

USE OF SMALL SPARK-IGNITION (SSI) ENGINES



Small Spark-Ignition Engines (LPG/CNG/Gasoline) are commonly used in many industrial applications. Although propane-powered engines offer many advantages over gasoline engines, all of them can produce dangerous toxins if not properly maintained and controlled.

These engines emit toxic gases from the exhaust, such as Carbon Monoxide (CO) and Nitrogen Oxides (NO_x), in quantities high enough to pose a health hazard to workers, especially in confined spaces where there is little or no ventilation.

EMISSIONS FROM SMALL SPARK-IGNITION ENGINES

The complete combustion of propane/gasoline will produce Carbon Dioxide (CO₂) and water vapour in theory. Unfortunately, toxic emissions, such as CO and NO_x are also being produced.

Carbon Monoxide (CO) is colourless, odourless and tasteless, yet very toxic. Depending on the equipment and the operating environment, CO levels can rapidly rise and reach dangerous levels. A CO rich environment can lead to headaches, lethargy, dizziness, loss of consciousness, and even death.

The range of CO in the tailpipe of a propane-powered engine can be 2,000-20,000 parts per million (ppm), and 30,000-100,000 ppm of a gasoline engine. CO is slightly lighter than air and therefore tends to follow air currents, vehicles and people in the workplace until it is removed by ventilation.

Nitrogen Oxides (NO_x) are formed within the combustion chamber of the engine. Propane-powered engine exhaust can contain varying amounts (250-2,000 ppm) of these corrosive and poisonous gases, gasoline engine – 3000-3500ppm. Depending on the individual, the concentration of contaminants and the duration of exposure, immediate effects may include eye, nose and throat irritation. Effects may also be felt several hours after the exposure and can cause a build-up of fluids in the lungs.

OCCUPATIONAL EXPOSURE LIMITS

There are permissible limits for airborne CO, Nitric Oxide (NO) and Nitrogen Dioxide (NO₂) in the work environment.

Occupational exposure limits	CO	NO	NO ₂
8-hours exposure limit *)	25ppm	25ppm	3ppm
Short-term (15 min) exposure limit **)			5ppm

*) - The average airborne concentrations to which it is believed workers may be repeatedly exposed without adverse effect during an eight-hour shift and 40-hour workweek, day after day.

**)- Limits to which workers may be exposed up to four 15-minute periods in an eight-hour workday, with at least one-hour interval between each period. There is no short-term limit set, a good way to determine a safe short-term exposure limit is to multiply the eight-hour exposure limit by three. For example, the limit for short-term CO exposure would be 25 ppm x 3, or 75 ppm.

MEASURES TO REDUCE EMISSIONS:

- **Use of low-emission engine/equipment.** When possible, try to use a propane engine or calibrate your carburetor/mixer to a lean mixture.
- **Regular maintenance of the engine.** This is a crucial measure. You should have a regular maintenance program that includes an analysis of tailpipe emissions (particularly the CO content). When tuning an engine, a compromise between the optimum performance and the minimal emissions needs to be reached. In most engines, the tailpipe's CO level can be kept below 5,000 ppm by a good engine tune-up. Following a tune-up and after reaching a steady working pace, check the equipment area to ensure exposure standards are maintained.
- **Ventilation of work area.** Make sure your working area is properly ventilated regardless of the installation of a catalytic muffler/converter or not.
- **Proper work practice.** Since emissions from small spark-ignition engines are higher when the engine is cold, you should warm up the engine outdoors before operating the unit indoors.

AIR-QUALITY MONITORING

Periodic air monitoring is important to ensure the SSI engine is operated and maintained correctly and to minimize hazards to a worker's health and safety.

- Air-monitoring equipment for CO and NO₂ is required for evaluating work environments.
- Measuring devices are available on the market in many forms, from sophisticated electronic instruments to manually operated aspirator pumps.
- Safety equipment distributors should be able to provide you with the type of monitoring devices most appropriate for your workplace.

For more information, please refer to your local Workplace Health & Safety Regulations or contact the local Authorities.