Annex A

Technical circular

Message from ZMA's Technical Manager for Fleet A (container) vessels dated 22 May 2003 held onboard *Maersk Doha:*

> *"We have recently suffered again on one of our company vessel ege fire resulting serious damage of ege. It has happened because soot (which can catch fire) has been collected despite recent washing.*
>
> *To avoid it proper procedure of gas side washing needs to be followed:*
>
> *All economisers have to be washed with sea water, using fire pump, using huge of water must be used (all the time it is necessary to monitor drain area – we have had cases with dirty water and soot overflowing into m/e turbochargers).*
>
> *Using sea water is essential, fresh wtr from fwg is soft and is not able to clean oily soot, second essential factor is amount.*
>
> *On completion of washing, with sea water rinsing with fresh water (1-2 tons) needs to be carried out. You need to carry such washing at least once monthly.*
>
> *Using karcher machine does not help at all, high pressure is only on the first row, in same time amount of water is far too small.*
>
> *When at sea, soot cleaning system have to be used as well. Vessels with solid brush cleaning system have to maintain enough steel balls in the system and carry out calibration of balls regularly. Too small balls are not good for cleaning and need to be replaced.*
>
> *If despite of all precautions fire still occurs, prompt and correct action, as described below has to be arranged:*
>
> *It is essential to attack fire with huge amount of water to extinguish fire as quickly as possible to avoid temperature raising and tubes/fins melting. Some economisers are fitted with fixed system over ege which can be supplied from fire pump. If such system is not existing we have to attack fire via top manholes with fire hoses. Main engine must be stopped and drain from ege open to avoid water overflow to main eng turbochargers".* [Sic]

Annex B

Relevant machinery monitoring and alarm system parameters

The parameters relevant to the auxiliary boiler and exhaust gas economiser that were monitored by the machinery control system are listed below to illustrate the information that would have been available to engineering staff.

Aux boiler	Drum high level
Aux boiler	Drum low level
Aux boiler	Abnormal
Condensate	Oil high
Aux boiler	MDO service pump run
Aux boiler	Steam pressure (0-16 Bar)
Aux boiler	Steam outlet temperature (0-186 ^{o}C)
Condensate collection tank	Low level
Boiler water	Circulation pump running (Nos 1 & 2)
Boiler water	Circulation pump failure (Nos 1& 2)
Feed water	Pump running
Feed water	Pump failure
Uninterruptible power supply	Failure
Exhaust gas boiler	Inlet temperature (0-600^{o}C)
Exhaust gas boiler	Outlet temperature (0-600^{o}C) High temperature warning 350^{o}C
Infrasound cleaning system	Abnormal
Soot blower	Abnormal

Table B-1 Alarm system parameters

Annex C

Crew language requirements

CREWING MANUAL – CIRCULAR

14 March 2005

Recruitment and Selection Criteria No. 012

Dear Sirs,

English Language ability

The following IMO based guidelines will be used for evaluating English Language ability. (IMO model course 3.17 – Maritime English)

The criteria provided will be used for ZORS evaluations and for pre-employment or pre-promotion testing interviews. These criteria align IMO model course definition of English Language ability to Company terminology.

IMO Beginner: ZORS / QC Evaluation '5'
Knows virtually no English and cannot understand spoken or written English. Or 'False Beginner', i.e knows a few words or phrases of English. May be able to string together very basic sentences using a narrow range of English but has extreme difficulty making himself understood. Has serious difficulty understanding spoken English.

IMO Elementary: ZORS / QC Evaluation '4'
Is able to use English for very basic everyday needs but without sustained fluency and with many errors. Has a limited understanding of spoken English, requires a lot of re-phrasing and, repetition and simplification of language.

IMO Lower Intermediate: ZORS / QC Evaluation '3'
Can communicate satisfactorily about everyday topics with a restricted range of language. Able to understand native speakers of English talking at a measured pace with some re-phrasing and repetition. Comprehension is likely to fail under pressure.

IMO Intermediate: ZORS / QC Evaluation '2'
At ease communicating about everyday topics and more abstract concepts. Makes some mistakes but is usually able to correct any major errors which prevent him being understood. Able to understand the essence of native speaker English but may misunderstand details.

IMO Upper Intermediate: ZORS / QC Evaluation '1'
Confident in using a wide range of language to express himself accurately and fluently in all but the most demanding situations. Makes some minor mistakes but these do not generally prevent him being understood. Experiences occasional problems of comprehension but these can usually be overcome with a little help.

IMO Advanced: ZORS / QC Evaluation '1'
Near native speaker, proficiency in all aspects of communication. Has no difficulty with comprehension and can express abstract concepts accurately and fluently. Able to resolve any problems of comprehension effectively.

Yours faithfully

ZODIAC MARITIME AGENCIES LTD
(As agents only)

Quality, Safety & Environmental Manager

MINIMUM ENGLISH LANGUAGE REQUIREMENTS FOR ZODIAC SEAFARERS

The Test of Spoken English (TOSE) is to be used in addition to the existing, computer-based Marlins Test.

TOSE is designed to provide manning offices with increased accuracy when assessing seafarers' standards of spoken English.

The outcome of a TOSE interview is the 'overall level' (see definitions below.)

The overall level is based on an average of three separate scores for spoken fluency; spoken accuracy and listening comprehension. Please refer to the TOSE CD for full definitions.

Definitions of Language Level

Advanced	Near native-speaker proficiency in all aspects of communication. Has no difficulty with comprehension and can express abstract concepts accurately and fluently. Able to resolve any problems of comprehension effectively.
Upper Intermediate	Confident in using a wide range of language to express himself accurately and fluently in all but the most demanding situations. Makes some minor mistakes but these do not generally prevent him being understood. Experiences occasional problems of comprehension but these can usually be overcome with a little help.
Intermediate	At ease communicating about everyday topics and more abstract concepts. Makes some mistakes but is usually able to correct any major errors which prevent him being understood. Able to understand the essence of native speaker English but may misunderstand details
Lower Intermediate	Can communicate satisfactorily about everyday topics with a restricted range of language. Able to understand native speakers of English talking at a measured pace with some rephrasing and repetition. Comprehension is likely to fail under pressure.

MINIMUM ENGLISH LANGUAGE REQUIREMENTS FOR ZODIAC SEAFARERS

Elementary	Able to use English for very basic, everyday needs but without sustained fluency and with many errors. Has a limited understanding of spoken English, requires a lot of rephrasing, repetition and simplification of language.
Beginner	Knows virtually no English and cannot understand spoken or written English. Or 'false beginner', ie knows a few words or phrases of English. May be able to string together very basic questions or sentences using a very narrow range of English but has extreme difficulty making himself understood. Fails to understand natural spoken or written English adequately.

MINIMUM ENGLISH LANGUAGE REQUIREMENTS FOR ZODIAC SEAFARERS

RANK	MINIMUM MARLINS COMPUTER TEST SCORE REQUIRED	MINIMUM MARLINS TOSE OVERALL LEVEL REQUIRED	EQUIVALENT ON-BOARD QC EVALUATIONS (Criteria 012 in Crewing Manual)
CPT	90%	Upper Intermediate	1
C/O	90%	Upper Intermediate	1
2/O	80%	Intermediate	2
3/O	80%	Lower Intermediate	3
D/C	80%	Lower Intermediate	3
E/C	70%	Lower Intermediate	3
EEC	70%	Lower Intermediate	3
C/E	80%	Intermediate	2
1/E	80%	Lower Intermediate	3
2/E	70%	Lower Intermediate	3
3/E	70%	Lower Intermediate	3
EE	70%	Lower Intermediate	3
G/E	50%	Lower Intermediate	3
BSN	50%	Lower Intermediate	3
A/B	50%	Lower Intermediate	3
O/S	Not Required	Elementary	4
SBA	Not Required	Elementary	4
SBO	Not Required	Elementary	4
D/T	Not Required	Elementary	4
E/T	Not Required	Elementary	4
P/P	50%	Lower Intermediate	3
FT1/FTA	50%	Lower Intermediate	3
HYD	Not Required	Elementary	4
FTB/FTC	Not Required	Elementary	4
M/M	50%	Lower Intermediate	3
STW	Not Required	Elementary	4
C/K	Not Required	Elementary	4
S/B	Not Required	Elementary	4

Annex D

Extracts from MAN Diesel Technical Paper

Soot Deposits and Fires in Exhaust Gas Boiler, download
P280-04-04 April 2004 Soot fires in exhaust gas boilers

Soot fires in exhaust gas boilers

A fire in the exhaust gas boiler may develop in two or three stages, see Fig. 15 and Ref. [2]. The ignition of soot normally develops into a small and limited fire, but under extreme conditions it may develop into a high-temperature fire.

Ignition of soot

Ignition of soot may arise in the presence of sufficient oxygen when the deposits of combustible materials have a sufficiently high temperature (higher than the flash point) at which they will liberate sufficient vapour, which may be ignited by a spark or a flame.

The main constituent of the soot deposit is particulates but, in addition, some unburnt residues of fuel and lubricating oils may be deposited in the boiler because of faulty combustion equipment and, in particular, in connection with starting and low speed running of the engine.

The potential ignition temperature of the soot layer is normally in the region of 300-400ºC, but the presence of unburnt oil may lower the ignition temperature to approx. 150º C, and under extreme conditions even down to 120◦C.

This means that ignition may also take place after stop of the main engine as a result of glowing particles (sparks) remaining on the boiler tubes.

Small soot fires

Small soot fires in the boiler are most likely to occur during manoeuvring with the main engine in low load operation. These fires do not cause damage to the boiler, or damage is very limited, but the fires should be carefully monitored. Heat from the fire is mainly conducted away with the circulation water and steam and with the combustion gases.

High-temperature fires

Under certain conditions, a small soot fire may develop into a high-temperature fire. The photo in Fig. 16 shows an example of an exhaust gas boiler which has had a high-temperature fire, where the boiler tubes have burned and melted. The reactions involved here are (see also stage 3 in Fig.15).

a. Hydrogen fire

This occurs because dissociation of water into hydrogen and oxygen or, in connection with carbon, into carbon monoxide and hydrogen, may occur under certain conditions. A hydrogen fire may start if the temperature is above 1000º C.

b. Iron fire

An iron fire means that the oxidation of iron at high temperatures occurs at a rate sufficiently high to make the amount of heat release from the reactions sustain the process. These reactions may take place at a temperature in excess of 1100º C.

In this connection, it is important to realise that also water (H_2O) may go in chemical reaction with iron (Fe), i.e. the use of the steam based soot blower will feed the fire.

Stage 1 Ignition of soot

Type of soot	Potential ignition temperature
Dry soot	300-400 °C
Wet (oily)	150 °C (120 °C)

Stage 2 Small soot fires

Small soot fires are most likely to occur during manoevring/low engine load with no or limited boiler damage

Stage 3 High temperature fires

A small soot fire may develop into a high temperature fire with the following reactions involved:

a. **Hydrogen fire,** temperature > 1,000 °C
Dissociation of water into hydrogen and oxygen:

$2H_2O \rightarrow 2H_2 + O_2$
$H_2O + C \rightarrow H_2 + CO$
} H_2 and CO are combustible

b. **Iron fire,** temperature > 1,100 °C
Examples of reaction with iron:

$2Fe + O_2 \rightarrow 2FeO + \text{heat}$
$Fe + H_2O \rightarrow FeO + H_2 + \text{heat}$
} The boiler tubes are burning

Fig. 15: Development of a soot fire in an exhaust gas boiler

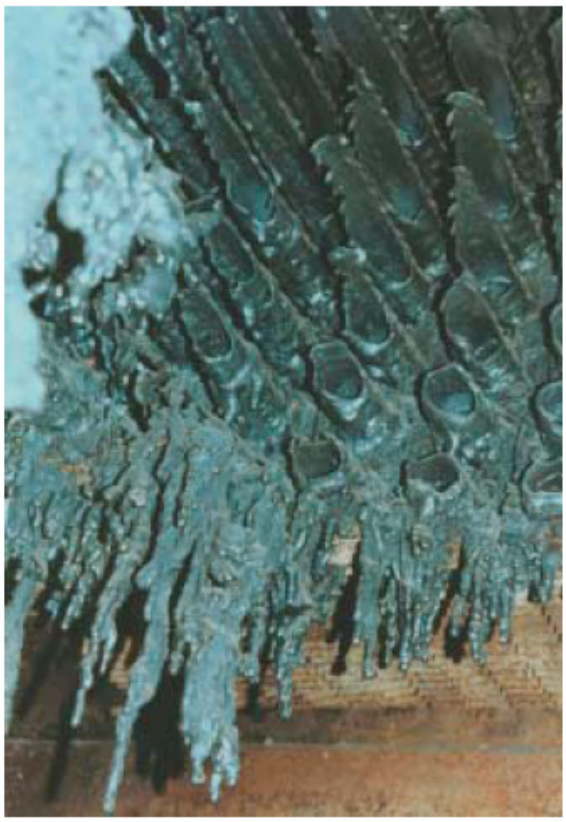

Fig. 16: High temperature fire of a gas fired water tube type boiler

Annex E

Fleetwide technical circular

FLEETWIDE

Re: Soot Fire In Exhaust Gas Boilers

Please find attached a casualty information about soot fires which are still an occasional problem within the fleet.

Cleanliness is the most important factor and all EGB's should be washed by fire hose and then a fresh water rinse at the end of each voyage **even** if soot blowing equipment is fitted.

The circulating pump should be started at stand by and should run at least two hours after FWE

The only way to extinguish such a fire is to carry out boundary cooling and to open access doors and use fire hoses and this requires prompt and positive action but as always there are possible consequences.

Blocked or inadequate drainage can cause flooding back to turbo charger and result in blockage or damage. The drainage is very acidic and can cause severe corrosion if allowed to remain in collecting tanks, bilges or bilge tanks for too long.

A recent case on a ship in our fleet was a classic in how **not** to react and showed how ill prepared the vessel was to deal with any sort of emergency.

Maersk Doha – Departure Norfolk

02/10/06

00:04 First engine movement DS Astern.
00:06 All lines onboard.
00:17 Docking pilot off.
Bow thrusters stopped. (Start shut down one generator).
00:25 While checking parameters on the computer console in ECR, 3/E noticed boiler pressure falling. (This was noticed on the graph which has time on x-axis and pressure on y-axis).
3/E went to the boiler space and checked–found pressure of boiler about 5 kg.

After some time, boiler low pressure audible alarm came on. 3/E who was near the boiler saw some steam coming out from the fan of the burner. He stopped the boiler and went up to tell the C/E.

00.30 1/E was called to come to engine room to assist.
When 1/E came to ECR and was advised of the auxiliary boiler leakage and that No.7 pump of main engine did not reverse.
3/E and 1/E went to check the auxiliary boiler and found abnormal sound coming from the boiler (a sound like safely valve being opened). Opened the burner and looked in with a torch, saw a small crack and water coming out, a furnace had already deformed (bulge had formed).
There was no water in the furnace all the leakage was evaporating.

Alarm hi-temp in economiser was heard and the 3/E started the second feed pump for the auxiliary boiler as decided after consultation with other engineers. (Now 2 pumps were working).
Feed water pump for the cascade tank was put to manual from auto and switched on.

On 1/E's orders, generator No.1 was stopped as is in same compartment as boiler and generator No.2 and No.3 were kept running.

In ECR, 3/E checked temperature of ex gas economiser and temp was increasing. It rose from 350 deg C to 600 deg C in about less than 5 min.

And one pump for circulating water to the economiser was working at this time. (There is small leak from the mechanical seal of the other pump).

C/E was advised about the situation. Then C/E went up to check the economiser. He came back shouting fire.

02:30 C/E informed bridge of the fire. Alarm raised from the bridge. Vessel had just passed the end of the channel.

Fire fighting commences. 3/E and M/M with a CO2 extinguisher and a fire hose tried to extinguish the fire from below.

02:48 C/O reported unable to contain the fire.

02:52 Crew evacuated from engine room. CO2 released.
The 3/O opened the CO2 remote release cabinet and opened the connecting valve between the two pilot cylinders on A deck. 1/E closed the QCV's for all the machinery. Then he closed remotely the flaps. Later he activated the electrical remote shut off and then 3/O opened the two pilot cylinder valves, C/E activated the release for full engine room.
The vessel was anchored about this time.

All crew were on deck waiting.

Emergency generator was started by 2/E and E/E but not put on power. Later on (time unknown) someone reported to the 1/E that the emergency generator had shut down on its own under alarm.

About 0400 hrs, all this while the ships generator No.3 was running.
After consultation with the office it was decided that the economiser would be opened and sea water would be sprayed directly into the fire.

At this time when the emergency fire pump was started it was noticed that there was no water in the fire line.

(Later on, 1/E went to the ballast control room and checked the Nor Control console, this is when he realised that the sea water valve was closed. Tried to reset the valve from the fire station but was not successful.

It was understood now that without entering the E/R it would be impossible to get water on deck. 1/E and AB entered using BA sets and went to the lower engine room floor and tried to open the valves manually. Nothing happened as the valves were open. Then they opened the cooling sea water valves on the main console of the engine control room (electrically operated). Immediately after left the engine room. No.3 DG still running).

Water was now available in the fire line and boundary cooling resumed.

1/E, 3/O and AB were the main fire team fighting the fire and supported by the rest of the crew.

Lower door of the economiser was first opened. Water sprayed directly onto the burning pipes.

Middle door was later opened and the above process repeated.

Upper door was at the end opened and fire was finally extinguished.

12:30 Confirmed there was no possibility of any fire anywhere re-igniting.

<u>03/10/06</u>

Of course after the events of previous day, the USCG, Classification and Flag must get involved and sadly the total lack of awareness, discipline and preparation meant that the incident descended into absolute chaos.

- The emergency generator could not be demonstrated as the previous day it had run with insufficient cooling and had in fact siezed.

- No-one was monitoring the MDO service tank so that it ran empty and as one generator ran down multiple efforts to start other generators meant that soon ship had no starting air and was effectively dead ship from 1000 hrs.

- The USCG then demanded that two tug boats stand by at all times until all systems were re-instated in full and ship's crew could demonstrate a proper level of competence.

<u>04/10/06</u>

00:10 Boat with generator alongside.

10:00 Ships generators started.

<u>16/10/06</u>

Ship finally proceeded on voyage after repairs.

Conclusion

It is easy to find fault with how people have reacted after the event but it is difficult to say how we would behave under stressful and dangerous conditions ourselves so the lessons of this incident to be learnt are:-

1) Be serious about training and drills as they give confidence in facing adversity.

2) All emergency equipment should be properly maintained and all should be familiar with its use and testing.

3) Do not abandon the engine room too quickly. Fight fire at its source. The CO2 is a last resort and without guarantee. (Did you notice that after CO2 release a main diesel generator kept running so obviously the CO2 failed to fill the engine room and it was later found that only 7 out of more than 230 bottles released!!).

4) When a serious incident occurs in the engine room, inform the bridge immediately.

   After the loss of steam and thus heating for fuel it should have been discussed with Captain and Pilot to quickly find suitable place to stop and assess damage. If it required further steaming it should have been done at an RPM to keep EGB below 240°C which is about the flash point of cylinder oil which tends to carry over and mix with the soot and ignite.

5) Quick investigation and organised action is required. An EGB fire is contained in the exhaust trunking so is easy to attack in the early stages – hoses prepared, access doors prepared for removal, soot blow if fitted, stop engine, open doors and direct water onto area. If can not stop the engine immediately then some boundary cooling may be necessary. Take care how water will drain – **do not** add to your problems.

6) Contact office soonest – we can help with advice and arrangements.

The whole sorry episode with offhire, as yet unknown claims for damaged reefer container cargo repairs, fines and expense will probably exceed US$ 1.0 million the majority due not to the fire but the consequences of poor state of readiness before and lack of routine discipline after.

For every action there is a consequence so be aware. Think about it and do not let it happen to you.