Percentage
Akron	Nick	98%
ACMH	Lisa	100%
Berkshire	Sean	
CHI Health CUMC/Bergan	Joe	100%
CHI Health Mercy	Joe	100%
Deborah	Megan	80%
Fairview	Jamie	82%
Henry Ford	Eliece	99%
Jackson	Dean	96%
St. Mary's	Katie	91%
Via Christi	Nancy	98%
Inspira – Elmer	Ally	92%
CHI Health St. Elizabeth	Joe	92%
Chambersburg	Ginger/SG	84%

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