

Report of investigation into

Fire in main galley of

Edinburgh Castle

on 21 August 1998

Extract from
The Merchant Shipping
(Accident Reporting and Investigation)
Regulations 1999

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the causes with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

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GLOSSARY OF ABBREVIATIONS

AB	:	Able seaman
CO ₂	:	Carbon Dioxide
DETR	:	Department of Environment Transport and the Regions
DOC	:	Document of Compliance
DPA	:	Designated person ashore
HSE	:	Health and Safety Executive
ISM Code	:	International Safety Management Code
MCA	:	Maritime and Coastguard Agency
m	:	metres
PA	:	Public address
SCBA	:	Self contained breathing apparatus
SMM	:	Safety Management Manual
SOLAS	:	The International Convention for the Safety of Life at Sea

SYNOPSIS

Edinburgh Castle was a 32,353gt Italian built, UK registered Class 1 passenger ship, operated in the cruise market by Lowline Ltd.

On the morning of 21 August 1998, the galley crew began preparing breakfast for passengers. The vessel was on passage from Lisbon to Liverpool with 1000 passengers and 500 crew on board. Shortly after 0700 a galley fire was reported to the bridge by a fire patrol, operating in the galley because its loop of the fire detection and alarm system had been shut down.

An assessment party discovered that the fire was in the area of a group of three deep fat fryers. Using portable CO₂ extinguishers, several attempts were required to extinguish the fire, which had spread into ventilation ducting. The sprinkler system activated automatically and the steam smothering system was used in the ventilation ducting. The fire was reported out one hour after it was discovered.

An initial investigation by ship's staff found the power contactor of one deep fat fryer had welded closed. This prevented interruption of power as the fat's temperature increased. This resulted in overheating and ignition of the cooking fat in the fryer. As advised in Merchant Shipping Notice M.1022, replacement and repaired fryers were reported to have two thermostats with independent contactors.

The investigation found some weakness in the control of fire parties, particularly when using self contained breathing apparatus (SCBAs). Owners reported that extra staff training of has since been undertaken.

Accurate data on the vessel's ventilation system and damper arrangements was limited. It is recommended that more comprehensive information on this and other aspects of the vessel's systems are made available to ship's staff before she is considered to comply with the requirements of the International Safety Management (ISM) Code.

Other recommendations cover:

- Checking for compliance of the vessel's galley ventilation damper system.
- Compiling User manuals for fire alarm and detection systems and
- Amending of Merchant Shipping Notice, M.1665, covering specification of breathing apparatus.

SECTION 1

Factual Information

1.1 Particulars of vessel and incident

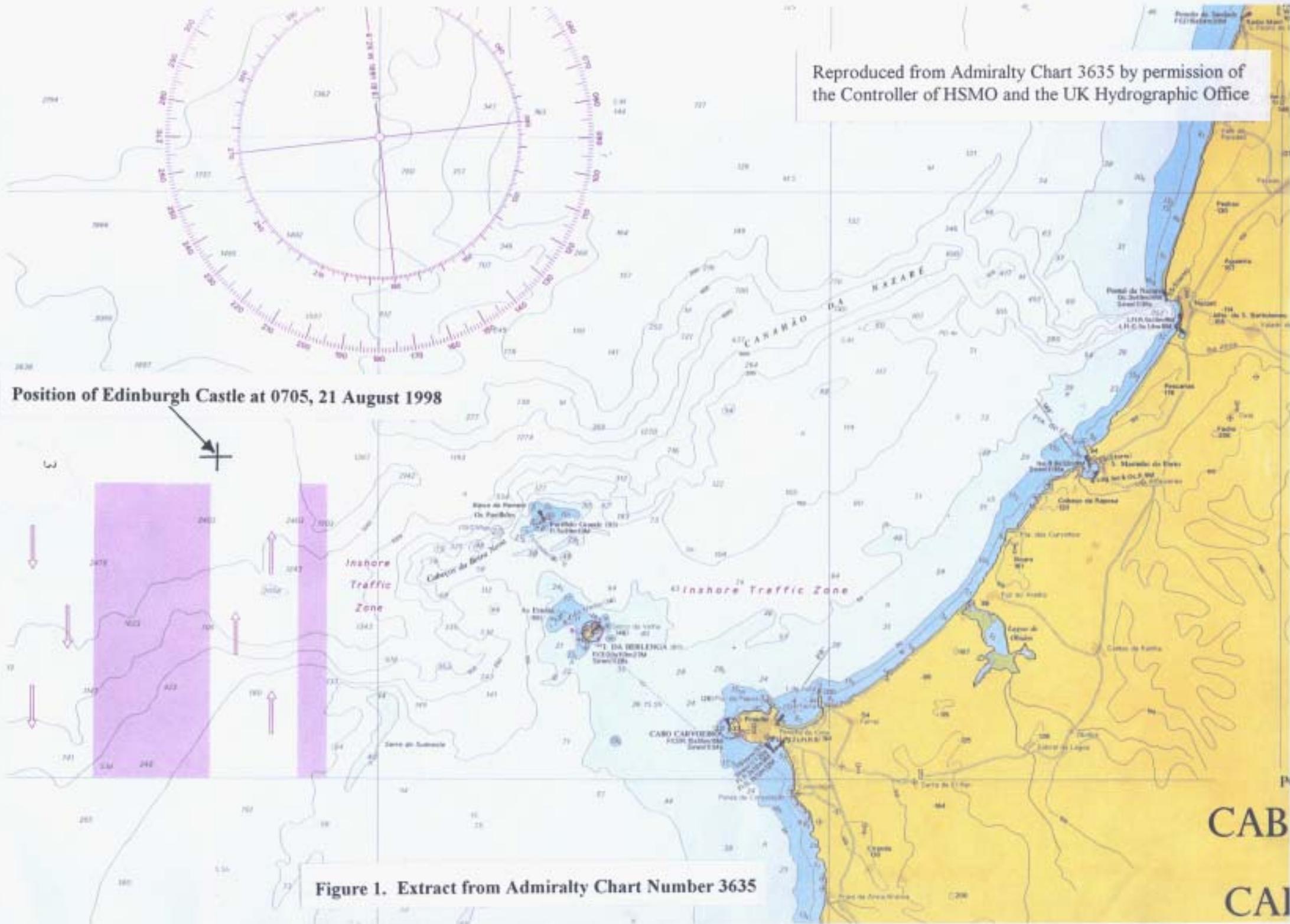
Name	:	<i>Edinburgh Castle</i> (formerly <i>Eugeno Costa</i>)
Port of registry	:	London
Official Number:		6502024
Type	:	Class 1 Passenger ship
IMO Number	:	900288
Registered length	:	217.39m
Gross tonnage	:	32,353
Built	:	Italy, 1966
Owners	:	Lowline Ltd. Morley House Badminton Court Church Street Amersham HP7 0DA
Date and time	:	21 August 1998, 0705
Position	:	39° 31' N 009° 47' W
Damage	:	Minor
Injuries	:	None

1.2 Background

The main galley of *Edinburgh Castle* was equipped with a fire alarm and detection system, and a water sprinkler system. The loop of the fire alarm and detection system which covered the main galley on Deck 7 had suffered a fault. This led to it being isolated by ship's staff during the evening of 20 August 1998, shortly before the vessel left Lisbon for passage to the UK.

To compensate for the loss of this part of the system an additional fire watch had been introduced using cadet officers and seamen.

Reproduced from Admiralty Chart 3635 by permission of the Controller of HSMO and the UK Hydrographic Office



Position of Edinburgh Castle at 0705, 21 August 1998

Figure 1. Extract from Admiralty Chart Number 3635

CAB
CAI

Coincidentally, the steam generator in the engine room was operating at 3-3½ bar, instead of its normal 8-10 bar. Apart from engine room services, this steam supply also served a steam smothering system connected to the ventilation ducting of the main galley.

1.3 History of voyage

Edinburgh Castle left Lisbon, Portugal, at 0130 on Friday 21 August 1998 for passage to Liverpool, UK, with 1000 passengers and 500 crew on board.

At 0705 that morning, the bridge watchkeeper received a report of a fire in the main galley from the fire patrol. This report was made by the fire patrol using a portable radio. The vessel had just cleared the traffic separation scheme west of Cape Carvoeir, Portugal, in position 39° 31' N 009° 47' W (**Figure 1**).

Members of the assessment party were called by a public address (PA) instruction to proceed to the main galley. An assessment was made by two of this party entering the galley and crouching beneath the smoke layer. They were able to see a fire in the area of the deep fat fryers. After withdrawing, confirmation of the fire was passed to the bridge at 0708.

Efforts to extinguish the fire were made using several portable CO₂ extinguishers. A fire blanket and chopping boards were placed over the fat fryers. During these efforts the sprinkler system heads activated in the area of the deep fat fryers at 0710.

Ventilation fans were stopped locally and from the bridge at 0711. Numerous smoke detecting heads of the fire detection system activated in corridor and stairway areas outside the main galley. The master made an initial report to the vessel's designated person ashore (DPA) via the company's shore based duty officer.

The crew alert signal was sounded at 0712 and a PA announcement made to passengers that they were not required to take any action.

Fire fighting operations were then passed to the fire party who were wearing SCBA sets. In and around the deep fat fryers the fire was quickly extinguished. Considered no longer necessary, the zone valve of the sprinkler system was closed at 0723.

At 0726 the fire was reported as extinguished. The Master announced this information to the passengers.

Fire in the ventilation hoods and ducting above the fat fryers was again seen and was tackled with CO₂ extinguishers.

 Fire Damper

 A-60 Fire Resistant Steel Bulkhead

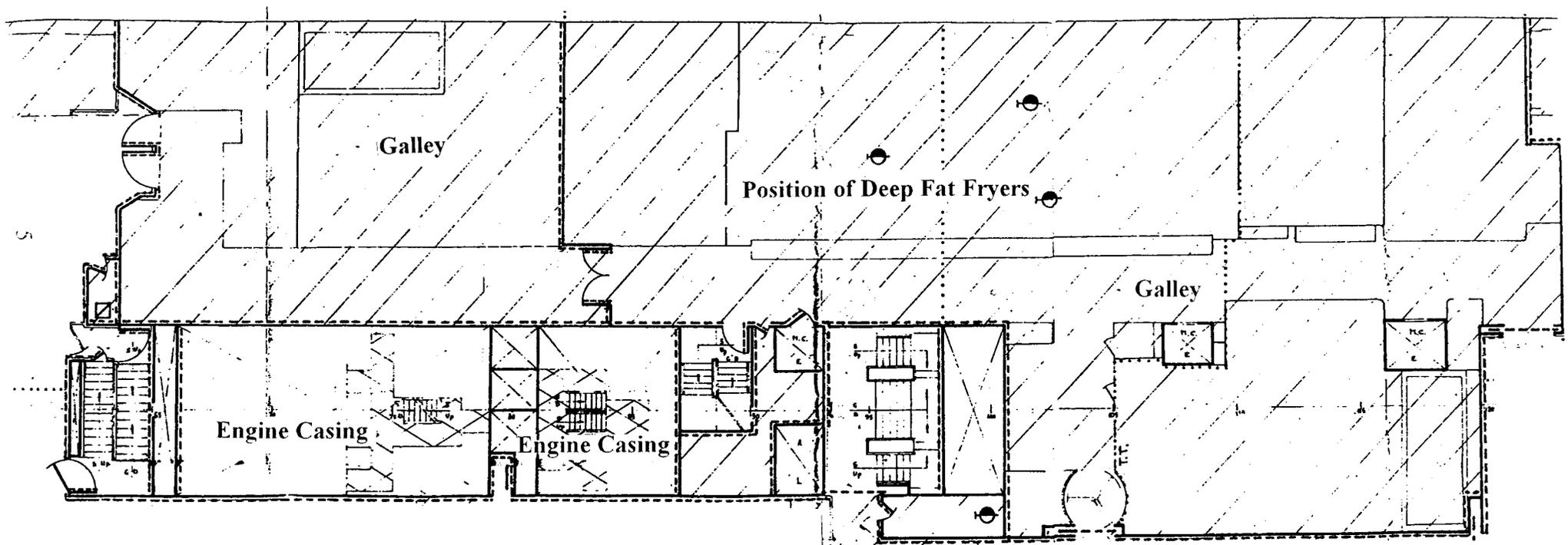


Figure 2. Extract from vessel's Emergency Fire Plan covering Deck 7 and Main Galley

The alarm system indicated a fire in a passenger cabin at 0727. This was investigated and reported as all clear at 0729.

Steam was turned on to the smothering system of the galley ventilation ducting.

Use of CO₂ extinguishers continued until the fire in the ducting looked to be extinguished. Fire was seen again in the ducting and was successfully tackled with CO₂. The ducting was then assessed for hot areas and boundary cooling parties were prepared. One member of the fire party withdrew from the galley owing to low air supply in his SCBA set. No low level alarm had been heard.

With a view to dousing the ducting with water from above, efforts were made to trace its route

As the smothering steam was making little obvious impact on the fire, and affecting visibility, it was turned off. The probability that the fire was out was reported at 0758.

Efforts to trace the route of the ventilation ducting continued. Hose parties stood by to introduce water into the ducting.

One hot area of the ducting was reported at 0804. The fire was reported as definitely out at 0807.

Fire parties stood by until 0945. Able seamen (ABs) then took on the task of monitoring until 1230 when they too were stood down. Ventilation was restarted at 1150.

The fire detection and alarm system was restored at 1700 and the sprinkler system at 1745.

1.4 The main galley

The main galley was situated on Deck 7, to the port side and forward of the machinery casing (**Figure 2**).

Access to the galley from Deck 7 was by fire doors forward, aft, starboard side and from stair wells in the centre casing. Three personnel/provisions lifts also served the galley.

Running fore and aft within the galley was a full height steel division or island against which cookers and fryers were positioned with ventilation extraction arrangements above.

On the starboard side of Deck 7 was the restaurant's passenger seating area. This extended forward and aft beyond the limits of the galley.



Figure 3. Two coupled deep fat fryers in centre of picture, independent unit to the left.



Figure 4. The coupled deep fat fryers. The unit on the left is the aft unit in which the fire occurred.



Figure 5. The contactor of the affected deep fat fryer.

1.5 Deep fat fryers

At the aft end of the centre island of the main galley were three deep fat fryers. The forward pair of these units was coupled. The third, aftermost unit, was independent (**Figure 3**).

The damaged deep fat fryers were the coupled pair. They were of a type fitted with two thermostats, each operating a common circuit breaker (**Figure 4**).

Following the fire, ship's staff examined the breaker on the aft damaged deep fat fryer and found the main contactor welded closed. This was taken as an indication that the breaker had been unable to open under the control of the thermostats (**Figure 5**).

The breaker of the forward coupled fryer was found to have an open circuit on one phase.

The fryer units could be electrically isolated using breakers in a cabinet within the galley, about 7-8 metre forward of the fryer units.

1.6 Fire detection and alarm system

During April 1997 a combined fire detection and alarm system was installed in all accommodation and service spaces of the vessel. The system did not cover machinery spaces.

The main galley on Deck 7 was served by loop K of the fire detection and alarm system. All 19 system detectors within the main galley were of the heat sensing type. Additionally there were four manually operated callpoints in this space (**Figure 6**).

1.7 Ventilation dampers

The vessel's emergency fire plan showed three dampers in the main galley (**Figure 2**). No identification labels or other marking were shown, either on the emergency fire plan or other drawings of the ventilation system (**Figure 7**).

Damper control levers within the galley were enclosed by deckhead linings. Symbols, code letters and numbers were marked on the hinged covers (**Figure 8**). None of the codes could be related to information contained in ship's drawings or other documentation.

None of the identified ventilation dampers within the main galley, or marked on the fire plan, were positioned at the boundary of the galley.

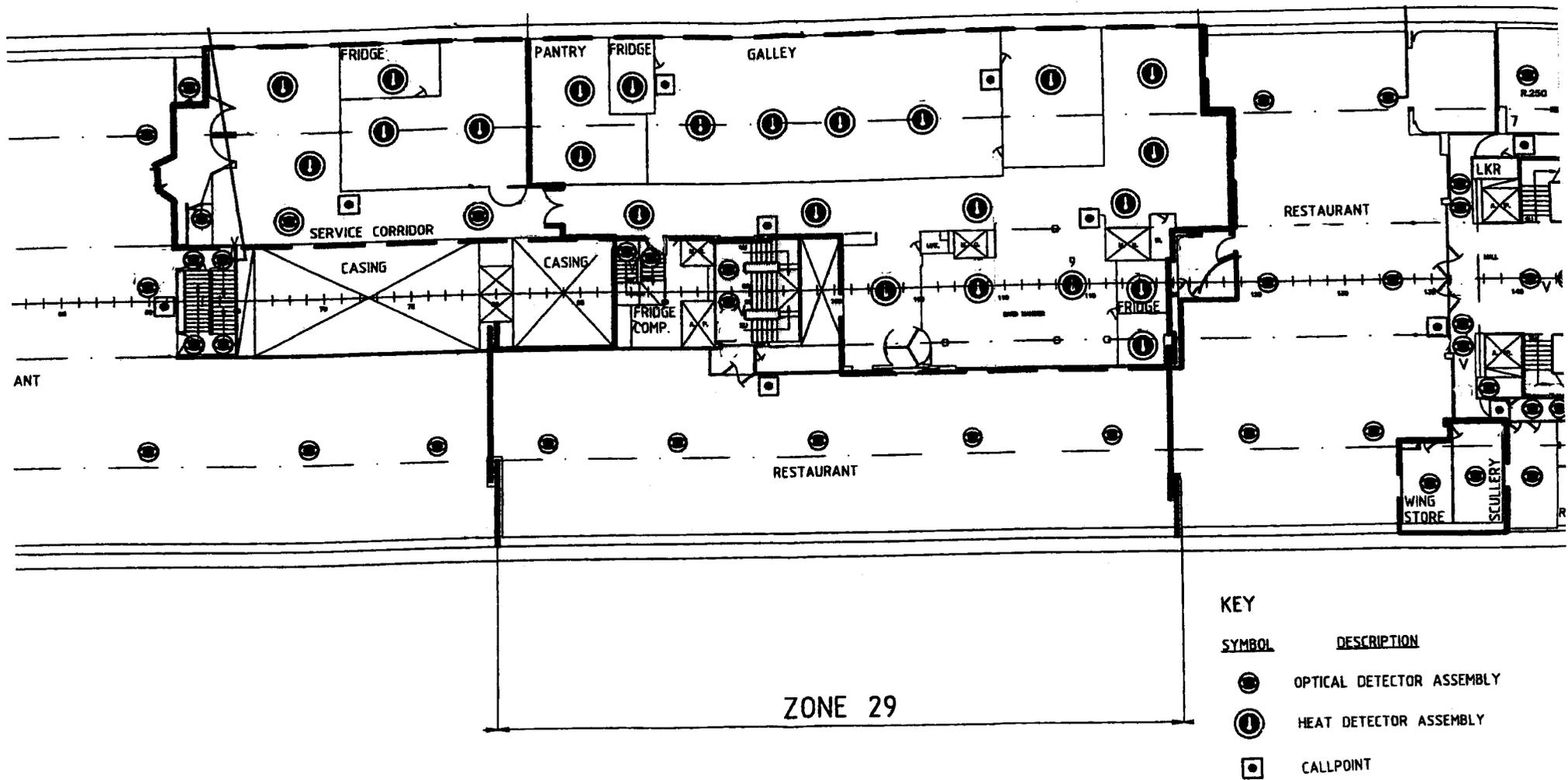


Figure 6. Fire Detection and Alarm system for Galley/Restaurant

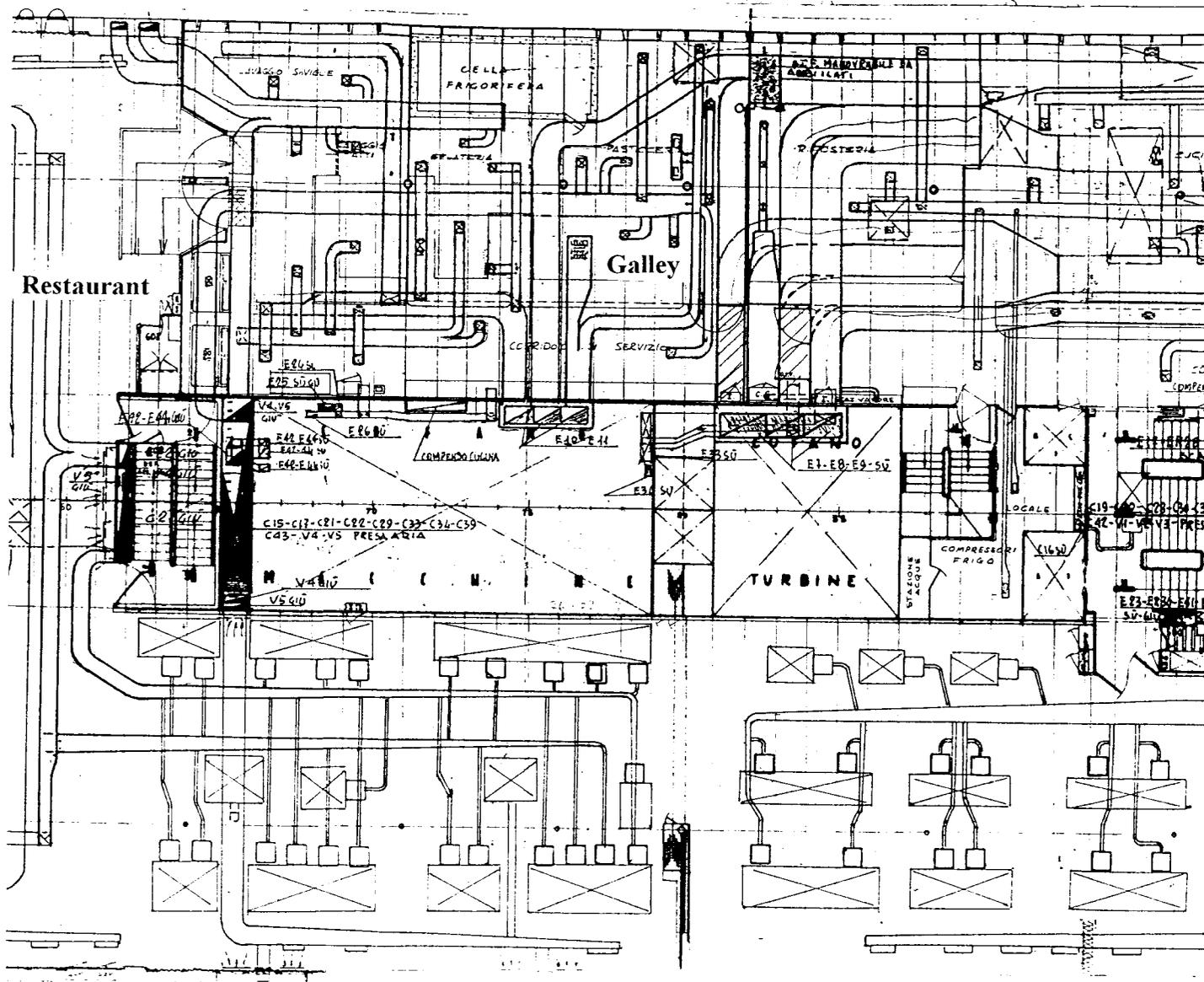
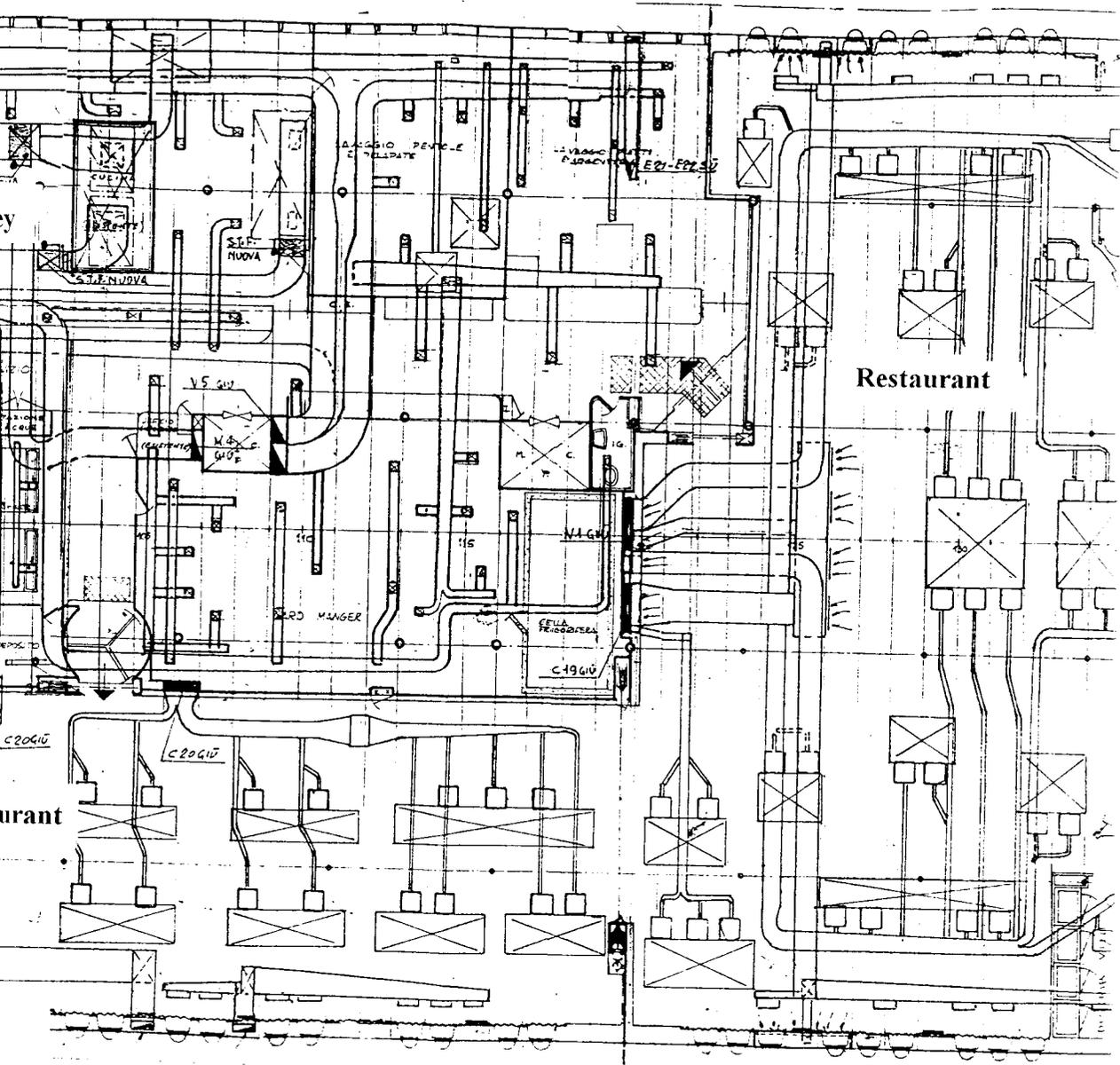


Figure 7. Main Galley and Restaurant



on Arrangements (on Deck 7 only)



Figure 8. A galley damper cover, with label.

All ventilation ductings had damper controls, within their respective fan rooms, with vacuum powered actuators. Few of these actuators were operational but the dampers remained capable of local operation.

1.8 Steam smothering system

Shortly after the vessel was purchased, in Genoa in 1997, a steam smothering system was installed in the main galley ventilation ducting. During this work the interior of the ducting was cleaned because it was very dirty.

Control valves for this system were positioned within a cabinet set into the engine casing, just forward of the door separating the forward and aft sections of the galley's service corridor (**Figure 9**).

1.9 Sprinkler system

The vessel's automatic sprinkler system included cover for the main galley.

1.10 Fire protection

Information contained in the fire plan indicates that the boundaries of the main galley, bulkheads, deck, deckhead and doors were of class A60 and in accordance with the International Convention for the Safety of Life at Sea (SOLAS) 74.

1.11 The vessel's ISM status

An amendment to the SOLAS, adopted in November 1993, added a new chapter, Chapter IX, designed to make mandatory the International Safety Management Code (ISM Code). For passenger ships on international voyages these amendments entered into force on 1 July 1998.

Owing to the vessel's recent change of flag and owners, the Maritime and Coastguard Agency (MCA) had allowed full compliance with these requirements to be postponed. An interim Document of Compliance (DOC) had been issued to the owners and an Interim Safety Management Certificate had been issued to the vessel.

Work was in progress to meet the requirements of the ISM code. Included was the compiling of a safety management manual (SMM) and the appointment of a designated person ashore (DPA).



Figure 9. Control cabinet for steam smothering system to left of picture. Working passage within galley leading off to the right.



Figure 10. New deep fat fryers to left of centre of picture.

1.12 Damage and injuries

Fire damage was limited to the immediate area around and above the deep fat fryers (**Figures 3 & 4**). Smoke damage extended over a larger area but was confined to the galley. No injuries were reported.

1.13 Fire response plan

The initial planned response to a fire alarm requires that a member of the bridge team investigates and reports by portable radio. An assessment party may then be called by means of a PA announcement and pager message. This party comprises: senior deck, engineer and electrical officers. All remaining deck officers and cadets proceed to the bridge and the deck fire party musters.

The assessment party provides the first response and advises the master on the bridge on the need to sound full crew alert.

The above response should be followed whenever a fire alarm sounds, except when a single heat or smoke detector is activated. In this event a member of the bridge team investigates and reports to the bridge by portable radio on the need to call the assessment party.

1.14 Crew exercises

Training exercises to prepare the crew for dealing with a galley fire were held on 11 June, 25 June and 9 July 1998.

1.15 Vessel operating data

When she was purchased, in June 1997, most technical information concerning the vessel's systems and operating procedures was in Italian. At the time of the fire, the company was producing its own data, rather than having existing information translated.

1.16 Remedial work

Following this accident, the vessel's owners removed the fire damaged deep fat fryers and replaced them with two new units (**Figure 10**). These were confirmed by the owners as complying with the contents of Merchant Shipping Notice M.1022.

The aftermost fryer was not replaced. However, the owners reported that new control switches were to be fitted before this unit was returned to service and that it will comply with the contents of M.1022.

SECTION - II

Analysis

2.1 Deep fat fryers

An inspection by the ship's electrical officer of the thermostat controlled breaker on the aft coupled fat fryer found the contactor welded in the closed position. It is reasonable to presume that once the unit had been switched on by galley staff, coming on duty to prepare breakfast, this defect resulted in the power supply remaining on until the fat's temperature reached ignition point.

The cause of the contactor welding closed is less certain. However, ship's staff reported that an adjacent power cable connection was loose and showed signs of overheating (**Figure 5**). It is possible that the heat generated by this poor connection caused the contactor to weld closed, or at least adversely affect the working of the contactor. In the absence of any other reported defect this possibility is accepted as most likely.

The reason for having a second thermostat and breaker fitted to these units is to protect against the failure of the primary thermostat and breaker. This incident demonstrates the value of a second independent thermostat as set out in Merchant Shipping Notice M.1022. Assuming the cause set out above is correct, a second thermostat and breaker is likely to have prevented this accident.

2.2 Fire patrol

Following the isolation of the galley's fire detection loop, an additional fire patrol was introduced. This worked as intended and was the mechanism which alerted the watchkeeping officer to the fire.

On discovering the fire, galley personnel attempted to raise the alarm by breaking the glass of a manual call point in the galley. This did not activate the alarm system. However, the cadet officer, who was the additional fire watch, raised the alarm by portable radio and no significant delay was caused by the manual call point not operating. The outcome of this incident was not significantly influenced by the failure of the call points to operate. However, uncertainty was introduced into the minds of the officers and crew, which probably affected their confidence in the complete fire detection system.

The manual call points did not work because the galley loop was isolated from the rest of the alarm system. Clear and unambiguous instructions should have been available to the crew so that the true status of the manual call points were known with confidence. The wording of the system's operating instructions did not cover this situation clearly. The system's instruction books could be improved to ease the task of officers and crews and enhance their confidence in their ability to reliably operate the system under all likely conditions.

2.3 Fire detection and alarm system

The system fitted to *Edinburgh Castle* featured a facility for addressing individual zones, loops and sensors, allowing the status of individual devices and circuits to be monitored and changed.

Instructions for the Guidance of Surveyors for the Survey of Fire Protection Arrangements in Merchant Ships, specifically mentions passenger ships and states:

The manual fire alarm system may be combined with an automatic fire detection and alarm system and should generally be so arranged that a fire alarm can be raised even though a zone or zones in the automatic detection system have been disconnected for maintenance or repair.

Individual zones on *Edinburgh Castle* may be addressed and isolated to satisfy this guidance. However, operating instructions contained in the system's user manual specify that 'sensors only' are isolated by one isolating procedure. That procedure does not make clear whether this includes manual call points. The wording of this instruction is ambiguous and could be interpreted as allowing all detectors to be isolated, while allowing manual call points to remain in use, as in the guidance given to surveyors.

Important and widely quoted terms such as *zones*, *loops* and *circuits* are not clearly defined in the user's manual. Although not demonstrated as a factor on board *Edinburgh Castle*, this may result in the incorrect use of terms by users, with the potential for generating confusion or uncertainty. The system's instructions contained in the user's manual would benefit from amplification and clarification.

The system has a 'graduated access' feature, where only designated people are able to access particular features or levels of the system. The instruction manual, in its present format, may be useful to those with a level of specialist knowledge, such as a designated person with access to higher levels of the system. However, for people with limited specialist knowledge of the system's principles it is difficult to use.

A simplified version of the manual would be of benefit to end users. A user's manual should be understandable and quickly assimilated by a non-technical person. Such a manual has the advantage of giving the user confidence in the system's function and reliability as well as confidence in his ability to use it effectively.

A fire detection and alarm system is an important safety system on any ship. It is equally important that the user has confidence in the system.

2.4 Fire fighting equipment

SCBA sets were used during fire fighting operations. One user expressed surprise that the audible low air pressure warning did not function on his set. This was confirmed by another user in the immediate area.

A later examination of this SCBA set found a defect in the air pressure alarm system. It is not clear why this defect was not discovered during routine checking of the sets. The procedures for these checks should be re-appraised to ensure that the low air pressure alarms are tested regularly.

Control and monitoring of SCBA users should be capable of identifying any user approaching the limits of his air supply. The use of a controller is an important safety check and a supplement to, rather than a replacement for, any safety warning device on the SCBA's. Similarly, checking of air pressure gauges by fire team members should be an important part of their operational procedures. A need for additional training for the SCBA users and controllers is indicated. According to the owners, additional training has been undertaken.

The requirements for self contained breathing apparatus carried on UK ships is contained in Schedule 5 of Merchant Shipping Notice M.1665. No mention is made in this Schedule of any requirement for a low pressure alarm to be fitted to SCBA sets. However, it does contain a requirement that all such apparatus shall comply with the Joint Testing Memorandum of the Health and Safety Executive (HSE), Department of Environment Transport and the Regions (DETR) and the Home Department. This memorandum is obsolete and, following an amendment to EC Directive on Marine Equipment, has been replaced by the requirements of the European standard EN 137.

EN 137 contains a clear requirement that SCBA sets are fitted with a low pressure warning device.

The present contents of Schedule 5 of M.1665 are therefore incomplete, inaccurate and might be misleading. MCA should amend Schedule 5 to take account of the requirements of EN 137.

2.5 Ventilation dampers

During the incident, ventilation was shut down by stopping fans and closing all necessary dampers in the fan room on a higher deck. However, ship's staff had difficulty in locating the correct damper controls, mainly due to unclear labelling and drawings. Important information on the ventilation system was not readily available, suggesting that even senior staff were uncertain of the function and location of those dampers in the galley.

Documents, drawings and labels indicating the positions of ventilation dampers serving the main galley were not clear. Ship's staff were handicapped by this lack of information during the incident and the investigation which followed.

The vessel's fire plan, for example, showed three fire dampers within the main galley (**Figure 2**). However, the position and function of these was not clear from an inspection of the galley or from other documents.

There is a need for the crew to have information which is clear and accurate. The owners have indicated that they recognise this and stated they are to improve identification of these dampers and crew training on this subject.

To ensure that fire fighting activities can be performed effectively and efficiently, clear, accurate and readily available information is essential. Only then can requirements of the ISM Code be fully satisfied. The Maritime and Coastguard Agency (MCA) should ensure that it is available and on board, before the vessel is considered to fully satisfy the requirements of the ISM Code.

2.6 Muster and fire fighting

Mustering of the fire assessment party functioned largely according to the fire response plan. The assessment party's initial response also appeared sensible. After the initial stages, some difficulties were generated by doubts about the layout of the ventilation ducts from the galley and the position of some dampers.

The fire started while galley staff were preparing breakfast for passengers. The restaurant seating areas for the passengers are to starboard, aft and forward of the main galley. Passengers were making their way to these areas during fire fighting operations. Although PA announcements were made to keep passengers informed of developments, no instructions were given for passengers to clear the restaurant area.

At the risk of unsettling some passengers, there would have been some merit in clearing the restaurant and adjacent areas of all non-crew without using the PA system which could have alarmed passengers. Restaurant staff should have been able to perform this task. This would have removed all passengers from the spaces into which smoke or flame might have passed when fire doors were necessarily open for access during fire fighting. It would also have provided greater separation between passengers and the fire in the event of serious escalation.

SECTION - III

Conclusions

3.1 Findings

1. During the evening of 20 August 1998, the loop of the fire detection system serving the main galley on Deck 7 of *Edinburgh Castle* was isolated.
2. Additional fire patrols were introduced to cover for the isolated loop of the fire detection system.
3. *Edinburgh Castle* left Lisbon at 0130 on 21 August 1998 for passage to UK.
4. In making preparations for cooking passengers' breakfasts later that morning, galley staff switched on the deep fat fryers.
5. Fire broke out in the main galley at about 0705 when the vessel was in position 39° 31' N 009° 47' W.
6. Manual fire alarm call points in the galley did not function when activated by crew.
7. The fire was reported to the bridge watchkeeping officer by the fire patrol.
8. The fire assessment party mustered and found fire in the area of the galley's deep fat fryers.
9. Members of the assessment and fire parties used SCBAs.
10. Ventilation fans were stopped.
11. The low pressure alarm of one SCBA set did not function.
12. The control and monitoring of fire fighting teams using SCBAs was inadequate.
13. Fire spread into the ventilation ducting over the deep fat fryers.
14. The fire was tackled with portable CO₂ extinguishers, fire blankets, water sprinklers and smothering steam.
15. Steam supply to smothering system of the ventilation ducting was at an inadequate pressure.
16. Fire dampers in the main galley were not clearly marked or identified on the ship's drawings.
17. Dampers in galley ventilation ducts were closed at the fan room.

18. The fire was reported as extinguished at 0807.
19. There was no loss of life or injuries.

3.2 Causal Factors

1. Cooking fat in the centre deep fat fryer ignited as the fryer's heating element heated the fat above normal operating temperature, and then progressively to ignition point.
2. The heating element heated the cooking fat to ignition point most probably because the element's power breaker failed to open under the control of its thermostats.
3. A contributory factor was the lack of an independent power breaker served by the fryer's second thermostat, or safety cut-out.
4. A second contributory factor was probably overheating of a cable connection on the power breaker, leading to the breaker failing in the closed condition.

SECTION - IV

Recommendations

4.1 The Maritime and Coastguard Agency is recommended to :

1. Ensure that sufficient safety related documentation and information is available in English before *Edinburgh Castle* is considered to fully satisfy the requirements of the ISM Code.
2. Ensure that the galley ventilation duct layout and damper arrangements are acceptable.
3. Ensure that clear information on the galley ventilation and damper arrangements are available to the ship's staff.
4. Consider the needs of ship's staff for clear instruction manuals when approving fire detection and alarm systems. Consideration should be given to the need for clear and readily assimilated operating instructions, particularly for conditions where parts of systems may be isolated, and for the implications of any system state which is not the zero defect state to be clearly set out.
5. Consider amending Merchant Shipping Notice M.1665, or its Schedule 5, to include the requirements of, and to require compliance with, EN 137.