



LION[®]
ready for action

DESKTOP FLASHOVER

USER'S MANUAL

**ORIGINAL
USER'S MANUAL**

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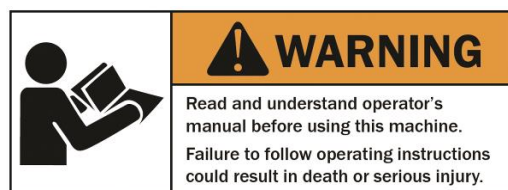


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FOR YOUR SAFETY

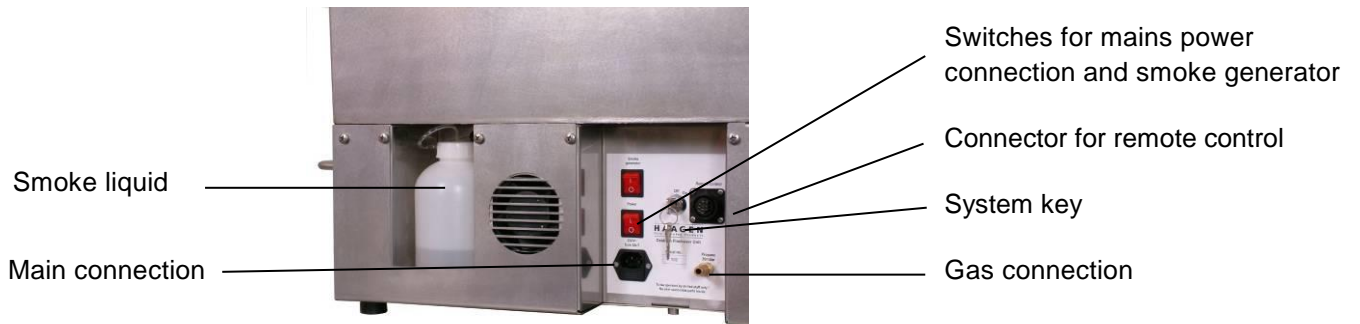
1. This appliance is for outdoor use only.
2. This device is intended for use only by qualified fire training instructors.
3. Always wear proper Personal Protective Equipment (PPE) when operating this unit.
4. Always use in accordance with all applicable local, state and national codes. Contact your local fire department for details on outdoor burning.
5. When using this appliance, exercise the same precautions you would with any open fire.
6. The use of alcohol, prescription or non-prescription drugs may impair the consumer's ability to safely operate this appliance.
7. Do NOT use this appliance without reading the entire "User's Manual".
8. Do NOT alter this appliance in any manner.
9. Do NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.
10. Do NOT use this appliance within 20 feet of automobiles, trucks, vans or recreational vehicles.
11. Do NOT use in an explosive atmosphere. Keep the area surrounding the appliance free and clear from combustible materials, gasoline and other flammable liquids.
12. Do NOT use this appliance under any overhead or near any unprotected combustible constructions. Do not use this appliance near or under overhanging trees and shrubs.
13. Always use this appliance on a hard, level, non-combustible surface such as concrete or metal.
14. Do NOT smoke while using unit.
15. Do NOT wear flammable or loose clothing when operating this appliance.
16. All surfaces of this appliance are hot when in operation. To avoid burns, do NOT touch appliance until it has completely cooled for at least 15 minutes.
17. Do NOT attempt to move or store until completely cooled.
18. Do NOT lean over this appliance when lighting or when in use.
19. Observers should stay at least 12 ft away from this unit while in operation.
20. This appliance should be thoroughly inspected before use and cleaned on a regular basis. Do NOT use if damaged.
21. The LP-gas supply cylinder must be disconnected when this appliance is not in use.
22. Connect only to cylinders marked PROPANE or LPG.
23. Death, serious injury or damage to property may occur if the above is not followed exactly.



1 General description

The Desktop Flashover may only be used by a qualified fire training instructor. Read the user manual completely and consult the safety checklist before using this equipment.

This equipment is intended for outdoor use only.



The casing is made of stainless steel and has a glass front. It is 72 cm tall and the base measures 79 x 51 cm. The apparatus consists of two parts. The upper space (51 cm in height) is the experiment section and the lower section is the 'technical space.' On top of the experiment casing are four stainless steel pressure release valves.

The window is made of 6 mm thick laminated glass, which is designed to withstand the demonstrations for which the equipment is intended. However, the glass is not resistant to prolonged direct contact with fire, the use of other types of gas than recommended, or extra oxygen used to intensify the flames.

The side of the experiment section features a stainless-steel door measuring 24 x 24 cm. This door provides access to the experiment section and can also be used to demonstrate a flashover or backdraft situation.

The lower section contains an electric motor to drive the fan, the electronics, a high-voltage transformer, the propane equipment and a smoke generator. The lower section is ventilated through slots in the base.

The motor drives a fan, contained in the experiment section. This is used to create a mixture of gas and oxygen within this space.

The ignition source is an arc of approximately 1 cm. This arc is generated between two electrodes with ceramic insulation in the experiment space. The voltage required for this is generated by a special transformer contained in the lower section.

A timer is fitted to the front of the lower section, indicating when, for how long and how fast gas is flowing into the experiment space.

The propane equipment consists of a 30-mbar/½ psi pressure reducer, a hose with a quick connector and internal pipes that are connected to the experiment space by means of two magnetic valves.

The remote control is connected to the Desktop Flashover by a 4 m long cable, and features a green LED indicating when the system is switched on, and a red LED indicating that the gas supply has been initiated.

The top of the Desktop Flashover is made of stainless steel, including the pressure release valves on the top of the casing. As these are made of stainless steel, they can become very hot during the experiments. Metal handles are fitted onto the side, to aid moving the equipment. The equipment also has rubber feet.

The required power is 230 Volt, 50 or 60 Hz. Only grounded power outlets may be used!

The shield box is a transparent screen made of polycarbonate and which is used as an aid in experiments in which situations with a gas leak in an adjacent space can be simulated.

Note:

The amount of gas delivered can change somewhat depending on ambient temperature. This may affect some of the timing of the experiments. It is therefore important for the instructor to be familiar with the equipment. Ensure that you have mastered the use of the equipment before giving a demonstration with it.

CONSULT THE SAFETY CHECKLIST BEFORE EVERY USE!

2 Connection and operation of the Desktop Flashover

Gas connection (PROPANE):

The Desktop Flashover is used in combination with propane gas. The external gas connection is made by a quick disconnect supply and can be connected to a gas cylinder by means of the supplied pressure reducing valve (30 mbar / 3 kPa or ½ psi) and hose. The gas cylinder must be fitted with a gas tap.

Electrical connection (POWER):

A standard power supply cable is provided for connection to the electrical power supply. This should be connected to a grounded electrical socket (230 V alternating current).

The Desktop Flashover is switched on using the “Power” switch on the rear.

System key (ON/OFF):

The operation of the Desktop Flashover can be initiated by switching the system key to the “ON” position. Use of the system key is necessary because only qualified trained instructors are permitted to carry out the experiments.

Smoke generator (SMOKE GENERATOR):

The Desktop Flashover also has a built-in smoke generator for the realistic simulation of flue gas combustion. The smoke generator must first be switched on using the “Smoke Generator” switch on the rear of the Desktop Flashover, after which the smoke generator needs approximately 5 minutes to warm up. The smoke generator is ready for use when the “smoke generator” lamp on the front lights up. When the smoke button on the remote control is pressed, smoke will be emitted into the experiment section. Since the equipment makes use of a small smoke generator, this may stop briefly during use to warm up again. The rear of the Desktop Flashover features a small tank (1 litre) for holding the smoke liquid. Ensure that this is always kept filled with LION “FLASH Smoke Liquid.”

If the tank has been empty, it might take some time before the Smoke Liquid is sucked in. Press the “SMOKE” button until smoke is produced continuously. If it takes longer than 1 minute, press the “SMOKE” button for 5 seconds and release it for 2 seconds. Repeat this action until the smoke generator produces smoke continuously.

Note! Standard LION Smoke Liquid CANNOT be used.

Remote control (REMOTE CONTROL):

The remote control is connected to the Desktop Flashover by a four-metre cable and features a green LED indicating that the system is switched on and a red LED indicating that the gas supply has been initiated. The remote control also has buttons for turning on the smoke generator (smoke), the fan (fan) and the ignition mechanism (ignite). The “Set” button is used to set the length of time. Once a time has been set, the start button can be pressed to initiate the gas supply (continuing for the length of time set). The LO/HI button is used to set the desired speed of the gas flow. When the gas is flowing, the Desktop Flashover will not respond to this button being switched. The Stop button can be used at any time to stop the gas supply. The timer setting can also be reset with this button.

Time indicator (TIMER):

A timer is mounted on the front of the lower section indicating when, for how long, and how fast gas is flowing into the experiment space. The timer can be set using the 'set' button on the remote control. Once the gas supply has been started, the timer also starts its countdown. The timer counts down from the time set by you beforehand. Once the timer has reached zero, the gas supply will be shut off. Should you wish to stop the timer/gas supply during operation, or to reset the timer to zero, you can use the stop button. The maximum time that can be set on the timer is 99 seconds. With a normal (low) gas flow, the lower explosion limit is reached after about 23 seconds.

Standard gas flow (LOW):

Once the gas supply has been initiated using the remote control (gas supply indicator lamp is on) and the LO/HI switch is in the LOW position, gas will be blown into the experiment section through the standard supply tube. When using propane at a pressure of 30 mBar (1/2 psi), the lower explosion limit is reached in the Desktop Flashover unit after approximately 23 seconds, and the upper explosion limit after 99 seconds.

Accelerated gas flow (HIGH):

To reach the upper explosion limit quickly, or to create a saturated mix quickly, there is also the option of an accelerated gas flow (HIGH) alongside the standard gas supply. This can be selected using the LO/HI switch on the remote control. By switching this to the HIGH position, the flow of gas will be faster. Length of time before the upper explosion limit is reached using accelerated gas flow: approx. 45 seconds (at an inlet pressure of 30 mbar (½ psi)).

3 Technical specifications

Casing material:	stainless steel
Glass:	6 mm laminated
Mains power:	230V 50 / 60 Hz, earthed connection absolutely necessary!
Max. power consumption:	3 A
Fuel:	propane
Operating pressure:	30 mbar (1/2 psi)
Gas consumption:	(propane with pressure reducer included) gas supply LOW: approx. 1.2 kg / h (10 l per minute) gas supply HIGH: approx. 3 kg / h (25 l per minute)
Max. inlet pressure:	1.5 bar
Operating temperature:	+5 °C / +30 °C
Dimensions:	w x d x h = 79 x 51 x 72 cm
Weight:	approx. 47 kg

Contents:

- Desktop Flashover
- Wired remote control (4 m)
- Polycarbonate shield box, w x d x h = 14 x 14 x 25 cm (base and one open side)
- 230 v power supply cable
- Gas connection set
 - pressure reducing valve (30 mbar / 3 kPa (½ psi))
 - 4 m propane gas hose NEN 5654 with fast connectors
- One litre of LION "FLASH Smoke Liquid".
- Manual

4 Inspection, maintenance and guarantee

- Inspect the Desktop Flashover regularly. Visually check whether the gas hose, the pressure reducing valve, doors and glass front, and the various connections show any damage. Do NOT use if damage is found.
- Clean the experiment section regularly using an all-purpose cleaning product. Do not use caustic substances or solvents.
- Regularly rinse the built-in smoke generator (at least every six months). To rinse the generator, remove the smoke liquid from the tank and add a mixture of distilled water (80%) and cleaning vinegar (20%) to the tank. After the smoke generator has been thoroughly heated, press the SMOKE button for about 15 minutes. Remove the cleaning mixture from the tank and refill it with LION “FLASH smoke liquid”. Press the SMOKE button for 3 minutes to dissolve the cleaning mixture leftovers. Open the pressure relief valves during this procedure. Clean the experiment room.
CAUTION: After using the cleaning mixture, make sure to flush the machine thoroughly with LION “FLASH Smoke Liquid” to prevent defects.
- The guarantee on the equipment ceases to be valid: if the instructions in the manual and the maintenance prescriptions have not been adhered to; in the event of faults or damage arising from improper use and/or rough treatment; and if the equipment has been modified.
- LION *Fire Training Products* cannot accept any liability for losses arising from the use or inadequate functioning of the Desktop Flashover.

5 SAFETY CHECKLIST FOR EVERY USE

A Desktop Flashover experiment may only be carried out by a qualified trained instructor!

- **Set-up:**
Only use the Desktop Flashover unit in a large, well ventilated space of at least 80 m³, preferably **not** with a system ceiling (The Desktop Flashover unit produces a shock wave, which can cause damage to windows, ceilings etc in a hermetically sealed space.). The Desktop Flashover unit must be positioned at least 1.5 metres from surrounding walls and at least 4 metres from the wall on the side with the side door. It must not be used in the vicinity of flammable materials or substances.
Do not allow anyone to get closer than 2.5 metres to the Desktop Flashover once a demonstration has started.
Ensure that no one is standing in front of the door when it is open during an experiment. A distance of at least 4 metres must be kept at all times!
- **Fire alarm / smoke alarm / sprinklers:**
If the room is equipped with smoke detectors, heat detectors, sprinklers etc., these should be switched off or covered up for the duration of the experiment. Don't forget to switch them back on again after the demonstration! Be sure to inform the responsible person too!
- **On/off switch off:**
Check that the power switch and the switches on the remote control are in the “off” position before connecting the equipment to the power supply.
- **Pressure release valves:**
Check that the valves on top of the Desktop Flashover unit open easily. Do NOT place anything on top of the unit.
You should take into account that the valves can become extremely hot if the Desktop Flashover unit is in use for an extended period of time.
Use heat-resistant gloves.

- **Fuel:**
Just before use, the gas valve on the gas cylinder should be turned on. After use, this gas valve should be shut off again.
- **Safety instructions (during use):**
 - Always check the Desktop Flashover before every use, particularly whether all openings, the fan, the ignition mechanism and the gas supply are in proper working order.
 - Ensure that the top pressure release valves can always move freely and that nothing is placed on top of them!
 - Do not allow anyone to get closer than 2.5 metres to the Desktop Flashover once an experiment has begun!
 - Ensure that no one is standing by the side access door if this is open or will be opened during an experiment. A distance of at least 4 metres should be kept from this door.
- **Ventilate the Desktop Flashover after every experiment by opening the side door and the pressure release valves and switching on the fan for at least 10 seconds. This is of importance for ensuring the success of the following experiments.**

6 Demonstrations with the Desktop Flashover

Discuss the expected results with the trainees before and after every experiment and explain the link with situations in practice.

Checks prior to use

Place the equipment on a sturdy non-combustible surface. The ideal table height is approx. 80 cm.

1. Ensure that there is nothing in or on top of the unit.
2. Consult the safety precautions (page 7) and ensure that these are all adhered to.
3. Once you have checked that all switches are in the "off" position, you can connect the power cable to the equipment. Only use a grounded power supply.
4. Check whether all the switches on the remote control are working.
5. Connect the gas cylinder using the pressure reducing valve and open the gas tap.

The Desktop Flashover is now ready for use.

Note:

The timing can vary slightly in every Desktop Flashover. It is therefore important for the instructor to be familiar with the equipment and that he can correct the timings stated for the experiments if necessary.

To recreate realistic scenarios, the built-in smoke generator can be used to fill the experimental room with smoke during different tests.

Testing the Desktop Flashover prior to the various experiments

1. Close the side door and the pressure release valves.
2. Switch on the ignition and the fan, with the HI/LO switch in the LO position.
3. Set the timer to 35 seconds and then press the start button.
4. Wait for about 23 seconds (lower explosion limit).
5. Once a Flashover has taken place, turn off the gas supply immediately by pressing the stop button. Switch off the ignition and the fan too.
6. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds.
7. Then close the side door and the pressure release valves again.

Different types of ignition

A variety of demonstrations can be made with this unit, depending on the curriculum of the instructor. Before the following experiments are carried out, you should ensure that your trainees know about explosion limits, flame reach, and how the energy released is dependent on the mix of fuel and air at that moment.

Open ignition source

If the ignition source is positioned close to the gas supply, ignition will occur immediately once the lower explosion limit has been reached. The energy released will be relatively low.

1. Close the side door and the pressure release valves. Set the timer to 40 seconds.
2. Switch on the ignition and the fan, with the HI/LO switch in the LO position.
3. Start the gas supply.
4. Wait until the gas ignites; note the ignition time (approximately 23 seconds after the gas supply is turned on) and the relatively weak ignition.
5. When the gas ignites, switch off the ignition and the fan.
6. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds.
7. Then close the side door and the pressure release valves again.

Intermittent ignition source

If the ignition source is not always present, ignition will usually take place a moment or two after the lower explosion level has been reached. A lot of energy can then be released!

1. Close the side door and the pressure release valves. Set the timer to 70 seconds.
2. Switch on the fan, with the HI/LO switch in the LO position, but do not yet switch on the ignition.
3. Start the gas supply.
4. Wait for a length of time approximately 50% longer than required for ignition to take place in the "open ignition source" experiment (approx. 35 seconds).
5. Switch on the ignition.
6. When the gas ignites, turn off the gas supply, the ignition and the fan immediately.
6. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds.
7. Then close the side door and the pressure release valves again.

Concealed ignition source

If there is an ignition source that is more or less shielded from the gas supply, ignition will only occur once the lower explosion limit has been reached in the shielded area around the ignition source. This is always far above the lower explosion limit in the area around the gas source. A lot of energy can be released!

1. Place the shield box over the ignition electrodes. Leave a gap of about 4 mm between the shield box and the glass by placing the shield box in front of the metal strip behind the sparker.
2. Close the side door and the pressure release valves. Set the timer to 99 seconds.
3. Switch on the ignition and the fan, with the HI/LO switch in the LO position.
4. Turn on the gas supply.
5. Wait until the gas ignites (approx. 65 seconds). Note that the ignition of the gas in the shielded area also ignites the gas in the experiment box.
6. When the gas ignites, turn off the gas supply, the ignition and the fan immediately.
7. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds.
8. Then close the side door and the pressure release valves again.

Follow with the description of the delayed ignition in a house filled with inflammable gas if there is an ignition source in an adjacent room.

Energy dependent flames

A. Lean mixtures

Below the lower explosion limit, a flame can only occur if extra energy is supplied or if the mix is preheated.

1. Close the side door and the pressure release valves.
2. Switch on the ignition and the fan, with the HI/LO switch in the LO position.
3. Switch off the lighting in the room, so that the ignition arc will be clearly visible.
4. Turn on the gas supply for 15 seconds (75% of the lower explosion limit).
5. Demonstrate that an arc only occurs if the ignition is switched on. To this end, switch off the ignition and then switch it back on again a few moments later. (This flame is present outside the explosion limits and is only possible through the addition of external energy).
6. Switch on the gas supply again for 15 seconds and gradually allow an explosive mix to develop.
7. When the flashover takes place, turn off the gas supply, the ignition and the fan immediately.
8. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds.
9. Then close the side door and the pressure release valves again.

B. Rich mixtures

Above the upper explosion limit, it is also the case that a flame can only exist if extra energy is supplied or if the mix is preheated.

1. Close the side door and the pressure release valves.
2. Switch on the fan, with the HI/LO switch in the LO position, but do not switch on the ignition!
3. Turn on the gas supply for approximately 50 seconds, in the HIGH position (accelerated gas flow).
4. After these 50 seconds have passed, move to a position as far away from the experiment box as possible and switch on the ignition. In the case of an oversaturated mix, an arc will only occur between the ignition electrodes if the ignition mechanism is switched on. The colour of the flame will be dark yellow. This flame will occur above the upper explosion limit and can only occur if external energy is supplied.
5. Switch the ignition off and back on again a number of times.
6. Switch on the ignition, carefully open the side door on the side of the experiment section (keeping head turned away and staying low). Never stand right in front of the side door! The sudden flow of air will produce a backdraft in the oversaturated mix. Depending on the saturation, this can take a few seconds. In the most favourable case, this will occur immediately. Wait until the entire gas mix has been burned up.
7. Switch off the ignition.
8. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds. Ventilate the room, too, if deemed necessary.
9. Close the side door and the pressure release valves again.

Discussion:

Ensure that your trainees become familiar with the oxygen-gas ratio in an oversaturated mix of propane and air. The upper explosion limit will be reached at approximately 9% gas and 91% air. The amount of oxygen in this mix is approximately 19%.

It is not the lack of oxygen that results in the mix not burning, but the excess of propane which has an extinguishing effect.

Flashover / Back draft

The Desktop Flashover enables you to recreate various flashover/backdraft situations.

Note: Safety measures must be taken because flames can extend outside of the Desktop Flashover unit! See the safety precautions.

Normal Back draft (example)

1. Place the shield box over the ignition electrodes. Leave a large gap of about 20 mm between the box and the glass by placing the shield box behind the metal strip.
2. Close the side door and the pressure release valves.
3. Switch on the fan, with the HI/LO switch in the LO position, but do not switch on the ignition.
4. Turn on the gas supply for 50 seconds.
5. After these 50 seconds have passed, move to a position as far away from the experiment box as possible and switch on the ignition. In the case of an oversaturated mix, an arc will only occur between the ignition electrodes. The colour of the flame will be dark yellow. The form and colour of the flame are an indication of how much higher than the upper explosion limit the mix is.
6. Carefully open the side door on the side of the experiment section (keeping head turned away and staying low), so that the fan ensures that the gas is mixed with the incoming air. Never stand right in front of the side door!
7. Watch the flame inside the shield box so that you can see when ignition is about to take place.
8. Once the back draft has taken place, switch off the ignition and the fan.
9. Ventilate the Desktop Flashover by opening the side door and the pressure release valves and by switching on the fan for at least 10 seconds. Ventilate the room, too, if deemed necessary.
10. Close the side door and the pressure release valves again.

Discuss variations on this experiment.



LION Protects B.V.

Industrieweg 5
5111 ND Baarle-Nassau
the Netherlands
T: +31 (0)13 507 6800
F: +31 (0)13 507 6808
E: infoEMEA@lionprotects.com

WWW.LIONPROTECTS.COM

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