

LPG Liquid-Measuring Devices

Part 1: Safety

NIST Weights and Measures Division
LPG Short Course
May 2005

Safety - Overview

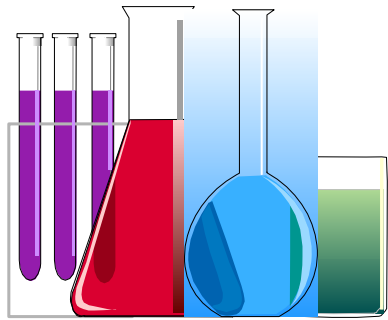
- % Importance of Safety
- % Hazards of Testing LPG
 - % Properties & Hazards of LPG
- % Essential Safety Equipment
- % Safety Precautions
 - % Safety Notes – EPO
 - % Glossary of Safety Terms
- % Reducing Safety Risks

The Importance of Safety

- % Safety is EXTREMELY IMPORTANT
- % Recommend in-depth safety training prior to LPG testing
 - Re-stress in field training
 - Work with your safety officer, OSHA, etc.
- % Cannot be over-stressed
- % If you don't learn anything else...learn that safety comes first
- % Unsafe practices can harm not only yourself, but also others

Hazards of Testing LPG Devices

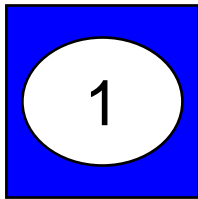
- % Certain hazards associated with LPG, *however...*
 - % Systems are designed in accordance with strict codes and requirements
 - % People who operate these systems should be trained for safe operation & response
 - % But you need to be prepared in case they are not!
 - % Stand by to assist as directed
 - % Situations develop rapidly, so you need to be prepared
 - % Likelihood of accident testing LPG is just as great as with any other W&M test
 - % Potential for serious consequences is what is critical



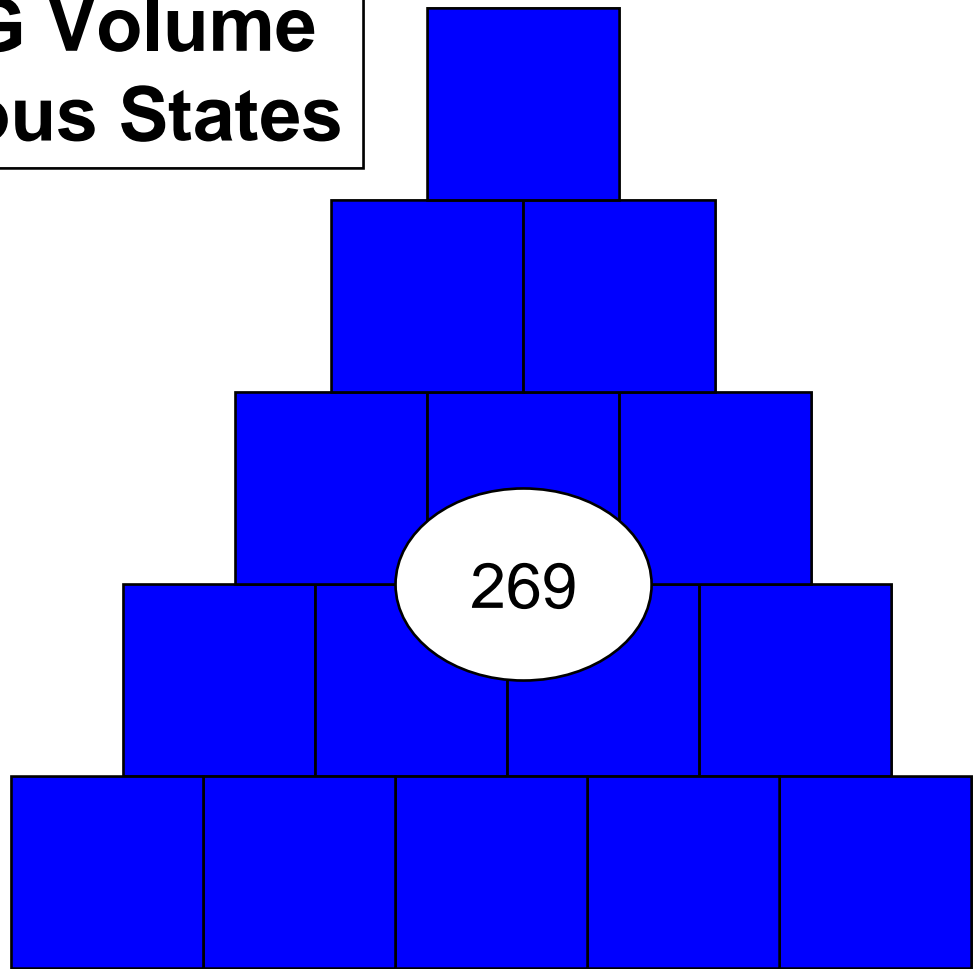
Important Properties of LPG

- % Gases at atmospheric temperature and pressure
- % Easily liquefied for storage & transportation
- % Stored in liquid state and used in gaseous state
 - % Takes up less space in liquid form
 - % Easily reconverted back to gaseous state for use
 - % by returning to atmospheric temperature and pressure
 - % Containers fabricated to withstand several times the vapor pressure of propane within the normal temp range

Comparison of LPG Volume in Liquid vs. Gaseous States



Liquid State



Gaseous State

Terms to Know

% Boiling Point

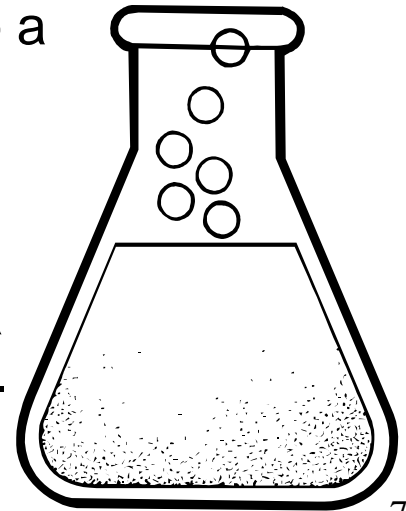
% Temperature at which a substance changes from liquid to gas

% Latent Heat of Vaporization

% The amount of heat that must be applied to a substance to cause it to go from a liquid state to a gaseous state.

% Vapor Pressure

% The pressure that must be applied to maintain a product in its liquid state at a given temperature.



Properties & Hazards of LPG

% Properties which make LPG desirable are also those that account for hazards associated with it!

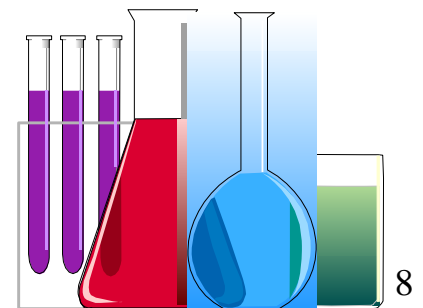
1) Boiling Points

% - 44° F for propane

% +32° F for butane

% thus.....propane is a gas at most atmospheric temps

% To be liquefied a substance must be maintained at a temperature below its boiling point

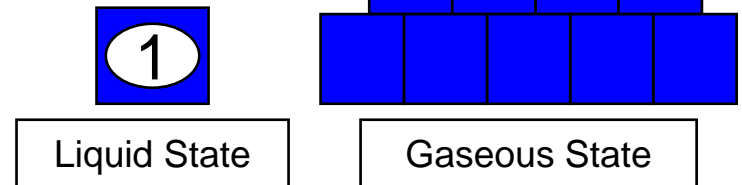


Properties & Hazards of LPG (cont)

2) Recall...269:1 ratio

% Economically desirable

% But can be a hazard if released uncontrolled into atmosphere



3) Propane boils instantly when exposed to atmosphere

% Boils in vicinity of leaks

% Refrigerant effect

% Causes burns on contact

% Protective goggles and gauntlet gloves are a must!

Properties & Hazards of LPG (cont)



4) Flammability

% LPG is under pressure

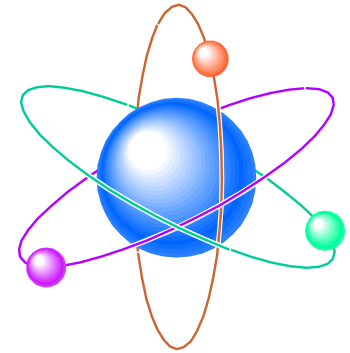
% Release may be rapid and hard to control

% High concentration of flammable gas

% Relatively narrow limits of flammability in air:

- Propane = 2.2% to 9.6%
 - Anything less than 2.2% or greater than 9.6% concentration will not burn
- Butane = 1.9% to 8.6%

Properties & Hazards of LPG (cont)



4) Flammability (cont.)

- % Narrow limits of flammability contributes to safety of LPG products
- % *However*, possibility of ignition is not remote
- % Treat any release of product as potentially dangerous

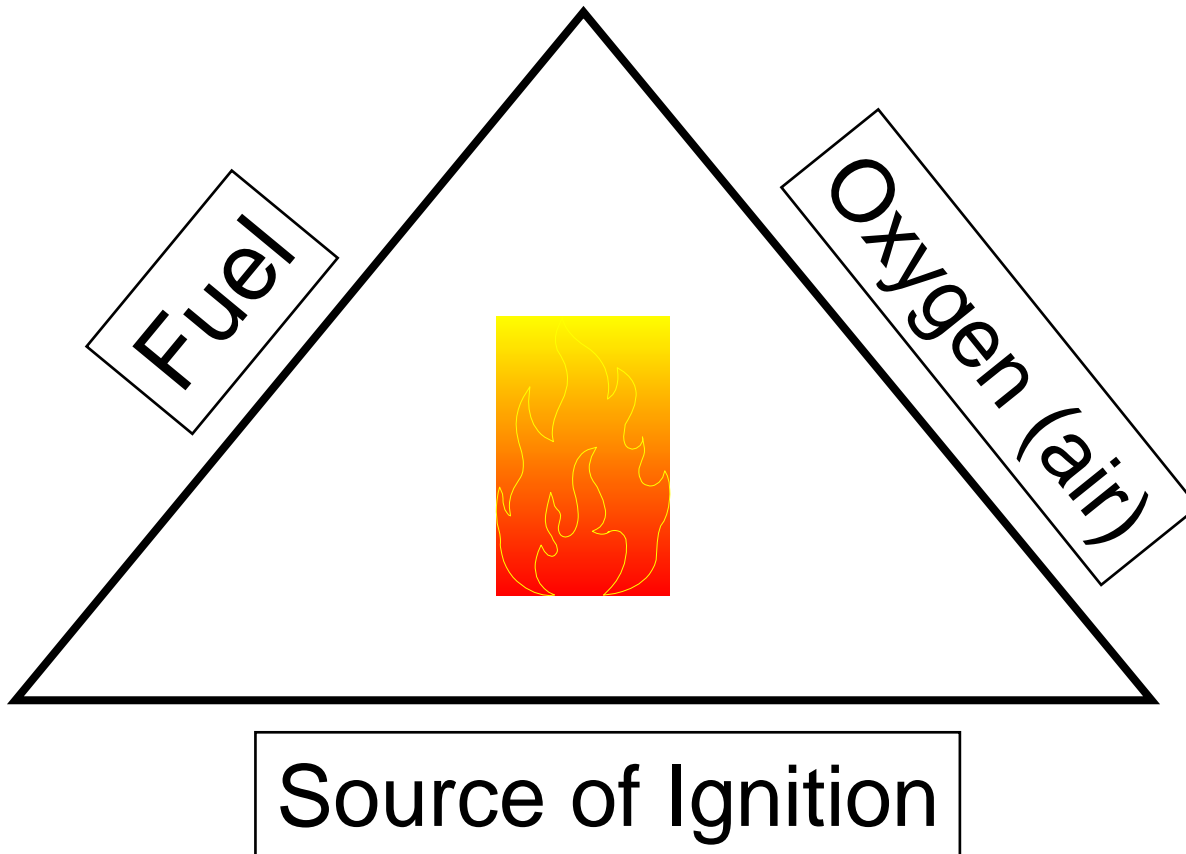
5) Both Propane and Butane Are Heavier Than Air

6) Odorless

- % Odorant such as ethyl mercaptan is added for detection
- % Learn to recognize

Fire Triangle

Need all three elements to start a fire:





Essential Equipment

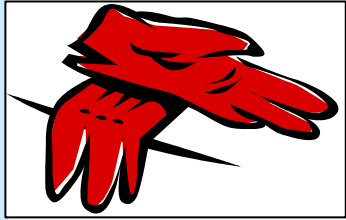
1) Fire Extinguisher

- % at least 1 for Class B (flammable liquids and vapors)
- % at least 1 for Class C (electrical)
- % capacity of approximately 20 lb dry chemical
- % should be the **FIRST THING YOU SET OUT**---Don't leave it hooked inside the prover!!!

2) First Aid Kit

- % appropriate for inspecting LPG meters
- % safety officer/local OSHA rep





Essential Equipment (cont.)

3) Protective Gloves with Gauntlets

% should be worn at all times

4) Protective Goggles

% especially important when working around LPG

5) Caution Signs

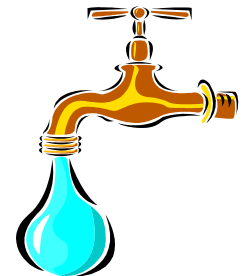
6) Safety Cones

7) Phone Numbers for Emergencies

% good idea to put on a card and keep in prover

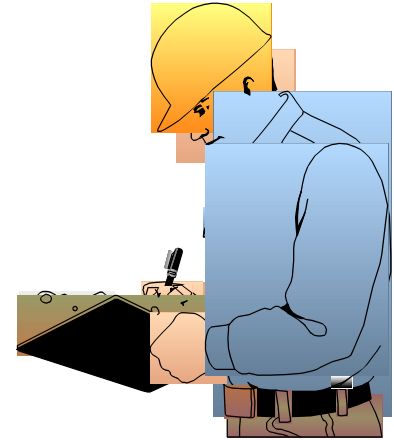
8) Continuous Supply of Water for Cooling Tank

% used to cool storage tank



*** Other Items Required by Jurisdiction/Co. ???***

Make Safety a Habit!!!



- % Observe safety rules at all times
 - % Includes use and maintenance of equipment
- % Understand operation and design of metering and testing equipment
- % Learn to always anticipate conditions
- % Use common sense & good judgement!!

Safety Musts



- 1) Follow Safety Notes in EPOs
- 2) No smoking within 100 feet
 - % If an employee refuses to cooperate, stop examination and contact owner
- 3) Look out for leaks & exposed/faulty wiring
 - % STOP EXAM until leaks are fixed
 - % STOP EXAM until dangerous conditions are corrected
- 5) Never leave equipment unattended



Safety Musts (cont.)



6) Eliminate all possible sources of electrical discharge

- % Includes clothing

- % Synthetic clothing causes static

- % Synthetic clothing melts at high temperatures; sticks to skin

- % Results in serious burns

- % Explosion-proof, non-sparking tools (incl. 2-way radios)

7) Chock or secure prover

- % Chock/secure trailer or vehicle to avoid rolling/shifting

- % Check again after prover is full of product

8) Ground prover

- % Do **NOT** Cut Off Ground Prong of Electrical Wire!

Safety Musts (cont.)

9) Be sure all connections are tight BEFORE starting test

10) Never disconnect lines without bleeding vapor or liquid between connections

% Always bleed off slowly

% Don't get in a hurry!

11) If any practice conducted by your jurisdiction is questionable, Contact Your Supervisor Immediately!!

% Express your concerns

** Other procedures Followed/Required by Your Jurisdiction **