Kurdistan Engineers Union

Subject :Research In Mechanical Engineering at LPG Applications

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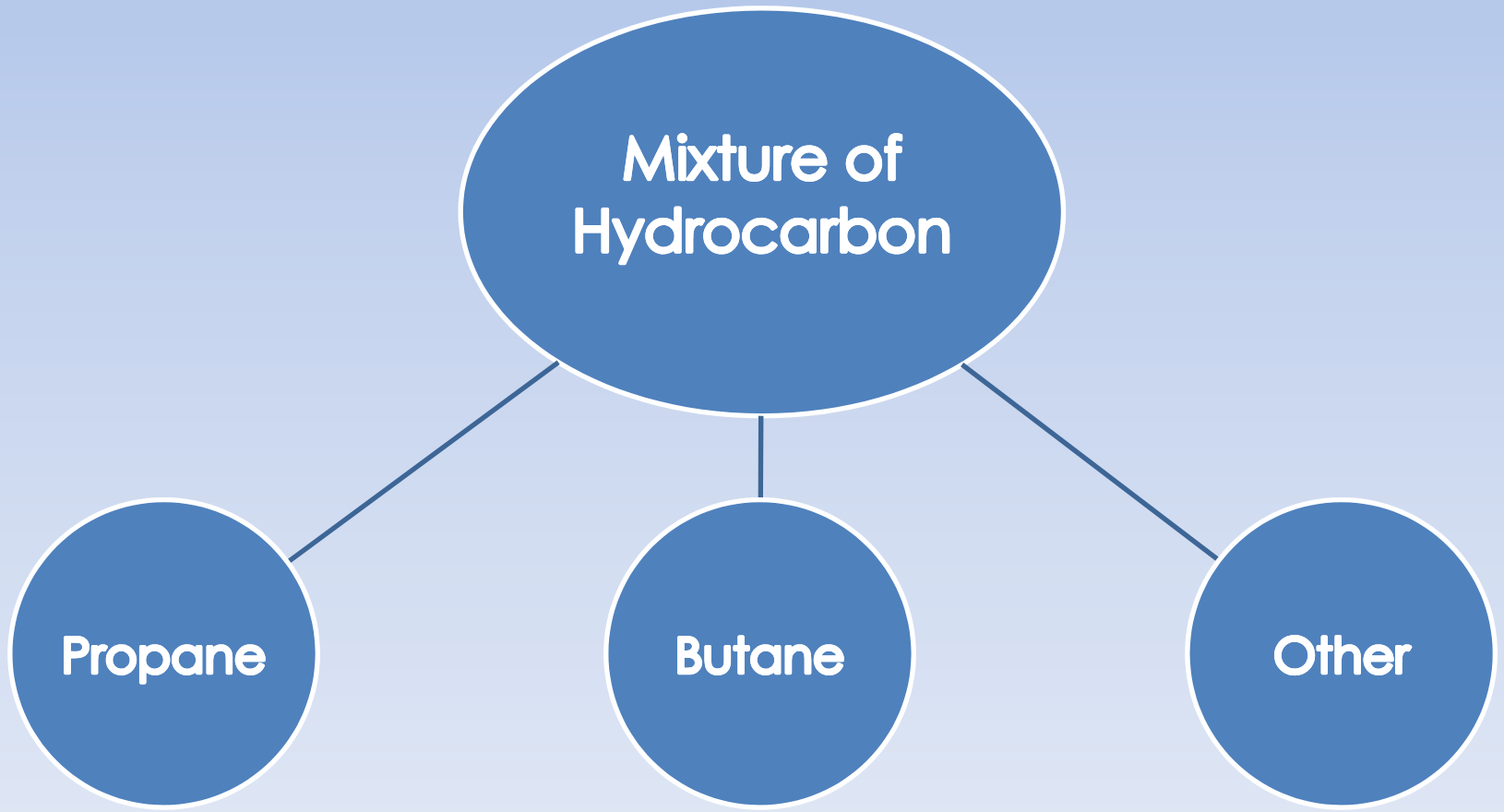
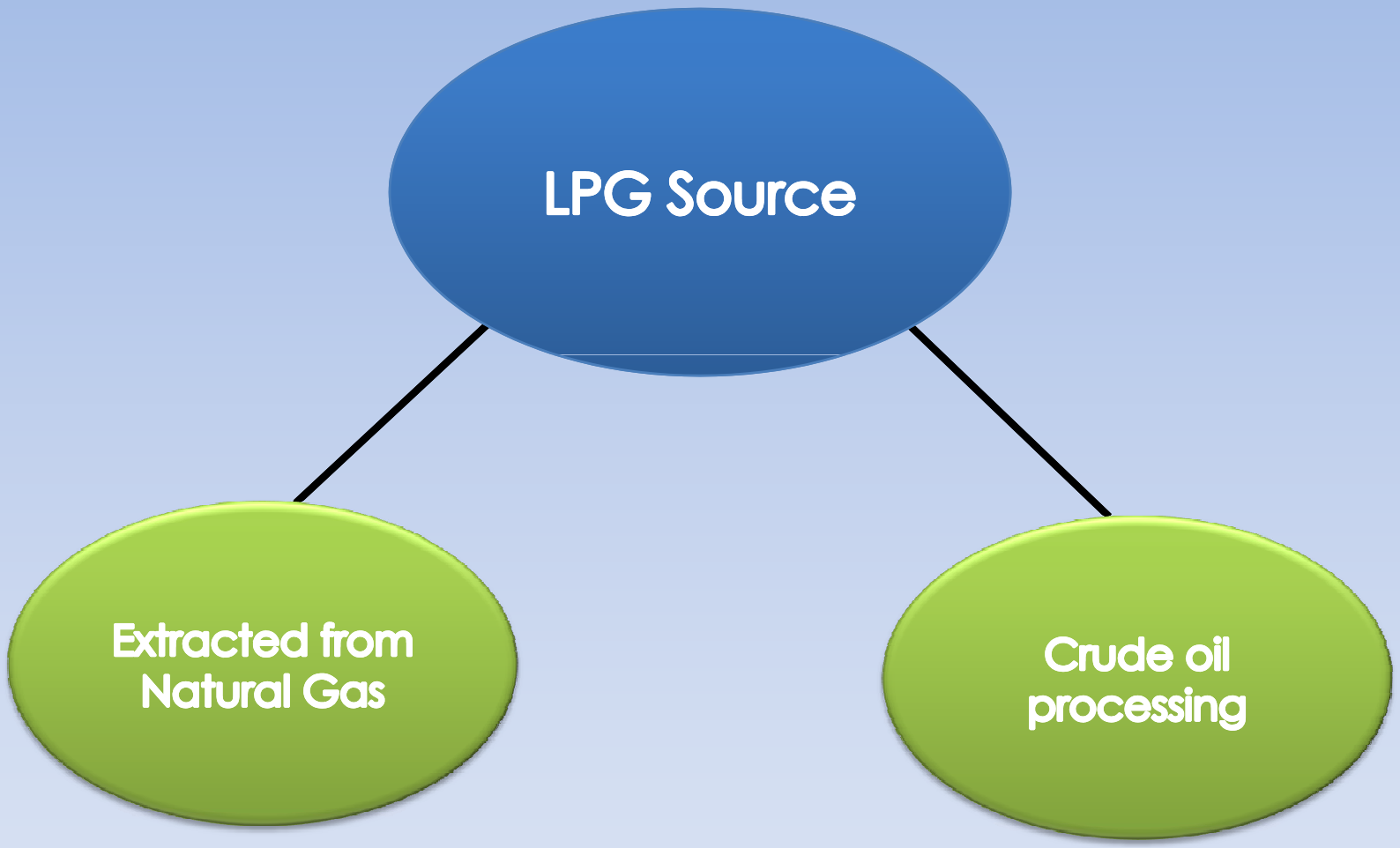
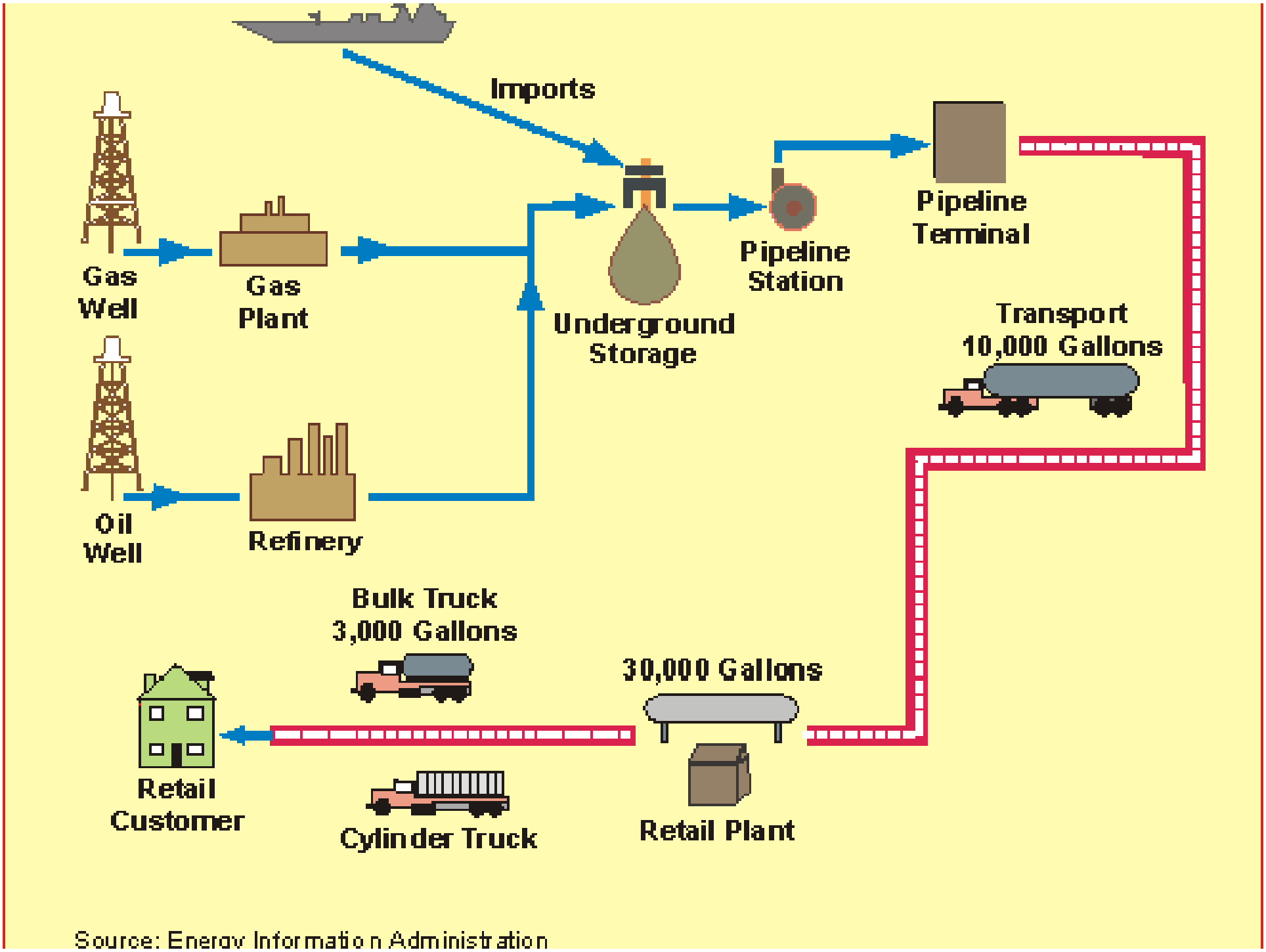
DATE :12-6-2012

WHAT IS LPG?
LIQUEFIED PETROLEUM GAS (LPG)

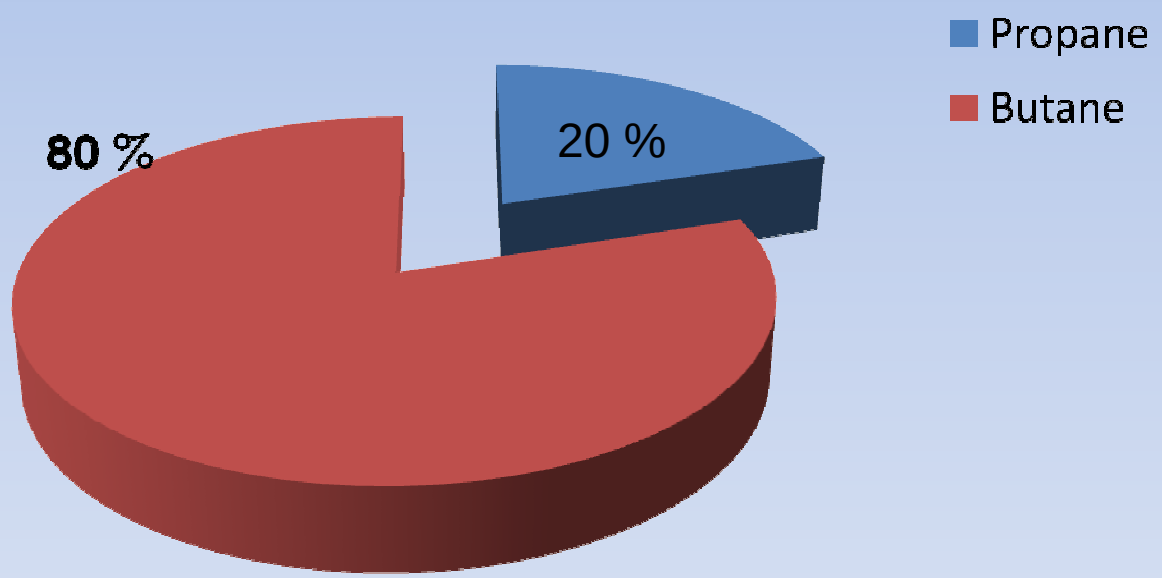



LPG Source
Extracted from Natural Gas
Crude oil processing



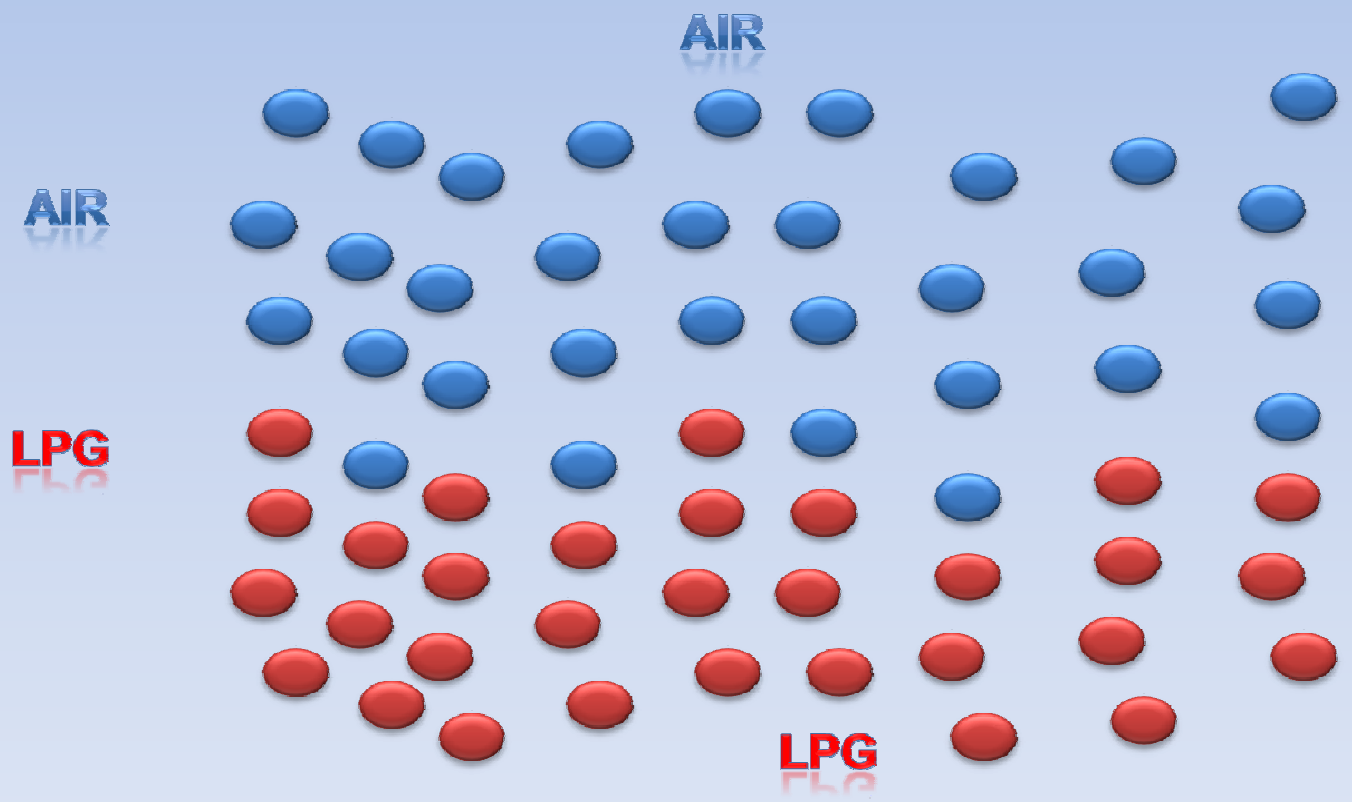
Source: Energy Information Administration

LPG



LPG PROPERTIES

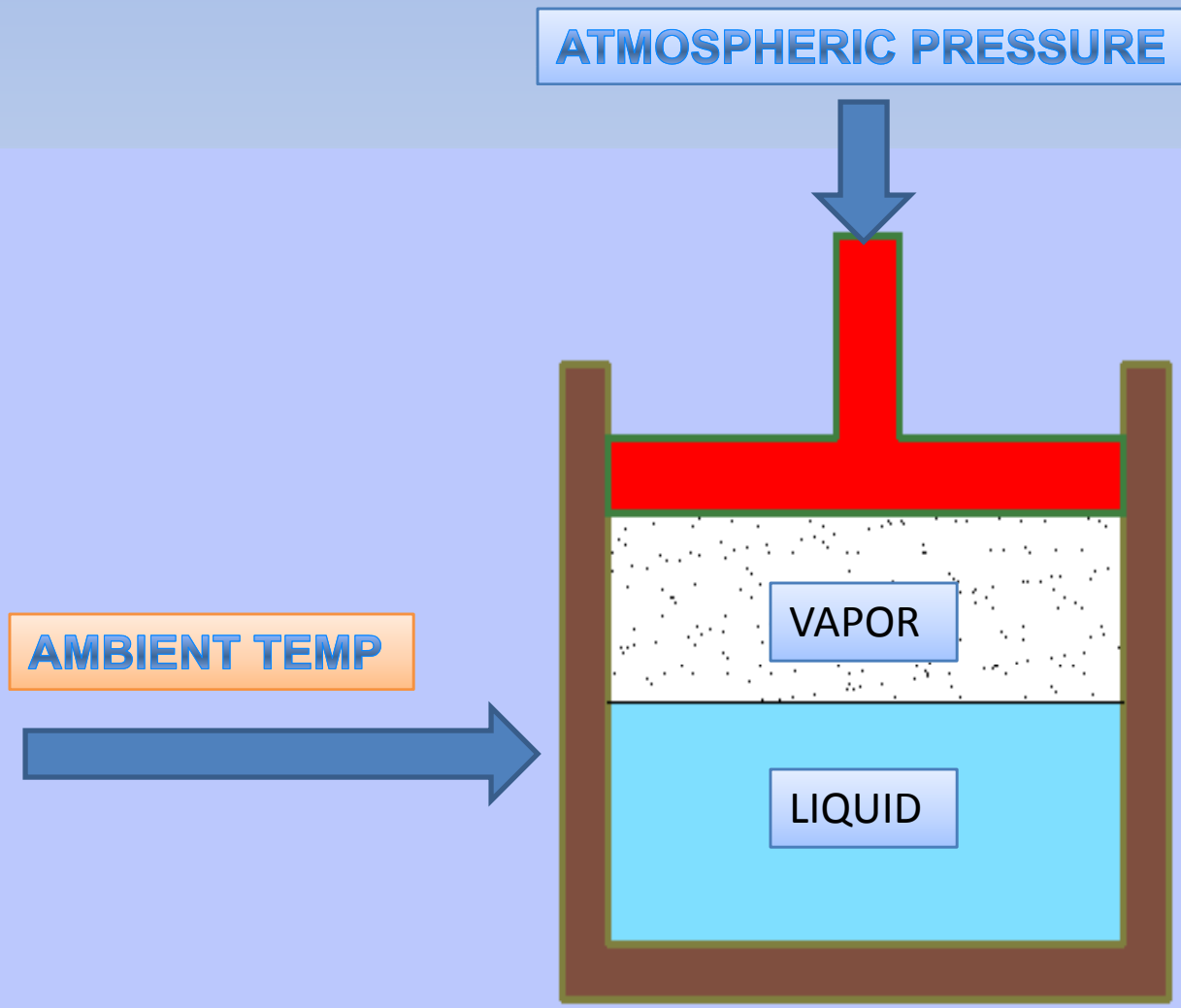
HEAVIER THAN AIR



BOILING POINT

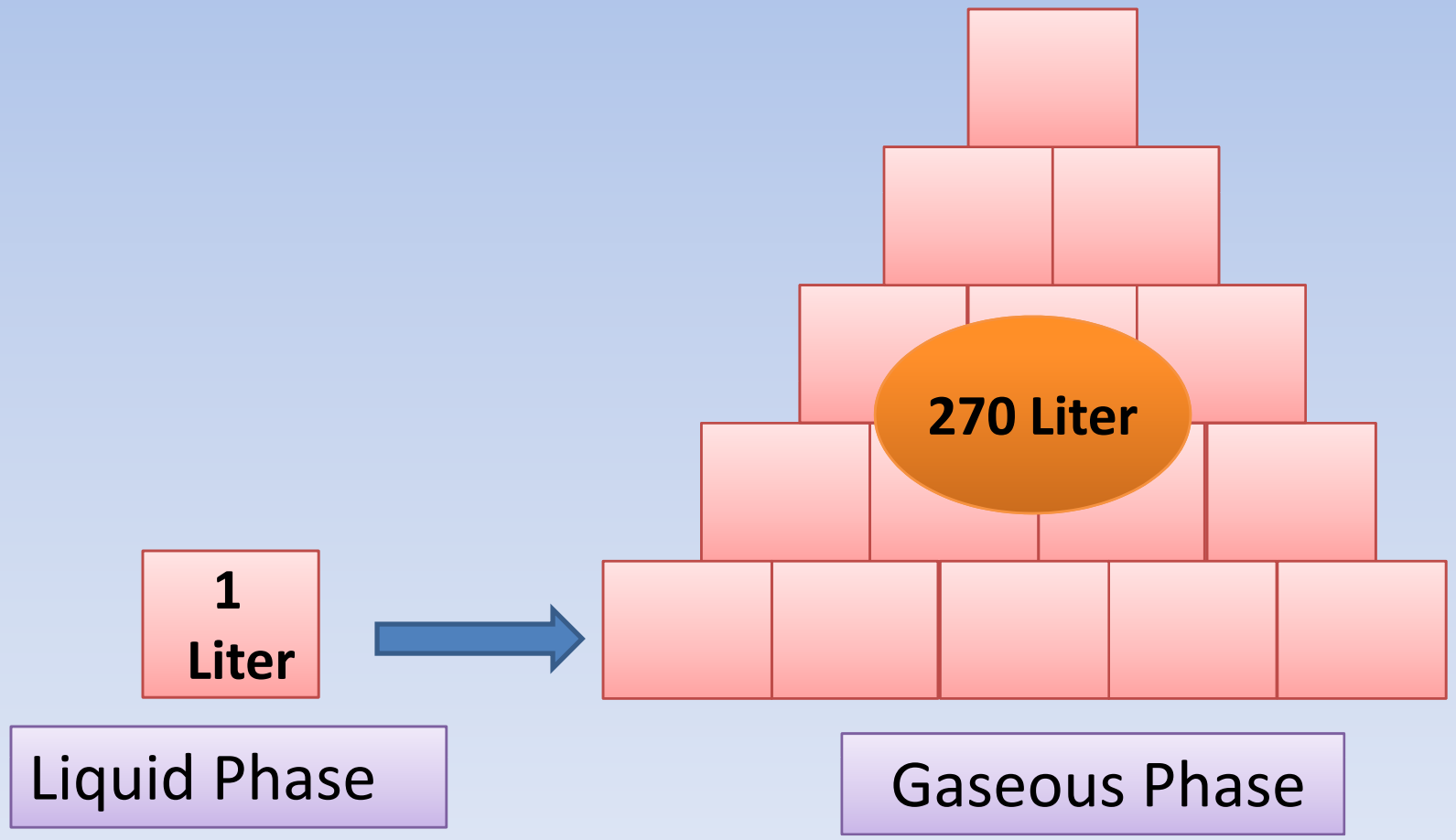
- Propane -40˚
- Butane -1˚

LIQUEFIED IN ORDINARY TEMPERATURE AND MODERATE PRESSURE



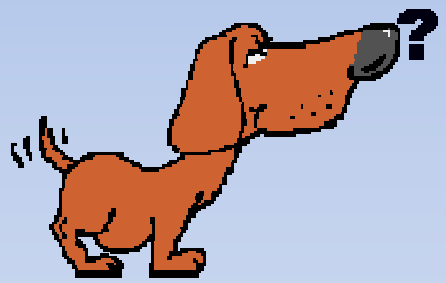
TEMPERATURE		TABLE 2 APPROXIMATE VAPOR PRESSURE, PSIG PROPANE → TO → BUTANE						
°F	°C	100%	80/20	60/40	50/50	40/60	20/80	100%
-40	-40	3.6	—	—	—	—	—	—
-30	-34.4	8	4.5	—	—	—	—	—
-20	-28.9	13.5	9.2	4.9	1.9	—	—	—
-10	-23.3	20	16	9	6	3.5	—	—
0	-17.8	28	22	15	11	7.3	—	—
10	-12.2	37	29	20	17	13	3.4	—
20	-6.7	47	36	28	23	18	7.4	—
30	-1.1	58	45	35	29	24	13	—
40	4.4	72	58	44	37	32	18	3
50	10	86	69	53	46	40	24	6.9
60	15.6	102	80	65	56	49	30	12
70	21.1	127	95	78	68	59	38	17
80	26.7	140	125	90	80	70	46	23
90	32.2	165	140	112	95	82	56	29
100	37.8	196	168	137	123	100	69	36
110	43.3	220	185	165	148	130	80	45

LPG RELEASE EXPANSION



HOW IS LPG SEEN & FELT

- Odorless



- Ethyl Mercaptan

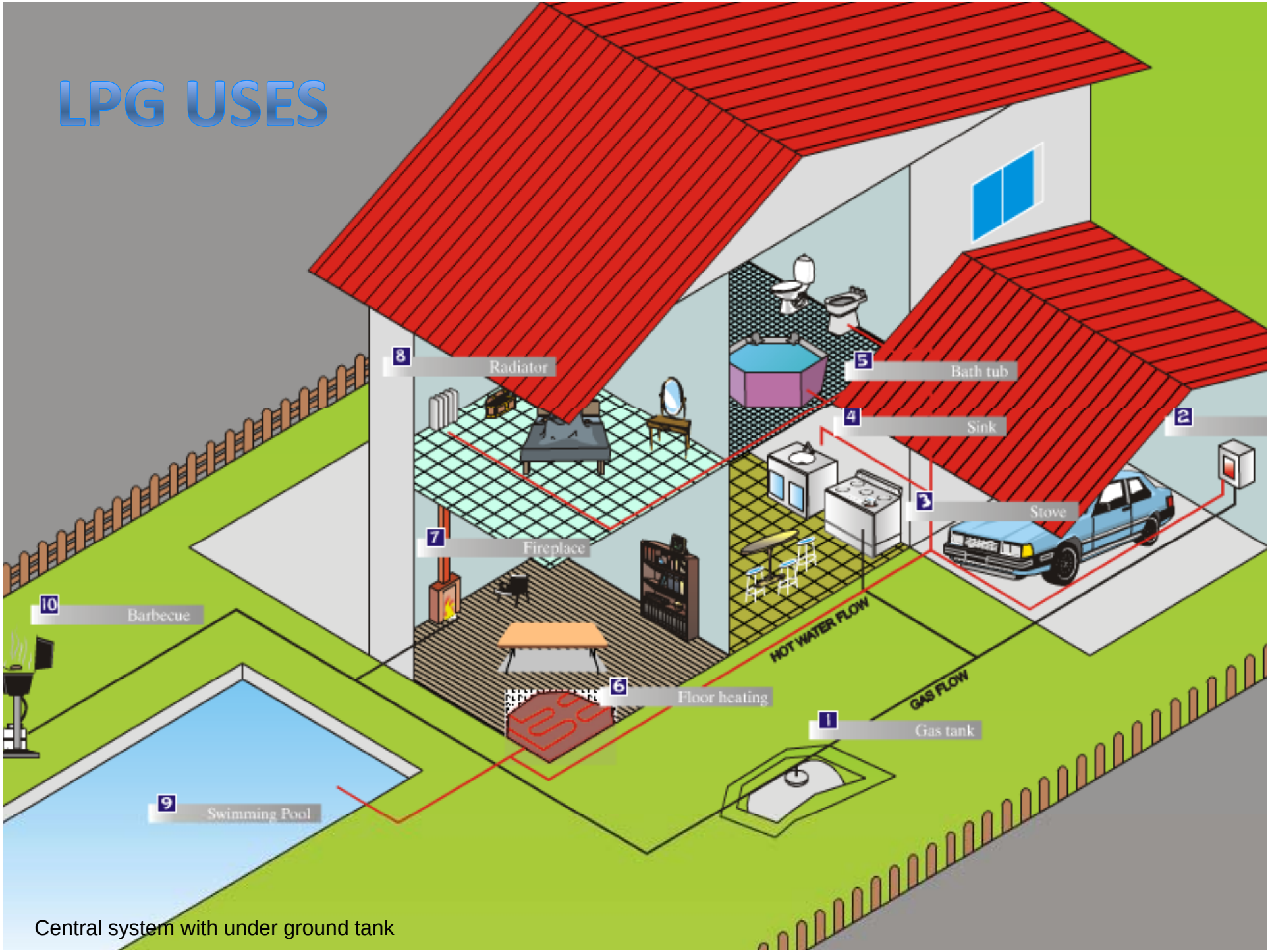
HEATING VALUE

1 KG

LPG

13.7KW

LPG USES

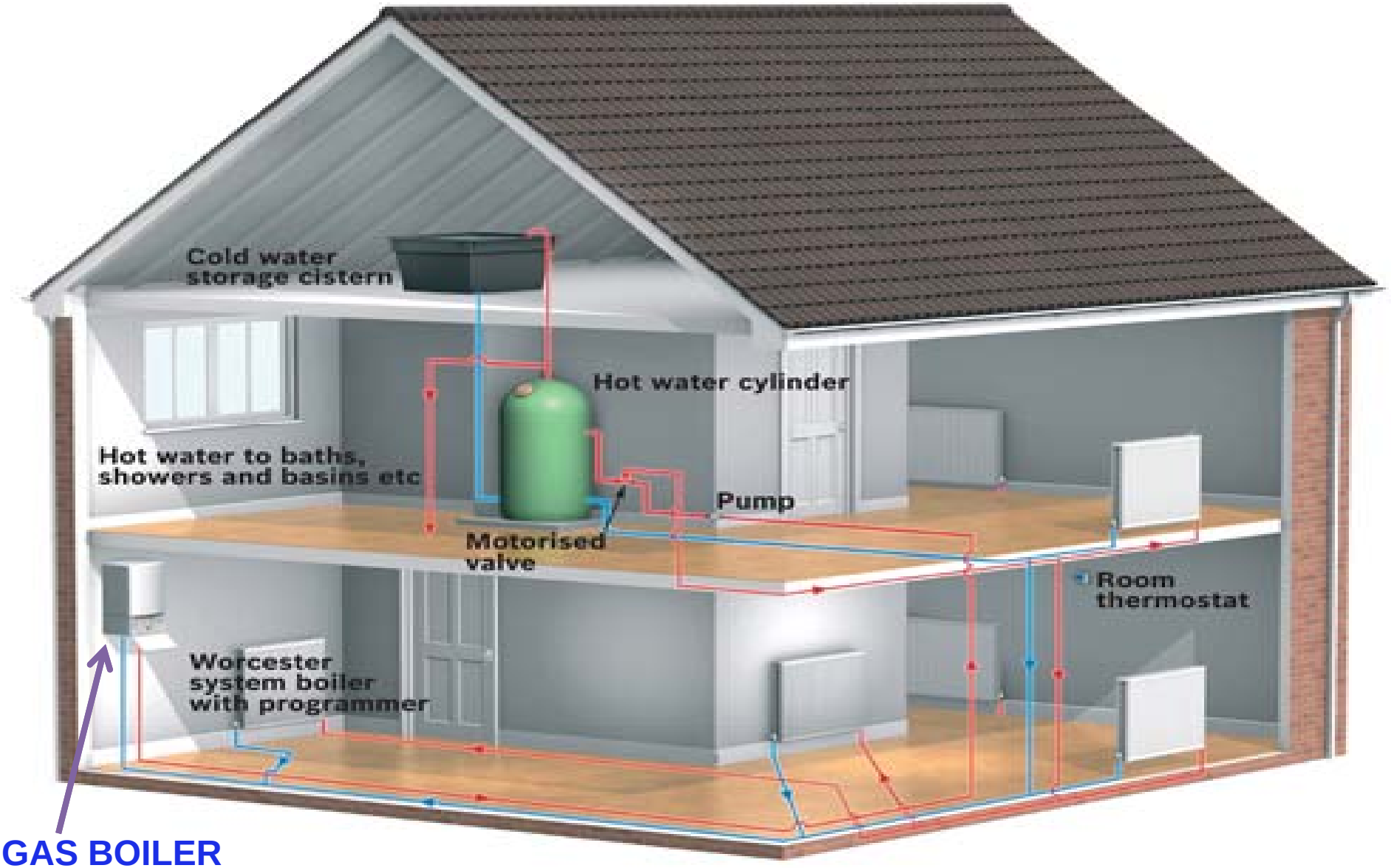


Central system with under ground tank

LPG USES
COOKING

LPG USES

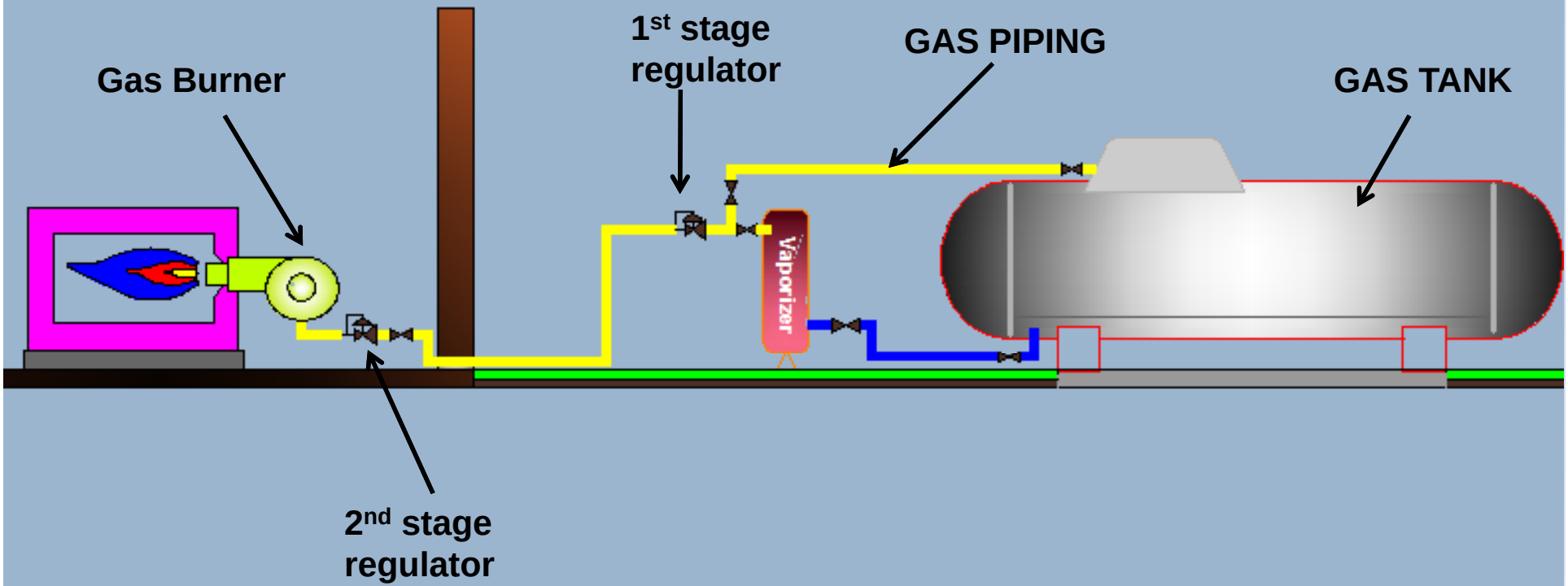
HEATING



LPG USES

INDUSTRY

LPG SYSTEM COMPONENTS



LPG SYSTEM COMPONENTS

- ABOVE GROUND TANK

LPG SYSTEM COMPONENTS

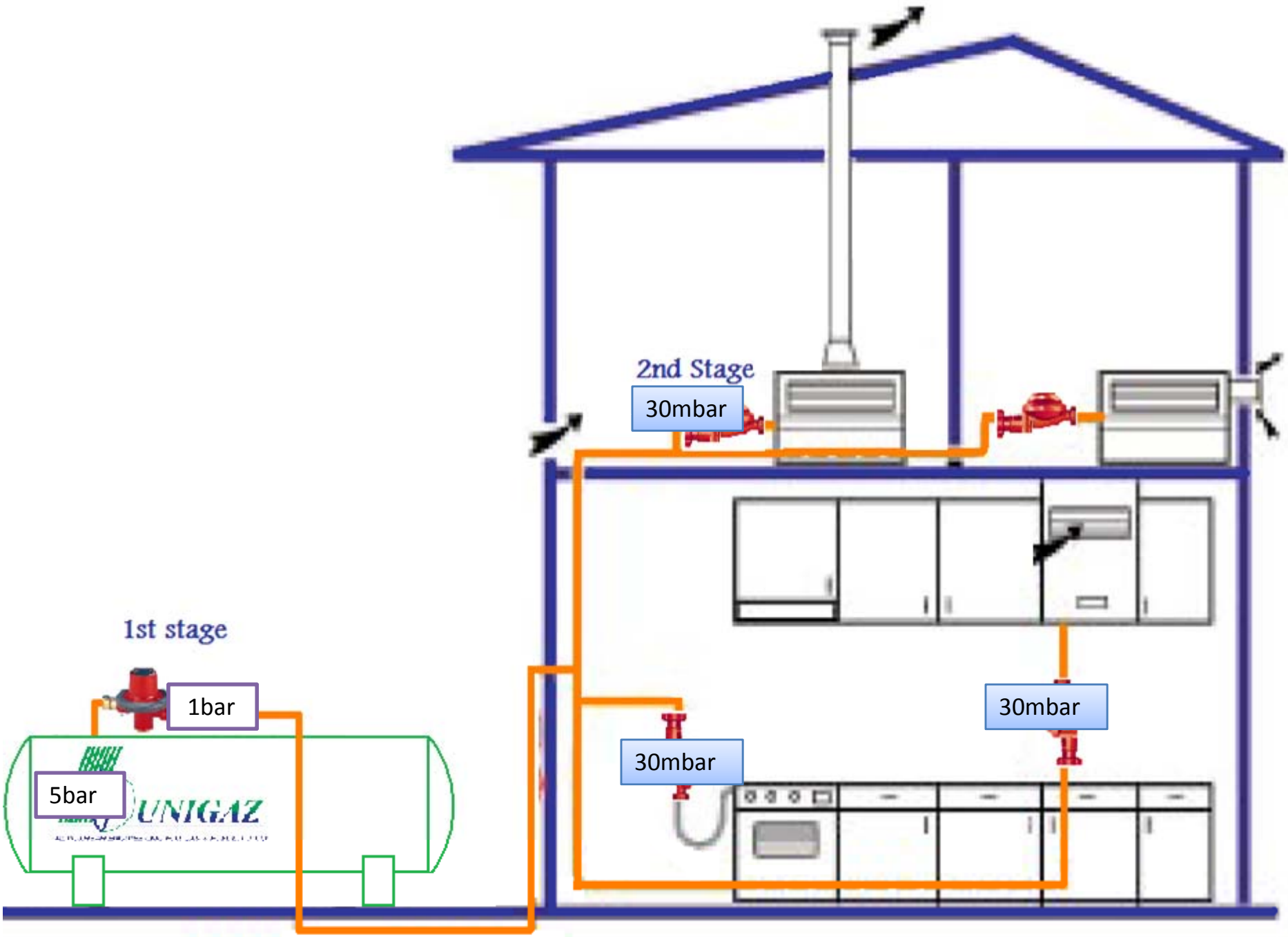
- UNDER GROUND TANK

LPG SYSTEM COMPONENTS

PRESSURE REGULATORS

- **Regulator, First-Stage.** A pressure regulator for LP-Gas vapor service designed to reduce pressure from the container to 1.5 bar or less.

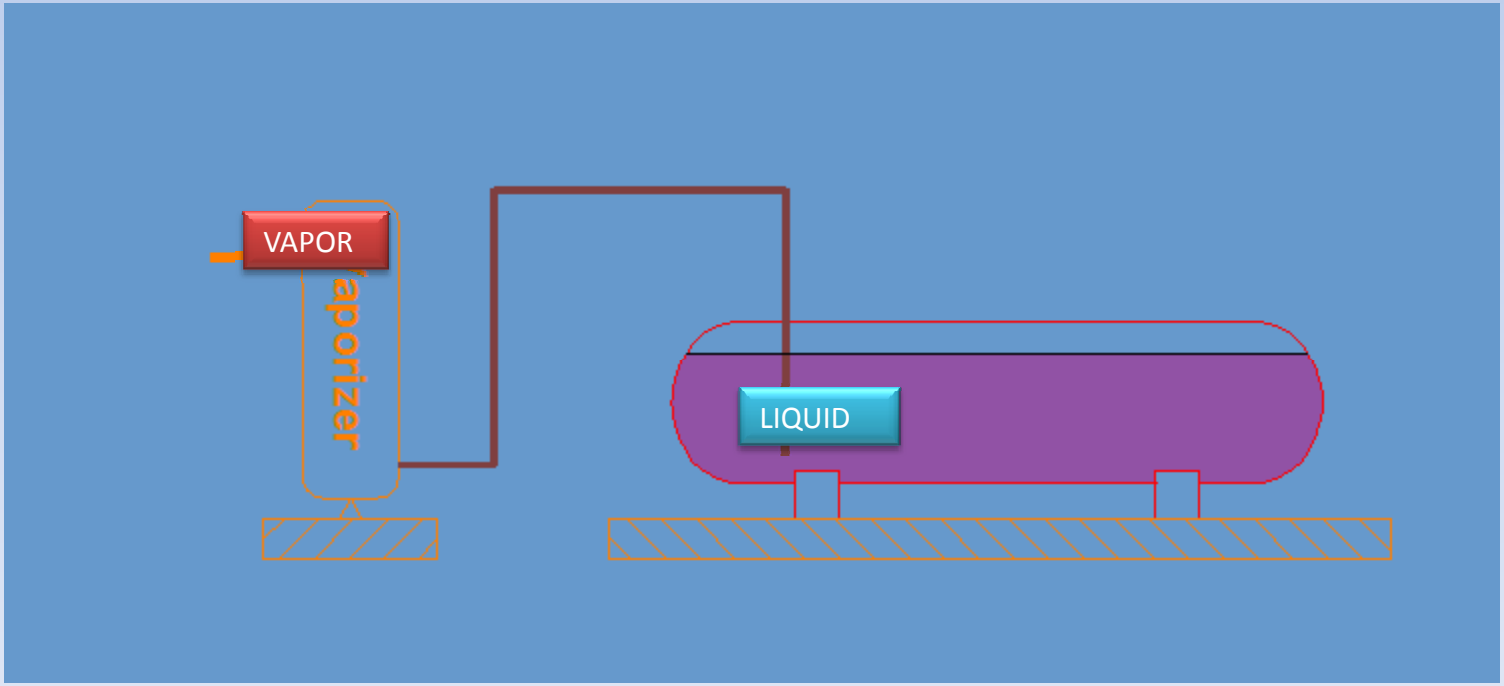
- **Regulator, Second-Stage.** A pressure regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to be suitable for appliances (commonly 37mbar)


2nd Stage
30mbar
1st stage
1bar
5bar
UNIGAZ
30mbar
30mbar

LPG SYSTEM COMPONENTS

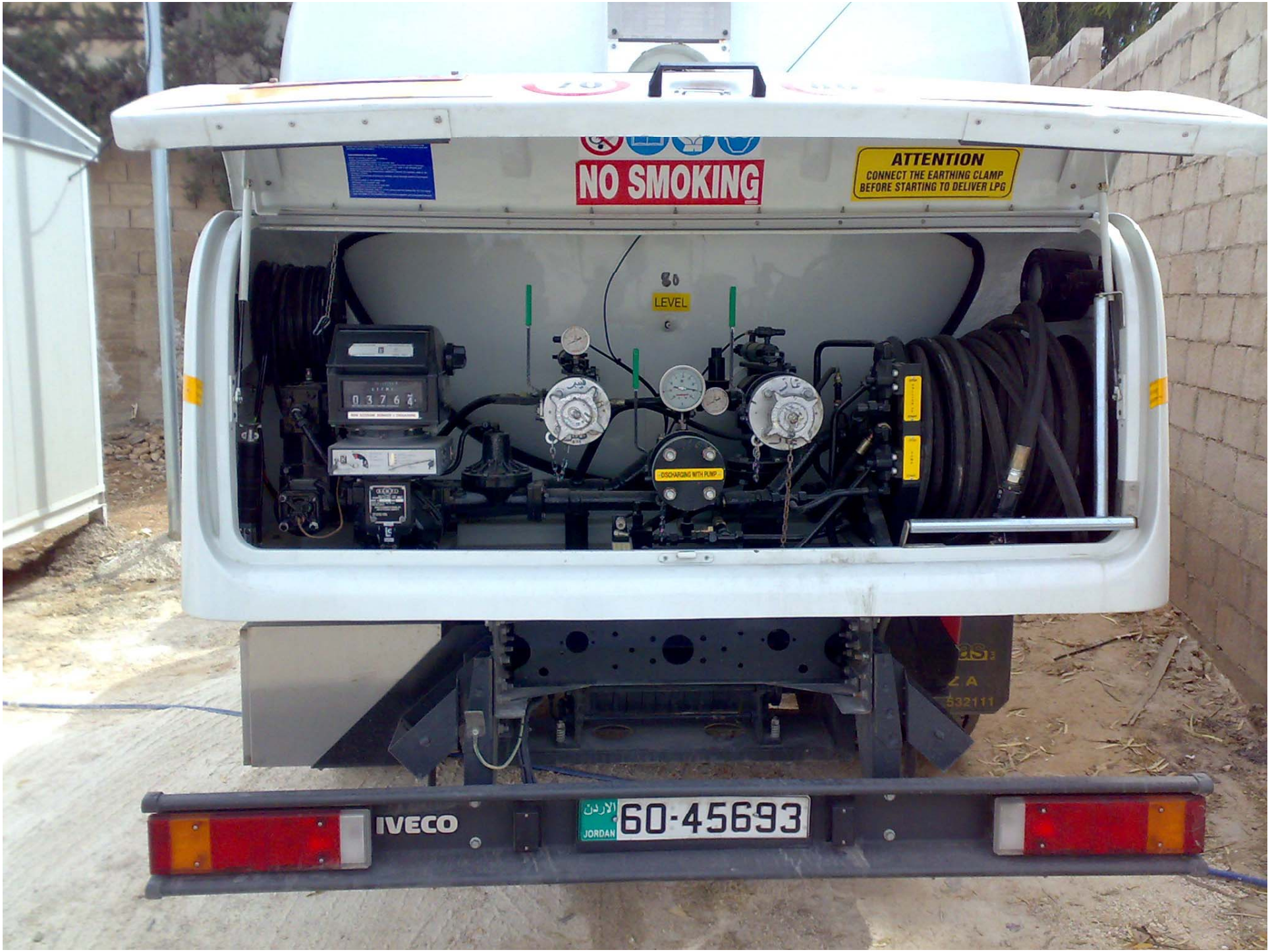
VAPORIZER

- **Vaporizer.** A device, other than a container, that receives LP-Gas in liquid form and adds sufficient heat to convert the liquid to a gaseous state.



GAS DISTRIBUTION SYSTEM
HOW IT IS WORK

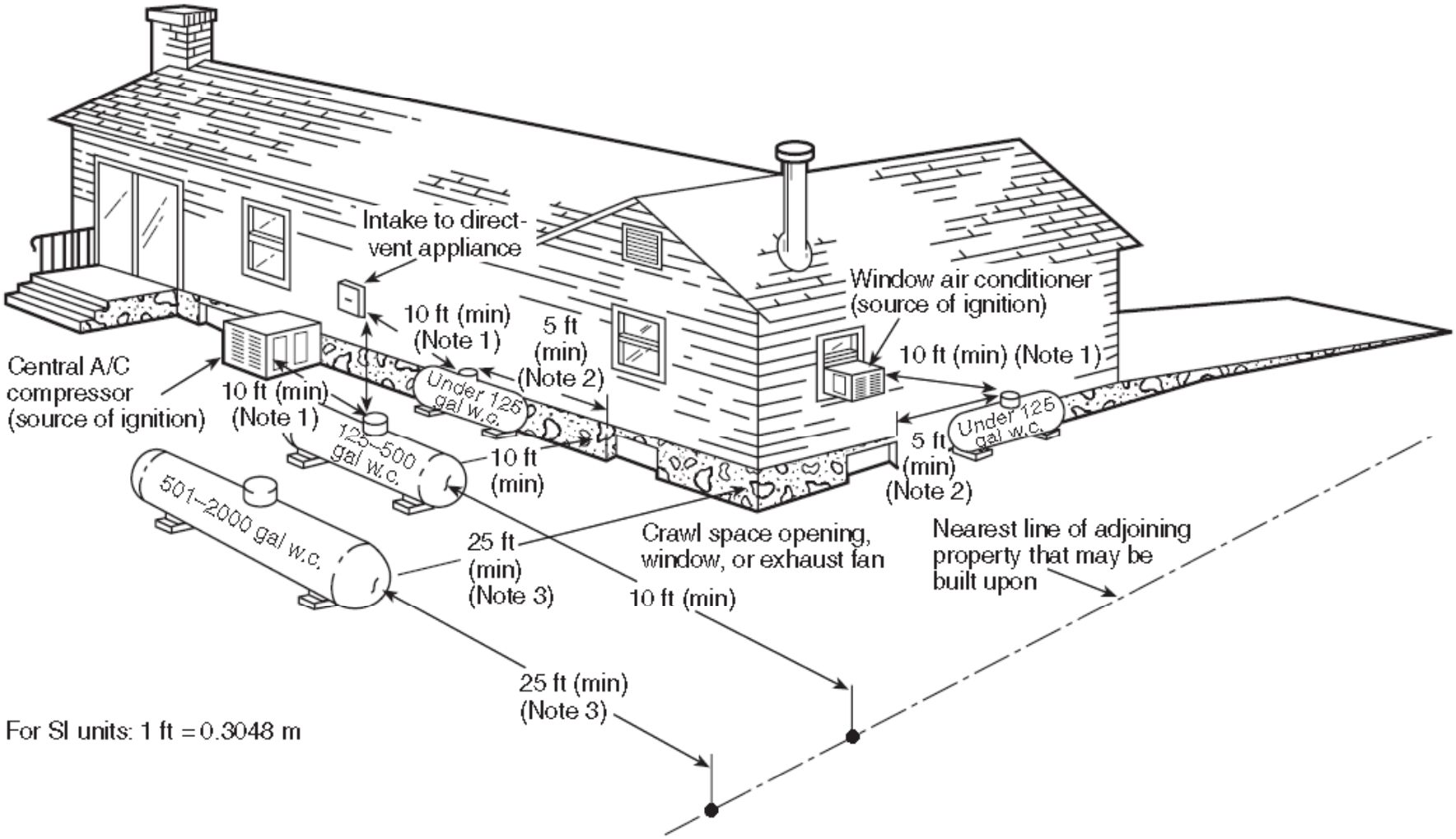
Bobtail


NO SMOKING
ATTENTION
CONNECT THE EARTHING CLAMP
BEFORE STARTING TO DELIVER LPG
LEVEL
DISCHARGING WITH PUMP
IVECO
الاردن
JORDAN
60-45693

REQUIRED SPACING FOR LPG TANK FROM IMPORTANT BUILDING

ABOVE GROUND LPG TANK

FIGURE I.1(b) Aboveground ASME containers. *(This figure for illustrative purposes only; code shall govern.)*



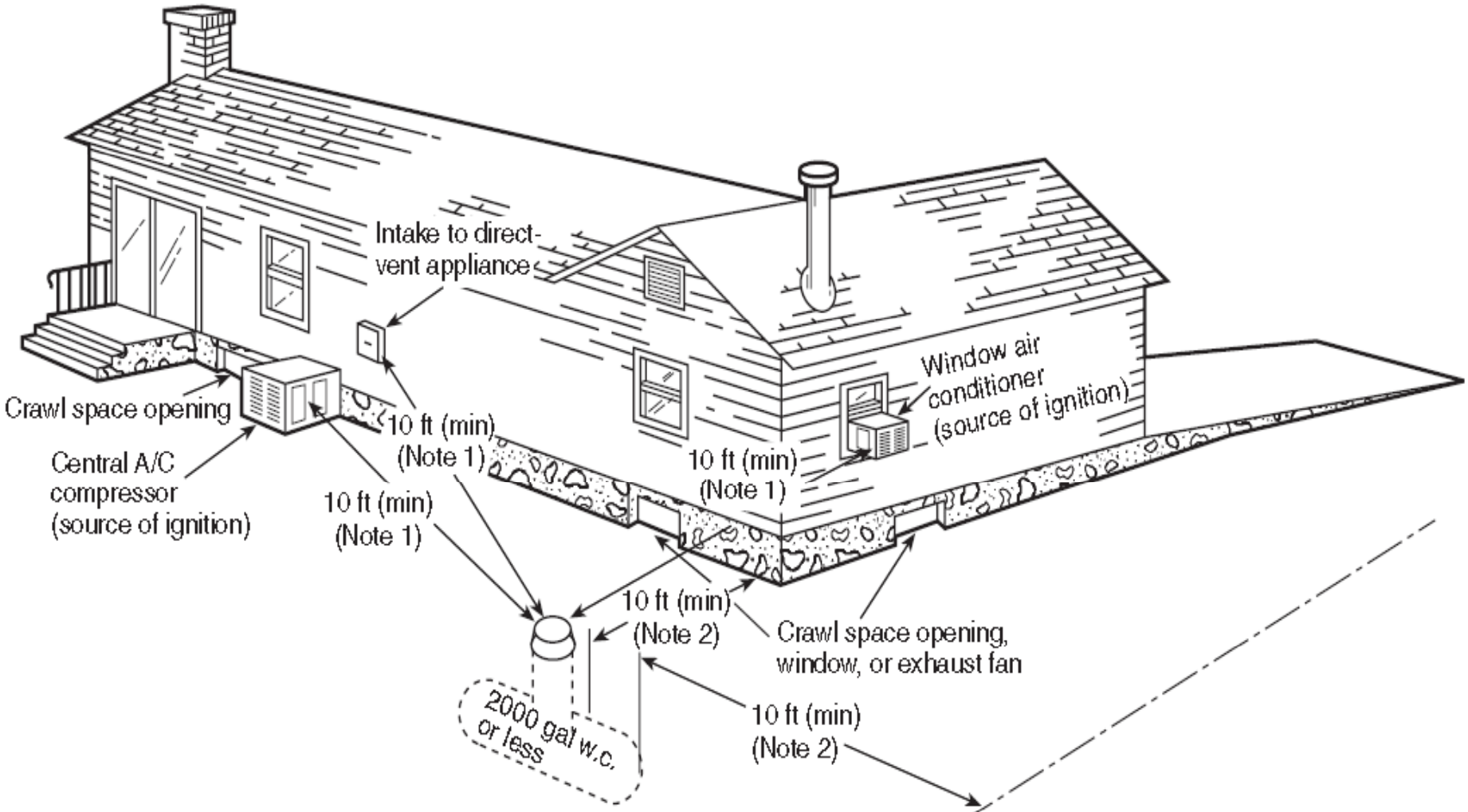
Note 1: Regardless of its size, any ASME container filled on site must be located so that the filling connection and fixed maximum liquid level gauge are at least 10 ft from any external source of ignition (e.g., open flame, window A/C, compressor), intake to direct-vented gas appliance, or intake to a mechanical ventilation system.
Refer to 3.2.2.2(d).

Note 2: Refer to 3.2.2.2(c)

Note 3: This distance may be reduced to no less than 10 ft for a single container of 1200 gal (4.5 m^3) water capacity or less, provided such container is at least 25 ft from any other LP-Gas container of more than 125 gal (0.5 m^3) water capacity. Refer to 3.2.2.2(e).

REQUIRED SPACING FOR LPG TANK FROM IMPORTANT BUILDING

UNDER GROUND LPG TANK



Note 1: The relief valve, filling connection, and liquid fixed maximum level gauge vent connection at the container must be at least 10 ft from any exterior source of ignition, openings into direct-vent appliances, or mechanical ventilation air intakes. Refer to 3.2.2.2(f).

Note 2: No part of an underground container shall be less than 10 ft from an important building or line of adjoining property that may be built upon. Refer to 3.2.2.2(f).

For SI units: 1 ft = 0.3048 m

LPG system include the following :-

- Storage tanks .
- Pressure regulators
- Shut off valves
- LPG piping from gas tanks to apartments
- Safety system.
- Gas metering system
- LPG filling pump system

Storage tanks

- The tanks capacity has to be sized with adequate volume .
- The tanks manufactured according to European Norms
- The storage capacity Enough to supply LPG for a period not less than 2 months.
- The location of tanks is outside building , 3 meters from building wall (that’s according To NFPA58)

Pressure regulators

- There are two types of pressure regulators

1) First stage: reduce the pressure from gas tank pressure to 0.5 bar , that is increase the safety and reduce the ability of condensation the gas inside pipe.
2) Second stage regulator; reduce the LPG network pressure from .5 bar to the operating pressure of cooking equipments which is about 30 mbar.

LPG piping from gas tanks to apartments

- The piping between gas tanks ,vaporizer and filling station are seamless carbon steel pipe sch. 80. that’s according to NFPA58, NFPA54
- The piping from vaporizer to and inside the building are seamless carbon steel pipe sch. 40. that’s according to NFPA58, NFPA54.
- shut off ball valves has to be installed at gas tanks area , building piping entrance, main valve for each floor, and at the appliances connection points.

Safety system

- Mechanical safety equipments:

1) Excess flow valves: shut off the gas flow in case the gas pipe were broken between gas tanks and vaporizer.
2) Seismic valve; shut off gas flow in case of earthquake.
3) Pressure relief valve; its to protect gas tanks and piping form any increase in the pressure, since it relief the pressure if it exceed 17bar.

Safety system

- Electrical safety equipments

Which is a gas leak detection system, this system include the following;

1) Gas leak detector; it detect any leak of LPG, the location of detectors as following

A) Gas tanks area

B) LPG shaft :minimum a three gas detectors in the shaft, one at the bottom of the shaft (basement one floor), the second at level 12, and the third 24, the propose of installing more than one gas detector in the shaft is to facilitate finding the location of leak inside shaft,

C) Gas meter cabinet;

D) Near the gas cooking appliances.

Note: the gas detectors also connectable to Fire alarm panel

Safety system

2) Emergency shut off valves (solenoid valve)

It receive the signal from gas detector and shut of the gas flow .

The location of solenoid valve as following:

a) After vaporizer; it will shut of gas flow to the building if there is any leak near gas tanks and inside gas shaft.

b) Gas meter cabinet; it will shut of the gas flow to the apartment if there is any leak near gas coking equipment our there is leak inside gas mete cabinet.

Note: the Solenoid valves also connectable to Fire alarm panel, and it will shut off the gas flow if there is any fire inside building

Gas metering system

- G 1.6 gas meter is diaphragm type, will read the LPG flow each for apartments , the minim flow reading is 0,016 m3/h and the maximum flow rate is 3 m3/h

Gas tanks filling station

- The filing station include the following:

1) LPG pump
2) Electrical driving motor (explosion proof)
3) Check valve
4) Electrical Control panel
5) Filter
6) 3” flexible hoses and couplings for connection to LPG Truck