# NOTES

CONTD.


# REPORT INTO INVESTIGATION OF A GAS EXPLOSION ON THE PLEASURE CRUISER "SANTA CHRISTINA" AT OLD HARBOUR, BALLYLEAGUE, LANESBOROUGH ON 18TH SEPTEMBER, 2002.

**The Marine Casualty Investigation Board was established on the 5th, June 2002 under The Merchant Shipping (Investigation of Marine Casualties) Act 2000**

# CONTENTS

## 1. SYNOPSIS.

1.1 On 18th September, 2002 an explosion occurred on board the hired pleasure cruiser, "Santa Christina", at Lanesborough, Co. Roscommon. Two of the four passengers sustained injuries, one of whom was hospitalized.

## 2. FACTUAL INFORMATION
### DESCRIPTION OF THE VESSEL

| | | |
|---|---|---|
| 2.1 | Vessel Name: | "Santa Christina"<br>(Previously "Inver Empress IV") |
| | Length: | 37ft 8in. |
| | Construction: | GRP |
| | Construction Date: | 1986 |
| | Builders: | Harvey Eastwood Ltd.<br>Norfolk<br>England |
| | Engine: | Single four cylinder diesel engine Perkins 72HP, Electrical Start |
| | Heating/Cooking: | Gas supplied by 2 domestic gas bottles |
| | Owner: | Ms. Rose Fay<br>22 Danesfort<br>Clontarf<br>Dublin 3 |

**2.2 Crew**
Dr. Hazem Kahlout, Mrs. Maggie Kahlout, Deanna Kahlout (9) daughter
Son x 2 (names and ages unknown).

**2.3** The vessel was surveyed on 25th November, 1996 (see Appendix 1).
The vessel underwent an RNLI Seacheck Survey in May, 2002 (see Appendix 2).

## 3. EVENTS PRIOR TO THE INCIDENT

3.1 The vessel was hired by Dr. Kahlout and his family on 14th September, 2002.

3.2 The vessel began the hire in Carrick-on-Shannon where the owner, Ms. Fay, demonstrated the controls and other features of the vessel.

3.3 At 1300 hours on September 18th, the vessel arrived in Old Harbour, Ballyleague, Lanesborough, Co. Roscommon.

3.4 At approx. 16.30 hours, the vessel prepared to leave Lanesborough.

3.5 Dr. Kahlout was in the upper steering position. His two sons were tending the mooring ropes. Mrs. Kahlout was in the galley. Deanna Kahlout was attending the control console in the saloon from where the engine was started (see Appendix 3).

## 4. THE INCIDENT

4.1 As the engine was started a large explosion occurred followed by a flash flame and a second explosion.

4.2 The interior of the vessel was substantially damaged (see Appendix 4).

4.3 Deanna Kahlout was burnt on one side of her face by the flash flame. Mrs. Kahlout suffered minor injuries and shock. Dr. Kahlout attended the injured until the emergency services arrived a short time later. The injured were removed to hospital.

## 5. EVENTS AFTER THE INCIDENT

5.1 The scene of the explosion was preserved by the Gardai until the MCIB Inspector arrived early next morning, 19th September, 2002.

5.2 The scene was attended by Detective Garda Michael Keating of the Garda Technical Bureau and Mr. Michael Glennon of Calor Gas Company (see Appendices 5 and 6).

5.3 Tests – an examination of the vessel was undertaken.

## 6. CONCLUSIONS AND FINDINGS

6.1 The gas bottles had been isolated and moved ashore by the Fire Brigade.

6.2 No evidence of residual gas could be detected.

6.3 Mr. Michael Glennon checked the gas installation and found it to be intact (see Appendix 6). He also tested the pressure regulator on the gas bottles and found them to be in satisfactory working order (see Appendix 6).

6.4 Examination showed that the starter motor was slack in its mounting and when an attempt to start it was made, a large electrical arc, 3 – 4 cms long, was observed between the starter motor and the engine block.

6.5 No sources of the origin of the gas could be found other than the installed heating and cooking system.

6.6 Det. Garda Keating reported that, on inspection, he observed that the right front burner control of the cooker was in the "low flame" position (see Appendix 5).

6.7 The cooker had no flame supervision device.

6.8 The vessel had no gas leakage detection alarm.

6.9 The explosion occurred because the cooker was left on and the gas exploded when the motor was switched on, the arc between the starting motor and the engine block causing the ignition.

6.10 The vessel was surveyed in November, 1996. (see Appendix 1). No reference was made to the absence of safety devices associated with a marine gas installation.

6.11 The RNLI Seacheck contained no reference to gas installation safety devices.

## 7 RECOMMENDATIONS

7.1 Marine Notice No. 1 of 2002 was issued in January, 2002 to inform users of pleasure craft of the dangers associated with gas installations on board vessels. The Marine Notice replaced Marine Notice No. 25 of 1991, both of which contain recommendations that appliances should be fitted with flame supervision devices. They also recommended that vessels be fitted with gas detection devices that provide an audible and visible alarm in the event of a build up of flammable gas (see Appendices 7 & 8).

7.2 Marine Notices (No. 25 of 1991 and No. 1 of 2002) clarified information given in relevant international standards (ISO 10239:2000, and BS 5482, part 3, 1979).

7.3 The MCIB recommend that the Minister of Communications, Marine and Natural Resources introduce legislation making the use of gas detection devices and flame supervision devices compulsory in all leisure craft where gas is used for cooking and/or heating.

## 8. APPENDICES

8.1. Copy of Survey of "Santa Christina" by S. Kirkpatrick Consultancy Marine Surveyors.

8.2. Copy of RNLI Sea Check.

8.3. Statements supplied to the Garda Siochana by the Kahlout family, incident witness and Gardai.

8.4. Photos of interior damage to the "Santa Christina".

8.5. Statement from Detective Garda Michael Keating of the Garda Technical Bureau.

8.6. Statement from Michael Glennon of Calor Gas.

8.7. Marine Notice No. 1 of 2002.

8.8. Marine Notice No. 25 of 1991.

# APPENDIX 8.1

8.1. Copy of Survey of "Santa Christina" by S. Kirkpatrick Consultancy Marine Surveyors.

APPENDIX 1

## S. KIRKPATRICK
CONSULTING MARINE SURVEYORS

TELEPHONE:- 01960 351521

FAX:- 01960 351321

REPORT NO 2143 25TH NOVEMBER 1996

SURVEY REPORT

"INVER EMPRESS 1V"

This is to certify that the undersigned did at the request of a prospective purchaser:-

ROSE FAY
15 CASTLEKNOCK CLOSE
LAUREL LODGE
DUBLIN 15

carry out a detailed survey on 37' Motor Cruiser "INVER EMPRESS" on Saturday 23rd November. 1996.

At the time of survey, the vessel was ashore at Lough Erne Yacht Club, Goblusk, Killadeas, Lower Lough Erne, Co Fermanagh. and Ms Fay was in attendance.

INTRODUCTION

This vessel, which has GRP hull and decks, was moulded in 1986 by:-

AQUAFIBRE LTD
RACKNEATH
NORWICH
NORFOLK.

The interior of the hull has been designed, and fitted by:-

HARVEY EASTWOOD LTD
BRUNDALL
NORFOLK.

Aquafibre Ltd, have been moulding GRP hulls for many years, and in addition to building a substantial range of Motor Cruisers which are finished, and marketed under their own name, they mould hulls for many other boat companies including Freeman, and Broom.

All the GRp hulls are moulded in a modern factory which is contrilled for temperature, and humidity, and the work is carried out by an experienced workforce, under strict parameters of quality control.

REPORT NO 2143 2.

Harvey Eastwood Ltd, are well established boatbuilders with a reputation for detail, in the fitting out, and finishing of all types of luxury pleasure boats, and their services are widely acclaimed throughout the boating world.

This particular vessel was purchased new by Aghinver Boats, in 1986, and since that time, has been part of an extensive hire fleet on Lough Erne. During this period, the vessel has been maintained and serviced to a high standard, and kept up to the high standard required by the appropriate authorities responsible for the standard of hire cruisers.

GENERAL SPECIFICATIONS

| | |
|---|---|
| Hull construction | GRP modular |
| Hull design | Hard chined |
| Length overall (LOA) | 37' 00" |
| Length waterline (LWL) | 34' 8" |
| Beam (maximum) | 12' 00" |
| Draft (maximum) | 5' 08" |
| Displacement | 7 tonnes |
| Propulsion unit | Single 72Hp, 4cyl, Perkins 4236 diesel, inboard. |
| Berths | 8 |

REMIT.

The purpose of this survey was to assess the general condition of the hull, and fitments, in order to satisfy the requirements of a prospective purchaser, and comply with current insurance regulations. We also attempt to assist Underwriters by offering some suggestion regarding current values.

To this end, a detailed survey was carried out which consisted of the following elements:-

1. HULL CONSTRUCTION AND CONDITION
2. INTERIOR FITMENTS
3. PROPULSION UNIT
4. IDENTIFICATION OF ANY LOSS PRODUCING CIRCUMSTANCES WHICH MIGHT ARISE
5. CONCLUSIONS.

SURVEY.

1. HULL CONSTRUCTION AND CONDITION

As stated in the introduction, the hull and decks have been moulded in GRP, with each unit moulded as separate modules, which have been joined together around the sheerline at deck level.

This type of modular construction is one of the many inovations peculiar to the introduction of GRP into the marine industry, and usually makes an extremely strong, rigid hull, with the transverse, and longitudinal stiffening moulded to the inside of the hull module.

When the hull is being moulded, the layup of GRP is made very thick around the keel areas, and tapers off towards the gunnels, ensuring that the strength in the hull is properly apportioned, and the completed hull, has a natural stability when afloat.

GRP modular construction of the two main elements usually results in a completed hull which is easily kept watertight, and is less difficult to maintain than a conventional wooden hull.

This survey showed both main modules to be well moulded, with no evidence of cavities in the inner laminates, or wicking, which is sometimes caused by individual strands of GRP matting protruding into the gel. These strands show up as white streaks under the gel surface, and can absorb any moisture which reaches them. This condition can, under certain circumstancesdevelop into an osmotic condition.

The underwater area of the hull has been treated with three coats of waterproof epoxy paint, applied when the hull was new, and therefore dry. Epoxy forms a positive shell over the gel and is the recommended treatment to prevent the ingress of water into the laminates.

A visual inspection of the underwater area showed the hull to be in good condition, with no evidence that it has ever been seriously damaged or repaired, and it was noted that the underside of the long keel is protected by a metal strap which extends the full length of the keel.

Although the application of epoxy tends to inhibit a 100%visual inspection of the gel, and hull laminates, the problem was largely overcome by the use of an electronic moisture meter, to measure the inherent moisture content of the inner hull laminates.

Measurements, taken at approximately every square foot over the outside of the hull, showed readings as follows:-

| | |
|---|---|
| UNDERWATER AREA (EPOXY COATED) | 3% - 6% |
| TOPSIDES | 2% - 4% |

These readings are quite low, and indicate that the chances of this hull developing an osmotic type defect in the medium term, is remote.

The topsides of the hull appeared in sound condition, and the gel had a good shine, and depth of colour. This area of the hull is well protected by substantial rubber beltings on each side, but it was noted that there were some scratches

on the forward part of the hull on port and starboard sides.
These scratches are confined to the gel coat, and do not affect the vessels integrety, but we recommend that these are filled with gel fillers, and faired off, to prevent water getting into the inner laminates.
Scratches on this part of the hull are usually caused by coming alongside a pontoon etc too quickly.
Lighter scratches can be removed by rubbing with a light rubbing compound, and repolishing.

The joint between the hull, and deck modules, which is the only major joint in the completed hull, was found to be securely bonded and bolted, with no sign of leaks or damage.
The shape of the deck module has been adopted to significantly stiffen, and strengthen this joint around the full length of the hull, on port and starboard sides.
The ouitside of the joint is well protected by a substantial belting.

The one piece deck module, which incorporates the raised coach decks over the accommodation areas, and the aft bridge deck, was found in sound structural condition, with no sign of serious cracking or crazing on the gel.

Equipment on deck included:- Stainless steel pulpit and pushpuit around the forward and aft ends, Good handrails along each soide of the raised coach deck, Stainless bow fitting with roller fairlead, strong mooring bollards with fairleads fore and aft, GRP moulded toerail around the outer edges of the main deck.
All the deck fittings appeared in good condition, and well secured, and all the working areas on deck were well etched to afford good footing.

## 2. INTERIOR FITMENTS

The interior of the hull has been well designed, and the designer has made good use of available space. The use of sound, well proven principles of marine construction, compliments the design, to create a comfortable, functional interior, with sufficient facilities to accommodate several people for extended cruising.

All the interior compartments, and the fitments therein, were inspected in detail as follows:-

**FOREPEAK:-** The forepeak is designed for the storage of anchor chain etc, and was found to be functional, and well ventilated, with good access from the forward cabin.

**FORWARD CABIN:-** The forward cabin has been fitted with singl berths alon the hull on port and starboard sides. Each berth has good storage space underneath, and fitted with foam cushions

In the port aft area of the forward cabin there is a set of drawers, and a full length hanging locker, fitted against the hull.

The hull and deck head have been insulated and lined to control any condensation, and the cabin has good natural light and ventilation from windows through the coach, and an opening deck hatch.

All the fitments in this cabin have been well made and fitted, and where appropriate, have been securely tabbed, or bonded to the main hull.

FORWARD CABIN NO 2.

A second forward cabin is sighted on the starboard side, and has been fitted with two single berths, upper, and lower. There is also a full length hanging locker, and a set of drawers in this cabin. The hull and deck head have again been insulated and lined, and there is natural light and ventilation from an opening window in the raised coach.

TOILET COMPARTMENT NO 1.

An enclosed toilet compartment is sighted to port, opposite No 2 cabin, and has been fitted with a flushing marine toilet, washand basin with hot and cold water supply. There is also a h&c mixer tap with shower head, and tray, and the whole compartment is lined with formica.

The installation of the toilet was checked, and found to be satisfactory, with the pipes properly looped above the waterline to abvoid any syphoning of water into the boat, and both the inlet, and outlet, sea valves were in good condition, and fully operational.

SALOON

The large saloon has a semi elevated position. and with the forward windscreen, and large side windows, there is excellent visability for helmsman, and crew.

The helmsmans position is sighted in the port forward area, where in addition to wheel steering, there is an instrument panel containing all the dials, switches, and guages, to monitor the performance of boat, and engine.

There are fixed helmsman, and passenger seat units on portan starboard sides, each unit having storage underneath, and fitted cushions.

Other fitments in the saloon include a full length stettee berth along the starboard side, which can be extended to form a double berth as required. There is a two seat settee to port, and a full length hanging locker in the port aft area.

All the fitments in the saloon have been well made and fitted, and the tabbing to the main hull was all firm and secure

A large opening deck hatch is fitted amidships above the helmans position, and all the seats/berths etc have good fitted cushions. This area has also beeen insulated and lined, and has sliding curtains on all the windows.

GALLEY:- The comprehensive galley is sighted on the starboard aft area, with direct access from the saloon, and fitments include a gas cooker with four burners, grill, and oven, a stainless steel sink and drainer with hot and cold water supply, a fridge operated by gas or electric, and a comprehensive arrangement of storage lockers above and below.

The installation of the gas cooker was checked and found to be satisfactory, with the delivery pipe being of seamless copper, and the gas storage bottles stowed in a ventilated lockeron the aft deck.

AFT CABIN:- The aft cabin, which leads directly from the galley, is sighted in the port aft area, and has been fitted with a full sized double berth, a full length hanging locker, and a storage locker. The hull and deck head have been insulated and lined, and all the fitments are well made and fitted.

TOILET COMPARTMENT NO 2 :- The No2 toilet compartment is sighted to starboard with direct access from the galley area, and fitments include a flushing marine toilet, washand basin and unit, with hot and cold water supply. There is also a H&C mixer tap with shower head and tray, and the whole compartment is lined with formica.

The installation of the toilet was checked, and found to be satisfactory with the piped properly looped above the waterline to avoid any syphoning of water into the boat, and bothe the inlet, and outlet seavalves were in sound condition, and fully operational,

BRIDGE DECK:- The aft bridge deck is sighted on top of the aft acbin, and is fitted with an outside steering position, and dual controls. Having an elevated position this area affords excellent all round visibility when manuevering in confined areas. Other fitment on the bridge deck include a large sun bed/seat to starboard, and the area is well protected by GRP coamings, and stainless steel rails.

All the fitments in this area appeared in good condition, and securely fastened.

## 3. PROPULSION UNIT

The propulsion unit, or engine in the vessel at the time of survey was a 72Hp, 4 cylinder, Perkins 4236, inboard diesel, with a 1·5 : 1 reduction Borg Warner gearbox, mounted in an insulated compartment under the saloon sole, with good access through lifting panels with removable support beams etc.

The survey showed the engine compartment to be clean and tidy.

The engine was not started during this survey, due to the lack of cooling water, but the installation was checked, and found to be satisfactory, with the main bearers securely bonded to the inside of the hull, and the engine sitting on resilient mounts, to absorb any vibrations.

Transmission of power to the three bladed propeller, is through a marine gearbox, fixed stainless shaft, and standard sterntube, with bearings at each end.

This is a traditional, and well proven method of installation, and when, as in this instance, it has been properly carried out, usually proves very staisfactory, and reliable.

The engine appeared in good condition, and well maintained, with no sign of oil or fuel leaks around the sump, or delivery pipes, and the unit was spotlessly clean.

Other equipment in the engine compartment included, fuel tank which appeared in sound condition, and stainless calorifier connected to the heat exchanger to provide hot water to the various outlets throughout the vessel.

SPECIAL EQUIPMENT

Special equipment on board at the time of survey, included:

| | |
|---|---|
| COMPASS | STEERING |
| DEPTH SOUNDER | SEAFARER |
| FENDERS & WARPS | |
| STAINLESS PULPIT & PUSHPIT | |
| STAINLESS BOARDING LADDER | TRANSOM MOUNTED |
| STEEL KEEL SHOE | FULL LENGTH |
| CALORIFIER | STAINLESS 15 GALLS |
| CABIN HEATERS | GAS CATYLITIC |
| FRIDGE | GAS / ELECTRIC |
| BATTERIES | 4 X 6 VOLTS |
| DIODE SPLITTER | MANUAL |
| CLOCK & BAROMETER | BHD MOUNTED |
| FIRE EXTINGUISHERS | B.C.F. |
| ANCHOR | CQR |
| ANCHOR CHAIN | |

4. IDENTIFICATION OF ANY LOSS PRODUCING CIRCUMSTANCES WHICH MIGHT ARISE

Having subjected this vessel to a detailed survey, we would summarise our findings as follows:-

"INVER QUEEN" is a well designed and constructed vessel, of a type which has proved very successful, and capable over many years. The moulding of the hull and decks has been carried out using modern methods which are universally acceptable for GRP construction, and the interior fitments have been fitted, and finished to a high standard.

All the components used in the construction, and fitting out of the hull were found well made and fitted, and in sound condition.

The installation of the various cabin heaters has been checked and found satisfactory with all the delivery pipes being of seamless copper, and each unit having an individual stop cock. The gas storage bottles are stowed in a ventilated

locker on the aft deck.

We recommend that the sea valves associated with the marine toilets, are kept in the closed position when not in use, or at least ensure that they are closed when leaving the vessel unattended...

## 5. CONCLUSIONS

In conclusion, having sighted this hull externally, and internally, as far as was possible, we are satisfied that "INVER QUEEN 1V" is in a sound and seaworthy condition, and would therefore have no hesitation in recommending her to whom it might concern.

We estimate this vessels current value to be in the region of £60,000. (Sixty Thousand Pounds)

S Kirkpatrick.

## 8.2. Copy of RNLI Sea Check.

**APPENDIX 2**

**SEA CHECK**
Safety Equipment Advisory Check

Safety Equipment Advisory **Check** – 37456

**Lifeboats** Ireland

(Please use BLOCK CAPITALS)

| Title | Surname Fay | Initials |
|---|---|---|
| Address: Rosslare | | |
| Tel: | Mobile: | |
| Email: | Fax: | |

Vessel Name: Santa Christina Length: 30 ft m

Home Port/Where Kept: Rosslare

Sailing Yacht ☐ Motor Cruiser ☑ Sports Boat ☐ Sea Angling ☐

Dive Boat ☐ RIB ☐ PWC ☐ Other .....

☑ 1st Check ☐ Re-check ☐ Annual Check ☐ Yacht and Boat Safety Scheme

"I certify that this vessel is operated solely as a pleasure craft. I request and authorise this SEA Check to be conducted. I understand that this SEA Check is by way of an additional service to me. It in no way replaces or is a substitute for appropriate manufacturer warranties and proper and regular maintenance checks by qualified experts or for any government legislation which may apply to myself or my vessel and for which I acknowledge I am responsible for complying with. I further understand and agree that completion of this SEA Check indicates only that essential equipment was on board my vessel and that the Royal National Lifeboat Institution its employees, officers, servants and agents ("The RNLI") does not warrant the condition of the equipment and that the RNLI assumes no responsibility whatsoever with respect to either any services given or any opinions expressed in connection with this SEA Check. I understand that my boat and equipment details will remain totally confidential within the RNLI but that information gathered through the SEA Check service will be used to assist future accident prevention programmes."

Signed Rose Fay

Date 18/05/02

Your details will be used by the RNLI and passed to RNLI trading companies only. We never give your information to any other organisations. If you do not want to receive information about RNLI membership, the RNLI gift catalogue, lottery, special appeals or approved third party promotions please tick here. ☐ DPA

Shaded boxes denote equipment not considered necessary for category of use.
✓ = Equipment present. X = Not carried.
N/A = Not Applicable.

| Essential Equipment | Extended Passage Use | Offshore Use | Inshore Use | Sheltered Use | Tender/Inshore Craft |
|---|---|---|---|---|---|
| Anchor with warp / chain / strong point | | | | ✓ | |
| Radar reflector | | | | ✓ | |
| Appropriate navigation lights, shapes, sound signals etc | | | | ✓ | |
| Lifebuoy or similar | | | | | |
| Man overboard recovery equipment | | | | | |
| Life raft | | | | | |
| Life raft / inflatable dinghy | | | | | |
| Emergency steering | | | | | |
| 'Kill Cord' (PWCs RIBs etc.) | | | | N/A | |
| Compass | | | | ✓ | |
| Alternative means of propulsion or starting | | | | X | |
| Engine tool kit and spares | | | | X | |
| Lifejacket / buoyancy aid - per person | | | | ✓ | |
| Lifejacket 150 N - per person | | | | | |
| Safety harness / means of attachment | | | | | |
| Bailer | | | | ✓ | |
| Bucket and hand/electric pump | | | | | |
| Charts, navigation publications & nav instruments | | | | ✓ | |
| VHF | | | | | |
| Torch | | | | ✓ | |
| Pyrotechnics - in date | | | | ✓ | |
| Fire blanket - for cooking appliances | | | | ✓ | |
| Fire extinguisher(s) | | | | ✓ | |
| Temporary hull repair kit | | | | ✓ | |
| Clock/watch | | | | ✓ | |
| First aid kit | | | | | |

| Recommended Equipment | Extended Passage Use | Offshore Use | Inshore Use | Sheltered Use |
|---|---|---|---|---|
| Fair lead for anchor line | | | ✓ | |
| Mooring warp + fenders | | | ✓ | |
| Heaving line / rescue quoit | | | ✓ | |
| Boarding ladder | | | ✓ | |
| Dan buoy marker | | | | |
| Radio receiver | | | N/A | |
| VHF | | | | |
| Navtex | | | | |
| HF/SATCOM + EPIRB | | | | |
| Handheld VHF | | | | |
| Emergency aerial | | | | |
| Barometer | | | | |
| Echo sounder | | | ✓ | |
| Electronic positioning nav aid | | | | |
| Hand bearing compass | | | X | |
| Log | | | ✓ | |
| Binoculars | | | ✓ | |
| First aid kit | | | | |
| Personal protective / warm clothing | | | ✓ | |
| Emergency grab bag | | | N/A | |
| Emergency water | | | | |
| Emergency repair material | | | | |

**COMMENTS** Fire Extinguisher Needs Service

| SEA Check Area | Duration of Check: | Gold | Silver | Standard | SEA Check Adviser Signature: | ID No. |
|---|---|---|---|---|---|---|
| Ireland | 1 hr 30 min | ☐ | ☑ | ☐ | John McWeeney | 1293 |
| | | | No Award ☐ | | Print name: JOHN MCWEENEY | |

SEA Check is supported by the following organisations: Bord Iascaigh Mhara, Department of Marine and Natural Resources, Irish Coast Guard, Irish Sailing Association and Irish Water Safety.

8.3. Statements supplied to the Garda Siochana by the Kahlout family, incident witness and Gardai.

**APPENDIX 3**

**Statement of Dr. Hazem Kahlout, 116 Carpenterstown Rd., Castleknock, Dublin 15; DOB: 26.05.64; occupation: psychiatrist; taken on 19.09.02 by Sgt Thomas Conlon 18615E, Lanesboro Station.**

*I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence, I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.*

I am a psychiatrist and I work at St. Brendan's Hospital, Grangegorman, Dublin. Last week, myself, my wife Maggie, daughter Deanna, and two sons hired a cruiser from Carrick-on-Shannon for one week. Before we left Carrick-on-Shannon, Rose Fay, the owner of the cruiser, took us through the drill, safety, etc., for about one hour. We stayed in Carrick the first night. The next day, Sunday, we went up to Lough Key, and that night, we returned to Carrick and stayed there. Monday, we headed through Jamestown and ended up in Rooskey, where we stayed the night. Tuesday, we didn't travel far. We went to Tarmonbarry and just stayed the night there. Wednesday 18.09.02, we headed down to Lanesboro, arriving at about 1 o'clock. We went up the town and did some shopping. We carried the shopping back to the boat and made lunch, and had tea, and we just tidied up. We decided to head south to Portrunny. I undid the ropes at the harbour wall and got back on board to the aft deck steering. The two boys were behind me on the outer deck. My wife Maggie was in the saloon. Deanna was at the inside steering position about to start the engine. As she started the engine, there was a loud explosion. There was a flash flame, and there was debris everywhere, with doors flying, and so on. I was sort of leaning across looking in to the saloon area to see if Deanna was doing it right, and a burst of heat hit me in the face. No missiles came out of that gap. Maggie was in absolute shock, and I started to go down the step which were littered with debris, and a second explosion occurred.

We all panicked. I started pushing Maggie up the stairs, and helping her to go out. I went over and got Deanna. I had to help her out as she was in a daze. We ran out and decided to evacuate. The boat was starting to move out, and a chap from another boat pulled up back in to shore. We got into dry land. I realised Deanna was badly burned. I assessed her and decided to put her under water to freeze the burns. I took out my mobile and rang the emergency line. The emergency services soon arrived.

**Signed:** H. Kahlout
**Witnessed:** Thomas Conlon Sgt 18615E

**Statement of Maggie Kahlout of 116 Carpenterstown Rd., Castleknock, Dublin 15; DOB: 12.05.65; occupation: housewife; taken on 19.09.02 by Sgt Thomas Conlon, Lanesboro.**

*I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence, I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.*

I am a housewife and married to Hazem Kahlout. On Saturday September 14, myself, my husband, three children, headed from Dublin to Carrick-on-Shannon where we were to pick up a cruiser on the Shannon for one week. We eventually arrived in Lanesboro on Wednesday 18.09.02. We had lunch on the cruiser. After lunch we tidied up and decided to head for Portrunny. My husband and the two boys were on the outer deck, as far as I knew. I was inside in the saloon, and my daughter Deanna was up at the steering. She was starting the engine when a huge explosion occurred. There was a flash of heat and everything was flying everywhere. I didn't realise what was happening. I thought maybe the roof was falling in. I saw the piece of floor just shoot up into the air, and hit me on the head. Hazem was trying to pull me up on the steps, and a second explosion occurred. I think that's when I hurt my ankle, when I slipped down the steps. I knew that Hazem had gone in for Deanna. After a while, I remember the emergency services coming. At that time I was putting water on my face to cool it down.

**Signed:** **Maggie Kahlout**
**Witnessed:** **Thomas Conlon Sgt 18615E**

**Statement of Rose Fay, Aughavilla, Belturbet, Co. Cavan made to Sgt Thomas Conlon, Lanesboro on 19.09.02.**

*I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence, I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.*

I am the owner of the Santa Christina, a six-berth cruiser. It is known as a six plus two - the two is in the lounge where you can pull out the seat to accommodate two extra people. I bought the vessel about six years ago at a cost of £45,000. I have the vessel on private hire. I am always very thorough about the condition in which I let the cruiser out. At the time I bought it, I had a thorough survey carried out on it, and I still have the survey. The gas fridge wasn't working a few months ago and I had it replaced with a battery one. I also had the cooker replaced with a very expensive one. Last year, on the recommendation of the mechanic, I paid the sum of £1500.00 to have the gas heating system replaced with a blow-air system. This still had not been carried out, but the mechanic assured me he would do it this coming winter. This said, the heating system that was in it was very good, and it was only on the recommendation of the mechanic that I was changing it. He felt the less gas you have on board, the safer it would be. I used the heating in the lounge area myself two weeks ago to dry it out, and it was fine. During the months of June, July & August, I hire out the boat on a weekly basis, but outside of this, it could be shorter breaks. This year, the boat is available for hire on the Website, and it was hired by Hazem Kahlout for the week beginning Saturday 14.09.02. I showed this family through the boat and familiarised them with the safety drill. The man seemed to know a bit about it. A mechanic came down on that Saturday and spent two hours approx. checking the engine because the previous people had a slight problem starting it on one occasion. He checked it over and it was fine. The only contact I had from Hazem was on the Tuesday

and it was the same thing – it wouldn't start. I told him to leave it a few minutes and I would call him back in half an hour. As I spoke to him, it started. This was about 2pm on Tuesday. He said they were quite happy and having a lovely time. The next I heard was about 5.30pm on Wednesday 18.09.02, that there was an explosion in the boat. I was devastated, as I am always so careful about it. The boat is fully insured, as are those on board. I have completed all boat handling courses, and water safety courses up to lifeguard.

**Signed:** **Rose Fay**
**Witnessed:** **T. Conlon Sgt**

**Statement of Michael Napier, Slipaway, The Harbour, Lanesboro, Co. Longford; DOB: 25.06.82; occupation: unemployed; taken on 25.09.02 by Gda Seamus Farrell of Lanesboro Station.**

*I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence, I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.*

I am from 35 Lower Rudyerd St., North Shields, Newcastle, England. About three weeks ago, I came over to Ireland to visit my father. He lives on a boat called the Slipaway at the Harbour, Lanesboro. On Wednesday 18.09.02, between 4pm and 5pm, I was inside my father's boat when I heard a loud explosion, and the sound of a girl crying. I got up and was going to open the door of the cabin, when I heard a second explosion and more screams. I went outside and I looked across at a cruiser, which was beside the harbour wall. This cruiser was called the "Santa Christina". I went straight over to the cruiser, which was untied. There was smoke in the cabin and two windows had been blown out. When I got the cruiser tied up again, I assisted a young girl to get off the boat. She was crying and her right arm and face were starting to blister from burns. There was also a lady who had burns to her head. The man on the cruiser had cuts and bruises to his arms. There were also two young boys, but they seemed to be physically OK. The man was treating the girl by putting her under a cold tap, and he also contacted the emergency services with his mobile phone. I had noted that doors had been blown off inside the cabin, and shelves were damaged. I left the scene to go to the river bridge so that I could direct the emergency services to the cruiser. The Gardai, Fire Brigade, and Ambulance, arrived on the scene, and were present when I returned to the cruiser. I have heard this statement read over to me and it is correct.

**Signed:** **M. Napier**
**Witnessed:** **Seamus Farrell Gda 21749B**

**Statement of P.J. Hynes of Barnacor, Lanesboro, Co. Longford; DOB: 06.08.60; occupation: fire station officer; taken on 25.09.02 by Gda Seamus Farrell, Lanesboro Station.**

*I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence, I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.*

I am the fire station officer for Lanesboro fire brigade. At 16.48 (4.48pm) on Wednesday 18.09.02, we received a call from Fire Brigade Control, Dublin to go to the Marina, Lanesboro. It was a reported gas explosion. We went to the Harbour where we found a cruiser with two windows blown out. It was called Santa Christina, navigation no. 3663. There were five persons on the quay. Hazan Kahlout had been on the cruiser with his wife, Margaret, daughter Deanna and two young sons. Deanna had burns to her arm and face. Margaret had scorch marks to her hair, and it was suggested that she had got a knock to her head with a door. Hazan was in a shocked state. Two ambulances brought the family to Roscommon hospital. On checking the cruiser, I noted that the engine panels were out of place. The toilet was upturned, and other items were in an untidy state. A fireman disconnected a gas cylinder in a rear compartment, and it was left on the quay with another full cylinder from the same compartment. We left the scene at approx. 17.25 (5.25pm) and returned to the fire station, as there was no other apparent danger. This statement was been read over to me and it is correct.

**Signed:** P.J. Hynes
**Witnessed:** Seamus Farrell Gda 21749B

**Statement of Evidence of Sgt Thomas Conlon of Lanesboro Garda Station made on 08.10.02.**

*I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence, I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.*

I am a Sergeant of An Garda Siochana stationed at Lanesboro, Co. Longford. At 4.55pm on Wednesday 18.09.02, I received an emergency call to go to the scene of an explosion at a place known as the Old Harbour, Ballyleague, Lanesboro. I arrived at the scene at 5.05pm, where I saw a large cruiser known as the Santa Christina moored in the harbour. I met a man who gave me his name as Dr. Hazem Kahlout at the scene. He informed me that he was the hirer of the cruiser, and that there had been an explosion on board earlier. I saw his daughter, Deanna, aged 9 years; she had facial burns, and her skin was blistered. She was under a cold water tap as emergency treatment. She appeared very upset and traumatised. I also saw her mother, Maggie Kahlout, at the scene. Her face also appeared scorched and reddish-pink in colour. She seemed to have a bruise on her forehead. I also saw two boys from the family who didn't appear to be injured. I met a witness, Michael Napier, who heard the two explosions on the cruiser. We waited a short while for the fire brigade and ambulance to arrive at the scene. All members of the Kahlout family were taken away by ambulance to Roscommon hospital. I was present when fire brigade members disconnected the Calor Gas cylinder at the stern end of the boat, and placed it and another full cylinder on the harbour walkway. From a visual inspection of the outside of the cruiser, I noticed that a window on the front cabin and two rear windows were blown out. On examination of the inside of the cruiser, it was evident that doors had been blown off their mooring, and several items displaced, including the heavy floor section covering the engine compartment. The toilet was also removed from its mooring and thrown over. A panel at the rear of the

boat was broken. I believed that the incident was caused by gas explosions on the boat. I immediately undertook to have the scene preserved for technical examination. At 11am on 19.09.02, I met D/Gda Michael Keating from Ballistics Section at Garda Headquarters and Sgt Sean Leydon, Athlone, photographer, at the boat. They commenced to carry out full examination, and take photographs of the scene. Later that day, I also met Michael Glennon, Calor Gas, at the scene, and Mr. C.J. Uglow, Engineer from the Dept of Communications, Marine and Natural Resources.

**Signed: T. Conlon Sgt 18615E**

8.4. Photos of interior damage to the "Santa Christina".

## 8.5. Statement from Detective Garda Michael Keating of the Garda Technical Bureau.

**APPENDIX 5**

**STATEMENT OF EVIDENCE OF DETECTIVE GARDA MICHAEL KEATING, 20145F, BALLISTICS SECTION, GARDA TECHNICAL BUREAU, GARDA HEADQUARTERS, DUBLIN 8.**

I am a member of An Garda Siochana attached to the Ballistics Section of the Garda Technical Bureau. My duties include the technical examination of scenes of explosion and the subsequent giving of evidence in court in relation to my findings.

On Thursday the 19th of September 2002, I went to the scene of an explosion on board the cruiser "Santa Christina" which was moored alongside the harbour wall at Ballyleague, Co. Roscommon. The vessel and the area surrounding it were preserved by Garda Seamus Farrell of Lanesborough Garda Station, Co. Longford. The scene was pointed out to me by Sergeant Thomas Conlon, also of Lanesborough Garda Station. Sergeant Sean Laydon, official Garda photographer attached to Athlone Garda Station, accompanied me during my examination.

Externally the cruiser appeared to be in good post explosion condition, excepting blast damage to three windows.

Internally I found that the fixtures and fittings of the vessel were in some disarray. All covers to the bilge had been blown upwards. Doors had been blown off the hinges and been propelled considerable distances. The rear wall consisting of plywood had been broken and forced inwards away from the void behind. The domestic gas cooker had moved slightly forward from its original position. The W.C. was uprooted and the compartment damaged. Some of the gas heaters, although still attached to the pipe line, had been shaken from the wall.

I noted all except one of the gas taps servicing the appliances were in the "off" position. The tap to the domestic gas cooker was in the "on" position. I noted also on this cooker that the second knob from the right, which governs the gas supply to the right front burner, was in the 11 o'clock position. This position is used when a low flame is desired on the relevant burner.

Later that day I met Mr. Michael Glennon, District Supervisor for the Calor Gas Company. An my request he carried out safety checks to determine the presence of any residual gas till lingering in the bilge of the vessel, with negative results. He also tested the regulator which attaches to the domestic gas bottle. It was found to be in order. He tested the whole gas system fitted to the vessel for any apparent leaks. The system was found to be in good working order.

I also met Mr. Chris Uglow, an engineer and ships surveyor with the Department of the Marine and Natural Resources. He carried out his own investigation on the vessel.

As a result of information received, I carried out a technical examination on the starter motor fitted to the diesel engine on this vessel. I found that the three retaining bolts were not tight resulting in the starter motor being loose in its housing. When grasped by ones hand, it could be moved approximately ½ inch in any direction. Two of the bolts appeared to be so long that large nuts had been used on their shafts to take up the slack. The two self tightening nuts on these bolts were slack. The third retaining bolt and nut, although out of sight, was loose to the touch.

When the ignition key was used to engage the starter motor, an electrical arc of approximately 1½ inches long developed between the starter motor body and the engine short block. This occurred each time the ignition key was utilised for this purpose.

From my examination of the vessel and its equipment, it would appear that gas escaping from the right front burner of the domestic gas cooker entered the bilge. When an attempt was made to start the engine using the ignition key, the electrical arc already described occurred and was quite sufficient to ignite the gas present in the bilge. The subsequent explosion caused the injuries and damage report.

While at the scene, Sergeant Laydon took a quantity of photographs of the vessel and its equipment.

I informed Sergeant Conlon of my findings.

I hereby declare that this statement is true to the best of my knowledge and belief and that I make it knowing that if it is tendered in evidence I will be liable to prosecution if I state in it anything which I know to be false or do not believe to be true.

Michael Keating Detective Garda
(MICHAEL KEATING) 20145F

## 8.6. Statement from Michael Glennon of Calor Gas.

**APPENDIX 6**

CALOR GAS

Calor Gas, Long Mile Road, Dublin 12. Tel: 450 5000, 450 7022. Telex: 93693. Fax: 450 6070
Email: sales@calorgas.ie
Website: www.calorgas.ie

# *Statement for Gardaí*

SUBMITTED BY: Michael Glennon, Calor Gas
DATE: 20th September, 2002.
RE: Explosion on Santa Christina

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On Thursday, 19th September, 2002 I received a request from Sargent Tom Conlon, Lanesboro Garda Station to check a cabin cruiser moored in Old Harbour Ballyleague, Co. Roscommon. The property belongs to Ms. Rose Faye, Belturbet, Co. Cavan (086 273 0721) and was leased to the Kahlout family.

There was a suspected gas explosion on board the Kahlout vessel the previous evening. When I arrived at the scene I met Detective Garda Michael Keating, Ballistics Department, Technical Bureau, Garda Headquarters. Detective Garda Keating explained that his concerns was that gas may be laying in the lower parts of the boat.

With GMI Explosimeter I checked all parts of the boat starting at the top and working my way down. No trace of gas was found.

We then tested the gas installations for gas soundings. This test was carried out by removing the click on regulator and attaching a digital manometer to the flexible hose in the gas storage compartment. The gas lines up to the isolation valves at appliances was tested, all of which were in the off position with the exception of the isolation valve at the New World gas cooker.

The gas line was charged with air to 32MB and left to stabilise. The test commenced at 15.03 p.m. with pressure at 28.3MB. After 5 minutes the pressure was checked again and it had dropped to 23.1MB.

I then checked the Kosangas click on regulator which was dated February, 1979. Static pressure was 32.5MB and working pressure was 31MB. The gas hose connecting the regulator to the copper piping was dated January, 1986.

CALOR GAS

Calor Gas, Long Mile Road, Dublin 12. Tel: 450 5000, 450 7022. Telex: 93693. Fax: 450 6070
Email: sales@calorgas.ie
Website: www.calorgas.ie

Tests carried out used the following equipment:

* Explosimeter , Serial Number 1-3999, next calibration date is 28th February, 2003.
* Digital Manometer calibrated instrument, number SS4LE, calibration date 24th July, 2002, next calibration date is 23rd July, 2002.

All of the above tests were carried out in conjunction with Detective Garda Michael Keating, Ballistics Department, Technical Bureau, Garda Headquarters. Also present was Mr. C.J. Uglow, Engineer and Ship Surveyor, Marine Survey Office, Department of the Marine and Natural Resources.

8.7. Marine Notice No. 1 of 2002.

**APPENDIX 7**

Department of the Marine and Natural Resources

*Roinn na Mara agus Acmhainní Nádúrtha*

# Marine Notice No 1 of 2002

**To all shipbuilders, ship repairers, owners, masters, skippers, officers, ratings and crew of merchant ships, fishing vessels, pleasure craft and other users of marine craft.**

**Use of liquefied petroleum gas (LPG) installations and systems on merchant vessels, fishing vessels, pleasure craft and other marine craft.**

**Withdrawal of Marine Notice No 25 of 1991**

Marine Notice No 25 of 1991 Re: Use of Liquefied Petroleum Gas (LPG) in Domestic Installations and Appliances on Ships, Fishing Vessels, Barges, Launches and Pleasure Craft is hereby withdrawn.

**Preamble**

Marine Notice No. 25 of 1991 dealt with the dangers associated with the use of LPG on smaller marine craft. This new Marine Notice is intended to update and reinforce the information and advice given in Marine Notice No 25 of 1991. Whilst the Department of the Marine & Natural Resources recognises that, when handled and used correctly, LPG is a cost effective and versatile fuel for use on marine craft it would urge vessel owners, operators, masters and skippers to consider the use of other fuels such as electricity or gas oil for end appliances.

**General**

Due to the continuing use of LPG systems on smaller cargo ships, fishing vessels, pleasure craft and other marine craft the Department of the Marine & Natural Resources wishes to draw attention to the dangers, which may accompany their use.

The dangers associated with LPG systems when handled incorrectly include fire, explosion, burns and asphyxiation due to gas leakage from the system or accumulation of gas following flame failure in an appliance. Such incidents have caused loss of life and material damage. To help prevent accidents with

LPG systems such systems should be installed in accordance with the International Standard ISO 10239:2000.

As with any open flame type appliance there is risk of asphyxiation due to oxygen depletion of the atmosphere and carbon monoxide poisoning where an open flame appliance is operated in an area with inadequate ventilation or where the flame is incorrect.

It is dangerous to sleep in spaces where open flame type appliances are operated and heaters without flues should not be sited in sleeping quarters, adjoining spaces or in any unventilated spaces.

The use of open flame heaters and LPG refrigerators with non-enclosed burners is not in accordance with ISO 10239:2000

LPG is supplied in pressurised cylinders and is usually propane, butane or a mixture of the two gases. Cylinders must be clearly marked with their contents. LPG has a stenching agent added to enable the presence of gas to be detected by smell even when its concentration in air is below its lower explosive limit. Butane systems operate at final pressure of 28 mbar and propane systems at 37 mbar. Appliances should be checked to verify which gas they consume. **Natural gas appliances are not suitable for use with LPG.**

Propane cylinders are to be stored outside in a cylinder housing whilst butane cylinders may be located in a cylinder housing or a cylinder locker. All cylinders must be stored and used upright. LPG systems draw off the vapour phase of the gas from the top of the cylinder whilst the liquid phase remains in the bottom of the cylinder.

LPG is heavier than air and any leakage will tend to fall to the bottom of a compartment. Gas may travel some distance like this and will form an explosive mixture with the air in the compartment. A spark as small as the static discharge from clothing may ignite such a mixture.

In conjunction with any LPG system the provision of an automatic gas detection and alarm system of a reliable type is strongly recommended and is required when an LPG appliance is installed in spaces below decks. It is essential that any electrical equipment associated with the gas detection and alarm system is certified as flame proof or intrinsically safe for the gas being used.

All LPG systems should be installed at least in accordance with the International Standard ISO 10239:2000 and with the appendix to this Marine Notice, which includes the main points of ISO 10239:2000.

The Department of the Marine & Natural Resources wishes to stress the importance of obtaining expert advice regarding the installation of LPG systems. The Department of the Marine & Natural Resources recommends

that an inspection and test of such systems and associated alarm systems be carried out at least monthly to ensure their correct operation.

Any enquiries concerning this Marine Notice should be addressed to:

Marine Survey Office
26/27 Eden Quay
Dublin 1.

Phone 01 8744900
Fax 01 8724491
Email mso@marine.gov.ie

Secretary General
Department of the Marine & Natural Resources
Leeson Lane
Dublin 2
7th January 2002

# Appendix

## Definitions

**Accessible**
Capable of being reached for inspection, removal or maintenance without removal of a permanent part of the craft structure with or without the use of tools.

**Cylinder housing**
A ventilated enclosure intended solely for the storage of one or more LPG cylinders, pressure regulators and safety devices and located on the exterior of the craft where any leakage would flow overboard.

**Cylinder locker**
A vapour tight enclosure with an overboard drain intended solely for the storage on one or more LPG cylinders in a cockpit or recessed into the craft.

**Flame supervision device**
Device that has a sensing element, activated by the presence or absence of a flame that causes the inlet of the LPG supply to a burner to be opened or closed.

**Intrinsically safe**
Denotes that an electrical circuit or apparatus is so constructed, installed and operated such that it is incapable of causing an ignition of any LPG leakage or mixture in air.

**LPG appliance**
End consumer of an LPG system, which may include but not be limited to any of the following: cooker, hob, refrigerator, space heater, water heater, dryer etc.

**LPG liquefied petroleum gas**
Propane, butane or a mixture of the two gases maintained in the liquid state by storage in cylinders under pressure.

**LPG system**
System consisting of an arrangement of cylinder, safety devices, pressure regulators, connections, valves, piping, tubing, hoses, fittings, and devices intended to store, supply, monitor, or control the flow of fuel gas up to and including the appliance.

**Mechanical ventilation**
Air supply or exhaust to an appliance or space provided by a mechanical means e.g. power driven fan.

appliance to access the valve. If there is only one appliance in the system and the main shut off valve at the cylinder is readily accessible from the appliance, the low-pressure side shut off valve need not be fitted.

All shut off valves are to be clearly marked to indicate their function and the open and closed positions.

Gas detectors should be provided in each compartment containing an LPG appliance. Gas detectors should be positioned and secured in the lower part of the compartment containing the appliance and be of a type which will be actuated promptly and automatically by the presence of gas concentration in air of not more than 0.5%. Gas detectors should incorporate an audible and visual alarm. All electrical connections should be flame proof or intrinsically safe and the alarm unit / indicating panel should be located outside the compartment containing the appliance and the cylinder housing or locker but visible and audible from within the vicinity of the appliance. Gas detectors should be arranged to automatically cut off the supply of gas from within the cylinder housing or locker in the event of gas leakage being detected.

Carbon monoxide detectors should be provided in each compartment containing LPG appliances.

Smoke and/or heat detectors should be provided in each compartment containing LPG appliances.

**Appliances**

All LPG appliances fed from an LPG system shall be designed for use at the same working pressure.

Only appliances designated by the manufacturer for use with LPG in a marine environment shall be installed in the system. All appliances shall be fitted strictly in accordance with the manufacturers instructions.

Each LPG appliance shall be securely fixed to the craft. Gimballed appliances shall have the supporting structure securely attached to the craft. Gimballed appliances shall not have their free movement obstructed.

Each LPG appliance shall have flame supervision devices that shut off the supply off gas to the burner in the event of flame failure.

Each LPG appliance shall be clearly marked with the type of fuel gas to be used.

All unattended appliances shall be of the room sealed type with air intake and flue for outgoing products of combustion terminating outside the craft and with the combustion chamber contained in a totally enclosed shield.

- Compression fittings of copper alloy with solid or thick walled copper rings on copper piping
- Stainless steel rings on stainless steel piping

Joints shall be made without jointing compound on flared or compression fittings.

## Ventilation

Compartments containing an LPG appliance should not have access doors or openings to accommodation spaces or their passageways. Where this is impractical mechanical exhaust ventilation should be trunked to within 300 mm of the deck or floor adjacent to the appliance and adequate inlet ventilation should be provided.

Mechanical ventilation should be designed and installed to eliminate incendive sparking due to friction or impact of the impeller with the fan casing. Electric motors driving fans should be located outside the space, preferably outside the trunking and clear of the outlet. Intrinsically safe motors should be used where this cannot be achieved. Ventilation outlets should be separate from ventilation provided for cylinder housings and lockers and located away from any intakes and sources of ignition.

Compartments, containing an LPG appliance, which are situated on an open deck with direct access to the open deck and no opening direct to accommodation spaces or their passageways should also be adequately ventilated preferably by mechanical means.

In small craft where it is impracticable to provide mechanical ventilation as described above all compartments containing LPG appliances should have adequate natural ventilation, which will prevent a dangerous accumulation of gas. Notwithstanding the need on some craft to be able to close ventilators against the ingress of water in bad weather, ventilation provided for LPG systems should never be closed. If it is necessary to close ventilation provided for LPG systems the systems should be turned off and the gas supply isolated.

Natural ventilation provided for LPG systems should provide for the extraction of any gas leakage from the system and for the supply of fresh air. LPG is heavier than air and therefore exhaust trunking should be led from the lowest point in a compartment to the open air. Natural exhaust ventilation may be enhanced by the use of self-trimming cowls or rotary exhauster heads.

Ventilation, mechanical or natural, should not interfere with the flame pattern of an LPG appliance such that it may extinguish the flame or cause incomplete combustion of the gas.

- All appliances, including the function of the flame supervision devices and pilot lights shall be subjected to a burner function test following the system pressure test. A visual check for flame lift off due to excessive pressure at individual burners should be made. Also a check for adequate flame height with all burners in the system operating to ensure adequate but not excessive working pressure at each appliance.

**Emergency Action**

A notice detailing the action to be taken when a gas leak is detected, or a fault with the system is discovered, should be prominently displayed on board the vessel. The notice should include at least the following:

The need to be alert for gas leakage.

The action to be taken in the event of gas leakage being discovered.

The use and location of fire extinguishing equipment on board the vessel.

Any appliance instructions relating to the safe operation of appliances.

The location of shut off valves.

The need to extinguish all flames, cigarettes and not to operate any electrical or other equipment which may induce a spark.

8.8. Marine Notice No. 25 of 1991.

**APPENDIX 8**

**Department of the Marine**

# Marine Notice

NO. 25 OF 1991

NOTICE TO SHIPBUILDERS, OWNERS, MASTERS, SKIPPERS, OFFICERS AND SEAMEN OF MERCHANT SHIPS AND FISHING VESSELS, OWNERS AND BUILDERS OF PLEASURE CRAFT AND TO OTHER USERS OF MARINE CRAFT.

RE: USE OF LIQUEFIED PETROLEUM GAS (LPG) IN DOMESTIC INSTALLATIONS AND APPLIANCES ON SHIPS, FISHING VESSELS, BARGES, LAUNCHES, AND PLEASURE CRAFT

EXPLOSIONS, FIRES AND ACCIDENTS RESULTING FROM LEAKAGE OF GAS

1. In view of the considerable use on smaller cargo ships, fishing vessels, tugs, barges, launches and pleasure craft of bottled hydrocarbon gases for cooking, water and space heating, refrigerators, etc., the Department wishes to draw attention to the possible dangers which may accompany their use and to the need for installations to comply at least with the requirements of British Standard Institution publication BS 5482: Part 3: 1979- the code of practice for domestic butane and propane gas-burning installations; Part 3: Installations in boats, yachts and other vessels. Individual appliances and fittings should comply with the relevant British Standard Specifications listed in BS 5482: Part 3: 1979, some of which are give at Appendix 1.

2. The possible dangers associated with the misuse of such installations include fire, explosion and asphyxiation due to the leakage of gas from appliances, storage containers or defective fittings or due to an accumulation of gas following flame failure. Incidents may result in loss of life and sometimes cause serious material damage. The siting of gas consuming appliances and storage containers and the provision of adequate ventilation of the spaces containing them are consequently most important.

3. In addition to the risk of asphyxiation should the leakage or accumulation of gas occur in an enclosed space, there is also the risk of carbon monoxide poisoning when the appliance is in use. It is dangerous to sleep in spaces where gas-consuming open-flame appliances are left burning and it follows that heaters without flues should not be sited in areas designed as sleeping quarters or in unventilated spaces communicating directly with such areas.

4. Furthermore, open-flame heaters and gas refrigerators with non-enclosed burners may present a serious hazard from the fire and explosion aspects and if possible, their use should be avoided.

5. The gases most commonly used for domestic Liquefied Petroleum Gas (LPG) installations in ships are butane or propane. A stenching agent is added to enable the presence of gas to be detected by smell even when its concentration in air is below its lower limit of flammability.

6. It is important to remember with LPG installations that the gases, although heavier than air, if released, may travel some distance tending to fall to the bottom of a compartment. Here they diffuse and may form an explosive mixture with air, as in the case of petrol vapours.

7. A frequent cause of incidents involving LPG Installations is the use of unsuitable fittings or the replacement of items such as flexible hoses with temporary rubber or plastic tubing. It is essential that any repair or replacement part is in accordance with the original specification of the equipment as detailed in BS 5482: Part 3: 1979.

8. In view of the elements of danger in the use of LPG installations a warning notice in red should be displayed adjacent to each appliance to read as follows:

**WARNING**

1. **DO NOT LIGHT IF LEAKAGE IS SUSPECTED.**
2. **BEWARE OF ANY UNUSUAL SMELL AS THIS MAY INDICATE LEAKAGE FROM THE APPLIANCE.**
3. **DO NOT CHECK FOR LEAKS WITH A NAKED FLAME.**
4. **MAINTAIN GOOD VENTILATION AT ALL TIMES.**

9. In conjunction with any LPG installation the provision of an automatic gas detection and alarm system of a reliable type is strongly recommended and is absolutely necessary when a cooking or other gas consuming appliance is fitted in sleeping or other spaces below decks. It is essential that any electrical equipment associated with the gas detection and alarm system should be certified as being flame-proof or intrinsically safe for the gas being used.

10. As expressed above LPG installations should at least comply with the requirements of BS 5482: Part 3: 1979 but the Department also wishes to stress the importance of obtaining expert advice regarding the fitting of LPG installations and of the need to ensure that such installations and associated alarm systems receive adequate (and expert) maintenance in service.

11. BS 5482: Part 3: 1979 deals very fully with all aspects of LPG installations but some general comments are made in Appendix 2 as all users of such installations may not have access to this publication or to the selection of individual specifications listed at Appendix 1.

This Notice replaces Marine Notice No. 19 of 1983.

Fionan S. O'Muircheartaigh,
Runai

Department of the Marine,
Dublin 2.

3rd December, 1991

## APPENDIX 1

## SELECTION OF RELEVANT BRITISH STANDARD SPECIFICATIONS

BS 2491 Domestic cooking appliances for use with liquefied petroleum gases.

BS 2773 Domestic single room space heating appliances for use with liquefied petroleum gases.

BS 2871 Copper and copper alloys, Tubes,

Part 1, Copper tubes for water, gas and sanitation.
Part 2, Tubes for general purposes.

BS 2883 Domestic instantaneous and storage water heaters for use with liquefied petroleum gases.

BS 3016 Pressure regulators and automatic change over devices for use with liquefied petroleum gases.

BS 3212 Flexible rubber tubing and hose (including connections where fitted and safety recommendations) for use in LPG vapour phase and LPG/air installations.

BS 3605 Seamless and welded austenitic stainless steel pipes and tubes for pressure purposes.

BS 4104 Catering equipment burning liquefied petroleum gases.

BS 4368 Carbon and stainless steel compression couplings for tubes.

Part 1, Heavy series.
Part 3, Light series (metric).

BS 5045 Transportable gas containers.

Part 2, Steel containers up to 130 litres water capacity with welded seams.

BS 5314 Specification for gas heater catering equipment.

BS 5386 Specification for gas heating appliances.

Part 1, Gas burning appliances for instantaneous production of hot water for domestic use.

## A P P E N D I X 2

## GENERAL COMMENTS ON LPG INSTALLATIONS

### 1. Stowage of gas containers

Wherever possible gas containers should be stowed on the open deck or in a well-ventilated compartment on deck so that any gas which may leak can disperse rapidly. Where deck stowage is impracticable and the containers have to be stowed in a compartment below deck, such a space should be adequately ventilated to a safe place and any electrical equipment in the space should be of flame-proof construction. In all cases stowage should be such that the containers are positively restrained against movement, preferably in secure mountings specially designed for the purpose. On multiple container installations a non-return valve should be placed in the supply line near the stop valve on each container. If a change-over device is used it must be provided with non-return valves to isolate any depleted container. Where more than one container can supply a system it should not be put into use with a container removed. Where stowage below deck or use of appliances in accommodation is unavoidable, an added precaution is the provision of remote closure of the main gas supply from the containers. Containers not in use or not being fitted into an installation should always have the protecting cap in place over the container valve. Containers should never be lifted by means of a rope around the valve.

### 2. Stowage of spare and empty gas containers

It is important that the stowage of spare and empty gas containers receive the same consideration as the positioning of operating containers, particularly with regard to ventilation and electrical equipment should the spare containers be stowed below decks.

### 3. Automatic Safety Gas Cut-off Devices

A device should be fitted in the supply pipe from the gas container to the consuming appliances which will shut off the gas automatically in the event of loss of pressure in the supply line, e.g. should a connecting pipe fracture. The device should be of a type which requires deliberate manual operation to re-set it to restore the gas supply. It is strongly recommended that all gas consuming devices should be fitted, where practicable, with an automatic shut-off device which operates in the event of flame failure.

4. **Open-flame heaters and gas refrigerators**

Where such appliances are installed, they should be well secured so as to avoid movement and be preferably of a type where the gas flames are isolated in a totally enclosed shield, arranged in such a way that the air supply and combustion gas outlets are piped to the open air. However, in the case of refrigerators where the burners are fitted with flame arrestor gauzes, shielding of the gas flame may be an optional feature. Refrigerators should be fitted with a flame failure device and flueless heaters should be selected only if fitted with atmosphere-sensitive cut-off devices to shut off the gas supply at a $CO_2$ concentration of not more than 1.5 per cent by volume. Heaters of the catalytic type should not be used.

Heaters of the portable type which contain an LPG cylinder inside the heater cabinet should never be used on board a ship in any space.

5. **Fittings and Pipework**

Solid drawn copper alloy fittings or stainless steel tube with appropriate compression or screwed fittings are recommended for general use for pipework for LPG installations. Aluminium or steel tubing and any materials having a low melting point such as rubber or plastic should not be used. Lengths of flexible piping (if required for flexible connections) should be kept as short as possible, be protected from inadvertent damage and comply with the appropriate British Standard.

6. **Ventilating Arrangements**

(a) It is highly desirable that compartments containing a gas-consuming appliance should not have access doors or openings direct to accommodation spaces or their passageways, but where this is impracticable it is advisable that mechanical exhaust ventilation trunked to within 12 inches of the floor adjacent to the appliances and adequate inlet ventilation be provided.

(b) Compartments containing a gas-consuming appliance which are situated upon an open deck with direct access to the adjacent deck and with no opening direct to accommodation spaces or their passageways should also be adequately ventilated, preferably by mechanical means.

(c) In pleasure craft and in some small ships where it may be impracticable to provide the mechanical ventilation referred to in sub-paragraphs (a) and (b) above, all compartments where gas-consuming devices are used should have adequate natural ventilation of a type which cannot readily be closed and which will prevent a dangerous accumulation of gas. The ventilation should provide for extraction of any gas which might leak from the system, as well as providing a fresh air supply. Since the gas, which is heavier than air, tends to fall to the lowest level, exhaust ventilation openings should be led from a position low in the space. Such ventilation might be provided by wind-actuated self-trimming cowls or rotary exhauster heads.

(d) When mechanical ventilation is fitted to any space in which gas containers or gas-consuming appliances are situated, the materials and design should be such as will eliminate incendive sparking due to friction or impact of the fan impeller with its casing. Electric motors driving fans should be situated outside the space and also, whenever practicable, outside the ventilation trunking and clear of outlets, but suitably certified flame-proof motors should be used if this cannot be achieved. Ventilator outlets should be in a safe area free from ignition hazard. Ventilation systems serving spaces containing storage containers or gas-consuming appliances should be separate from any other ventilation system. Mechanical exhaust ventilation trunking should be led down to the lower part of the space adjacent to the appliance.

(e) In cases where loss of life has occurred due to asphyxiation or carbon monoxide poisoning the ventilation system has been found to be deficient because ventilators have been interfered with or neglected. It is not unusual to find ventilators deliberately blocked, and butterfly and sliding ventilators have been found to be in the closed position and immovable. The importance of adequate ventilation of spaces containing gas consuming appliances cannot be too strongly emphasised and on no account must a ventilation system be interfered with so as to prevent it functioning correctly.

(f) Whilst adequate ventilation is a prerequisite for safety, consideration should be given to the siting of gas-consuming appliances in relation to the ventilating system such that air turbulence does not bring about the extinction of unshielded gas flames and thus permit the escape of gas.

7. <u>Gas Detection</u>

Suitable means of detecting the leakage of gas should preferably be provided in each compartment containing a gas-consuming appliance and where this is a detector, it should generally be securely fixed in the lower part of the compartment in the vicinity of the gas-consuming appliance. Any gas detector should preferably be of a type which will be actuated promptly and automatically by the presence of a gas concentration in air not greater than 0.5 per cent (representing approximately 25 per cent of the lower explosive limit) and should incorporate an audible and a visible alarm, although on small craft a portable manually operated detector may be used. Where electrical detection equipment is fitted it is essential that it should be certified as being flame-proof or intrinsically safe for the gas being used. In all cases where detection and alarm equipment are used, the alarm unit and indicating panel should be situated outside the space containing the gas storage and consuming appliances.

Similar provision for automatic gas detection and alarm should also be make in small vessels, such as pleasure craft and barges, if a cooking or other gas-consuming appliance is fitted in sleeping or messing spaces below deck.

Detectors can be rendered unsafe for use in explosive atmospheres by inexpert servicing, particularly in respect of arrangements for sealing off the detection chamber. Any maintenance should therefore be carried out by persons competent to do so or by replacement of the detection unit.

In all cases the arrangements should be such that detection devices can be tested frequently whilst the craft is in service.

8. Emergency Action

A suitable notice detailing action to be taken when an alarm is given by the gas detection system should be displayed on board the craft. In addition, the information given should include the following:-

(a) the need to be always alert for gas leakage;

(b) when leakage is suspected all gas-consuming appliances should be shut off at the main supply from the container and no smoking should be permitted until it is safe to do so. NAKED LIGHTS SHOULD NEVER BE USED AS A MEANS OF LOCATING LEAKS;

(c) the correct use and maintenance of fire extinguishing appliances of which an adequate number should always be carried;

(d) the need for users to be fully aware of the contents of the consumer instructions and emergency procedures issued in accordance with clause 22 of BS 5482: Part 3: 1979.

# NOTES