

Code-Compliant Maintenance Facility Modification Training

Propane

Pittsburgh, PA

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Introductions: Clean Cities

- The U.S. Department of Energy's (DOE's) Clean Cities program advances the nation's economic, environmental, and energy security by supporting local actions to cut petroleum use in transportation.
 - Clean Cities has saved more than 8.5 billion gallons of petroleum since its inception in 1993.
 - 100 local coalitions serve as the foundation of the Clean Cities program.
- This series of workshops was supported by a competitively awarded, cost-shared agreement from the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE), under Award Number DE-EE0007815.

Introductions: Gas Technology Institute

Independent, not-for-profit established to tackle tough energy challenges, turning raw technology into practical solutions.



- Idea
- Market Analysis
- Technology Analysis
- Product Development
- Lab and Field Testing
- Demonstration
- Commercialization



Introductions: Superior Energy

- Superior Energy Systems has engineered, manufactured and installed propane infrastructure since 1975. Superior offers the engineering expertise, services and support to meet the needs of any application.
- Superior builds made-to-order propane vaporizers and mixers, portable and permanent rail towers, metering and odorant skids, propane autogas dispensers and complete dispensing stations.
- Superior also develops and safety programs and instruction to ensure regulatory compliance and train personnel on all aspects of working with and handling propane.



Background

- Propane is similar to gasoline or diesel so garages compliant with applicable codes could be compliant with propane requirements as well.
 - Not all existing gasoline or diesel garages will be compliant.
- Propane has a density greater than air **UNLIKE** gasoline or diesel vapors.
 - High density means propane will collect near the floor.

Properties

- Propane is a flammable but only within a narrow range of air to propane mixtures.
- If present in amounts between 2.15%-9.6% by volume and in contact with an ignition source it may ignite.
- Propane is more dense than air and will therefore remain at or near floor level.

Properties

Compound	Formula	Density (lb/ft ³)	Auto-Ignition Temperature (°F)	Lower Flammability Limit (LFL) %	Upper Flammability Limit (UFL) %
CNG (Methane)	CH ₄ (majority)	0.0447	1,004	5.3	15.0
Propane	C₃H₈	0.1175	850-950	2.15	9.6
Gasoline	C ₈ H ₁₈	0.287	495	1.4	7.6
Diesel	-	>0.3825	600	1.0	6.0
Hydrogen	H ₂	0.0056	1,050-1,080	4.1	74.00
Air	-	0.0806	-	-	-

Propane versus Other Alternative Fuels

- The garage modifications for propane code compliance are different than those for other fuels such as natural gas and hydrogen.
- Propane is often experienced as a vapor, but because it tends to fall, safety codes treat it similar to gasoline and diesel.
- The similarity to gasoline and diesel means a garage modifications will typically be minimal.

This does not mean that modifications to equipment or procedures can be ignored.



Risk Mitigation

The risks of propane can be mitigated by taking the proper engineering and administrative safety steps.

- **Preventing leaks from occurring** is a primary goal.
- **Diluting flammable mixtures** decreases risk of ignition in the event of a leak.
- **Eliminating ignition sources** is second line of defense.

Applicable Codes

- NFPA 58: Liquefied Petroleum Gas Code
- NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages
- International Fire Code



Photo courtesy of National Fire Protection Association, NFPA.com

Local Requirements

- Many states and local authorities have their own requirements.
- The local authority having jurisdiction (AHJ/LHJ) will make the final determination of which codes and requirements are applicable in each case.

Major and Minor Garages

- It is essential to determine what areas of a maintenance facility are considered major and minor, as they will have different requirements.
- A major repair garage is defined as:

A building or portions of a building where major repairs, such as engine overhauls, painting, body and fender work, and repairs that require draining of the motor vehicle fuel tank, are performed on motor vehicles, including associated floor space used for offices, parking, or showrooms.

Major and Minor Garages

- A minor repair garage is defined as:

A building or portions of a building used for lubrication, inspection, and minor automotive maintenance work, such as engine tune-ups, replacement of parts, fluid changes (e.g., oil, antifreeze, transmission fluid, brake fluid, air conditioning refrigerants, etc.), brake system repairs, tire rotation, and similar routine maintenance work, including associated floor space used for offices, parking, or showrooms.

Major and Minor Garages



Sprinkler Systems

- Fixed fire protection is required in maintenance facilities.
- Installation guidelines are stated in section 7.4.6 of NFPA 13: Standards for installation of sprinkler systems.

Electrical Classification

- Best Practice: Install electrical seal-offs between division/classification areas.
 - Class I, Division 1: areas in which classified hazards are likely to exist
 - Class I, Division 2: spaces made hazardous by the occasional presence of flammable gases or vapors in quantities that could be ignitable



Electrical Classification

- In major repair garages, any space within an unventilated pit or subfloor work area is Class I, Division 1, and electrical appliances within these areas need to be rated as such.
- In minor repair garages, unventilated pits and below-grade areas are Class 1, Division 2 areas.



Photo courtesy of Hartex Engineering,
hartexengineering.com.au

Electrical Classification

- Class 1 division 2 areas must have explosion proof electrical wiring, conduits, junction boxes, and electrical appliances
- NFPA 30A states that low-voltage wiring and conduits may be exempt from Class I, Division 2 requirements.



Photo courtesy of Hartex Engineering,
hartexengineering.com.au

Heat Producing Appliances

- Hot surfaces may ignite mixtures of flammable gas, so certain types of heating appliances are not permitted:
 - Solid Fuel Stoves
 - Salamanders
 - Space Heaters
 - Improvised Furnaces

Best Practice: Sparking Equipment

- Equipment that could produce a spark should be located in areas where propane gas is unlikely to be present.



Best Practices - Ventilation

- Proper ventilation systems can help avoid electrical classification modifications
 - In rare cases, adequate ventilation rates may prevent the need for Class I Division 2 equipment in electrically classified areas.
- Garages up to code for gasoline or diesel should be up to code for propane.
- Ventilation intake must be within 12” of the floor.

Best Practices - Draining the Fuel Tank

Before draining the fuel tank for the first time, **contact your fuel provider.** They will help to ensure that the defueling procedure is performed in a safe environment and with proper protective equipment.

The following slides describe the procedure your fuel provider may recommend, and the descriptions *are not instructions*.

Purging and Evacuation

- **Evacuation** – Removes propane from the tank
 - Should be done outside or in well ventilated areas
 - Should be done away from pits, ditches, drains, or other low-lying areas
- **Purging** – Removes air and water vapor from the tank prior to filling with propane

Propane Evacuation Methods

- **Venting:** Vent propane into atmosphere through a vent stack
- **Flaring:** Vent using a stack burner instead of going to the atmosphere
- **Reclaiming:** Pump from one fuel tank to another storage tank

Tank Purge Methods

- **Vacuum** – Use a vacuum pump to create a vacuum in the tank.
- **Vapor** – Vent contents of the tank to the atmosphere by feeding propane vapor from a fuel source into the tank.

Best Practice: Pit Safety

- Pits are of extra concern: Both liquid and gas propane will migrate into the pit due to gravity.
- If unventilated, the pit must have Class 1, Div. 1 rated electrical equipment.
- If ventilated, electrical equipment can be Class 2, Div. 2.
- Ventilation should extract air from the pit at it's lowest point, and bring in fresh air from outside of the pit.



Photos courtesy of Hartex Engineering, hartexengineering.com.au



Appendix: Additional Codes

- International Building Code
- International Electrical Code
- International Mechanical Code
- National Building Code
- National Electrical Code NFPA 70
- National Fire Code NFPA 1
- National Mechanical Code
- NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages
- NFPA 58: Liquefied petroleum gas code

Disclaimer

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