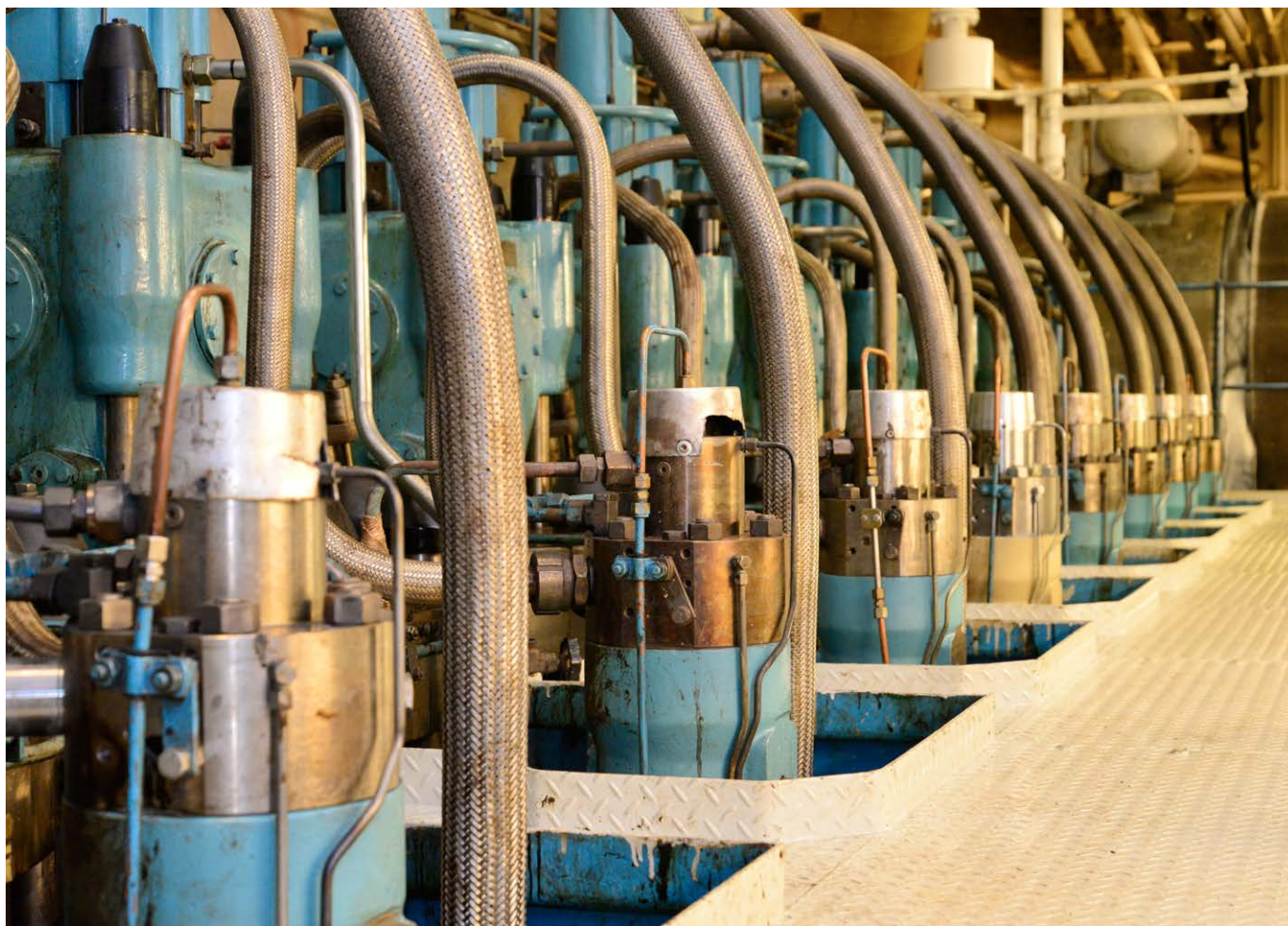


# Main Engine Damage



2015

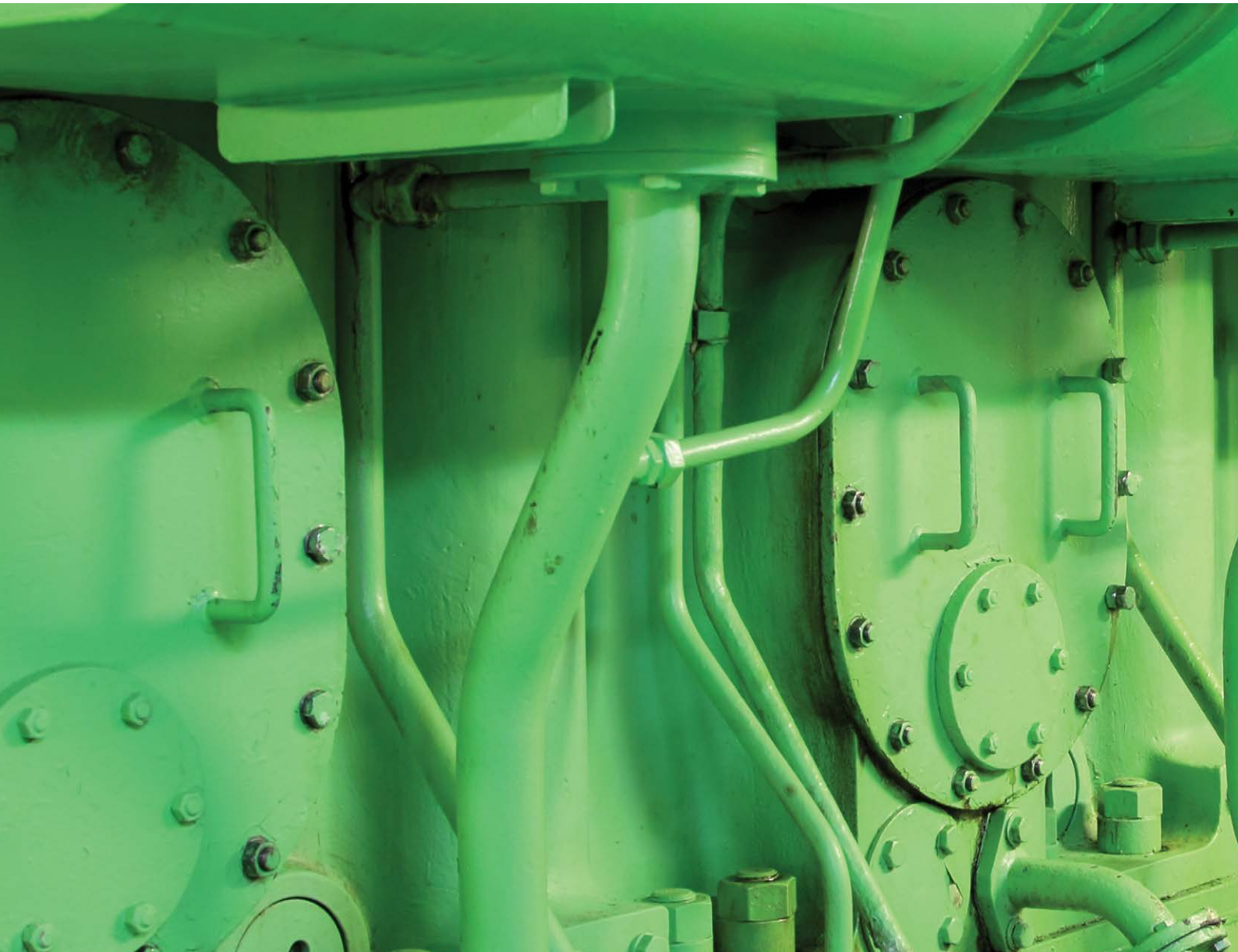




# Contents

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<b>Executive summary</b>	<b>2</b>
Findings	2
Cause of damage	3
Recurring issues	3
Core statistics	3
<b>Introduction</b>	<b>4</b>
<b>Overview</b>	<b>4</b>
<b>Hull &amp; Machinery claims</b>	<b>4</b>
<b>Machinery claims</b>	<b>6</b>
<b>Main engine claims</b>	<b>7</b>
Overview of main engine claims by vessel specifics	7
Overview of main engine claims by engine specifics	8
Damaged parts	9
<b>Cause of damage</b>	<b>10</b>
Maintenance	10
Recurring issues	10
Limited experience	10
<b>Prevention</b>	<b>11</b>
Management	11

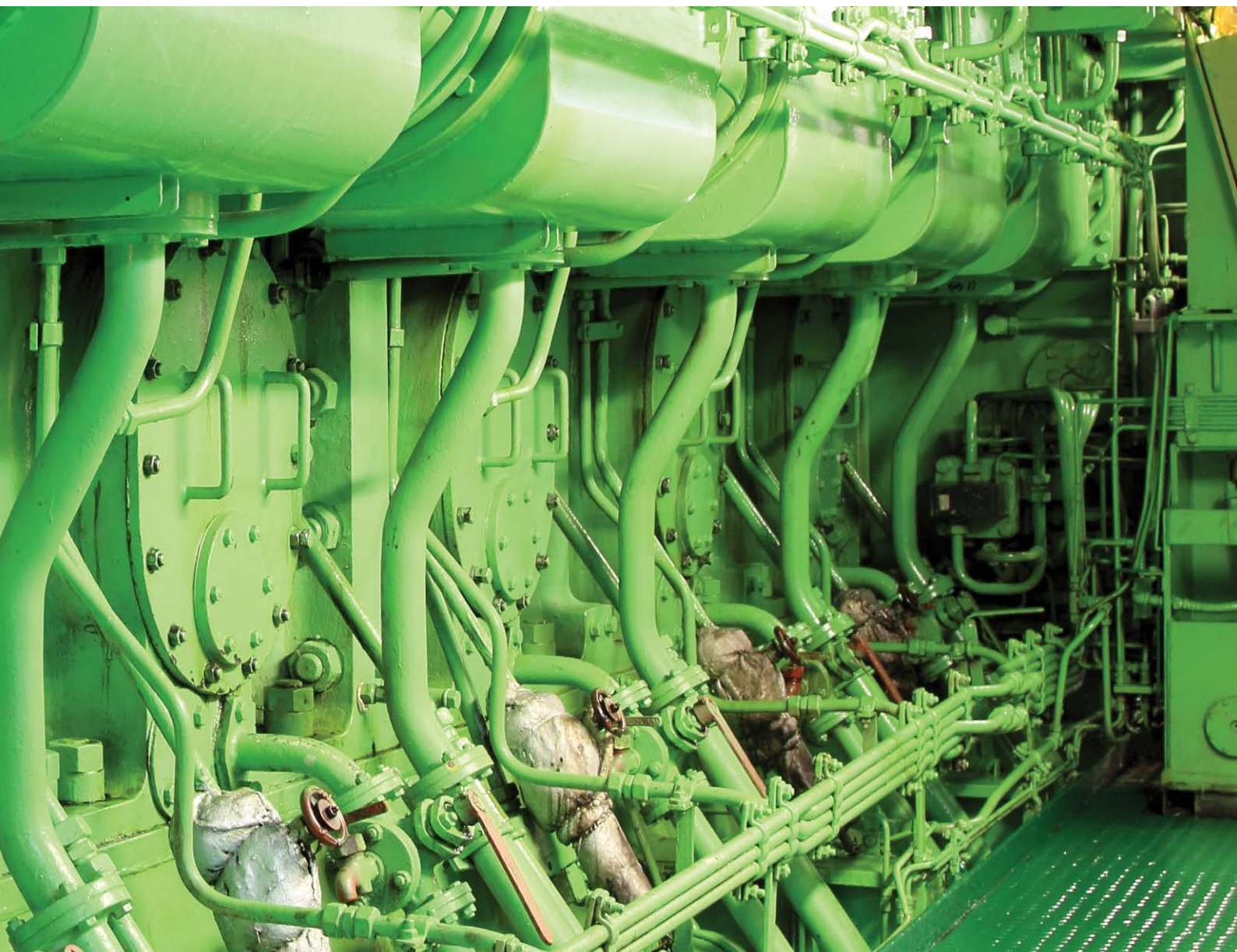


## Executive summary

### Findings

- ▶ Main engine claims account for 46% of total machinery claims cost with an average claim per vessel of USD 545,000.
- ▶ The frequency trend for main engine claims is stable at 2% of the vessels entered with The Swedish Club experiencing main engine damage.
- ▶ Since 2011, the average cost of main engine damage has decreased from USD 634,000 to USD 545,000 (-14%).
- ▶ Container and dry cargo ships have a disproportionately large claims cost in relation to fleet entry.
- ▶ Korean built vessels make up 31% of the club fleet but amount to only 12% of main engine claims cost. China on the other hand is over-represented with 30% of the club entries and 36% of the total main engine claim costs.
- ▶ Four-stroke main engines experience 2.5 times more claims than two-strokes
- ▶ Four-strokes in V configuration have an average of 42% higher claims costs than inline configuration.
- ▶ Bearing failures are the most expensive main engine claim categories with an average cost of nearly USD 1.6 million per claim. The cost for bearing failures is high due to consequential damage to crankshafts, etc.
- ▶ Lubrication failure is still the most expensive cause of damage.





### Cause of damage

- ▶ Contaminated lubrication oil
- ▶ Experts not in attendance at major overhauls
- ▶ Using contaminated bunkers
- ▶ Purifiers not operated as per manufacturers' instructions
- ▶ Engine components not overhauled as per manufacturers' instructions
- ▶ Crew with insufficient experience/training

### Recurring issues

- ▶ Insufficient planning
- ▶ Insufficient experience/training
- ▶ Non-compliance with company procedures
- ▶ Procedures which are unclear, not comprehensive enough or have not been implemented
- ▶ Experts not in attendance at major overhauls
- ▶ Not having adequate follow-up methods after maintenance work

### Core statistics: Vessels insured for Hull & Machinery (H&M) 2012-2014:

- ▶ Total number of vessel/years: 5,467
- ▶ All vessel types and sizes
- ▶ Claims equal to, or more than, USD 10,000 on 100% basis considered
- ▶ Deductibles included

**Number of machinery claims: 487**

**Number of main engine claims: 118**

**Total number of H&M claims: 1051**

# Introduction

In 2012, The Swedish Club presented the findings from a seven-year study of main engine damage (2005–2011). This report sets out the results of a follow-up study, spanning the three year period 2012–2014.

The objectives of this report are to update the analysis published in 2012; identify new claims trends; and to review and reinforce the Club's Main Engine Damage Loss Prevention Program. The fundamental aim is to reduce the frequency/severity of main engine damage.

Only claims exceeding USD 10,000 or more (deductibles included) have been considered. However, it should be borne in mind that the costs cited understate the true scale of the problem, as claims falling below the deductible tend not to be brought to the Club's attention.

Other costs that surround a claim such as Loss of Hire, cost for closed ports, loss of reputation etc. are not considered in this report.

## Overview

The Swedish Club provides members with a range of cover, including Protection and Indemnity (P&I); Freight Demurrage and Defence (FD&D) and Marine & Energy and Ancillary (Marine) covers.

The Swedish Club has always had a proactive policy, directed at raising awareness of main engine damage and encouraging manufacturers to respond with new and more effective measures for reducing the frequency of engine damage.

## Hull & Machinery claims

The Club's H&M claims in the 2005–2011 and 2012–2014 periods are shown in Graphs 3 and 4, respectively.

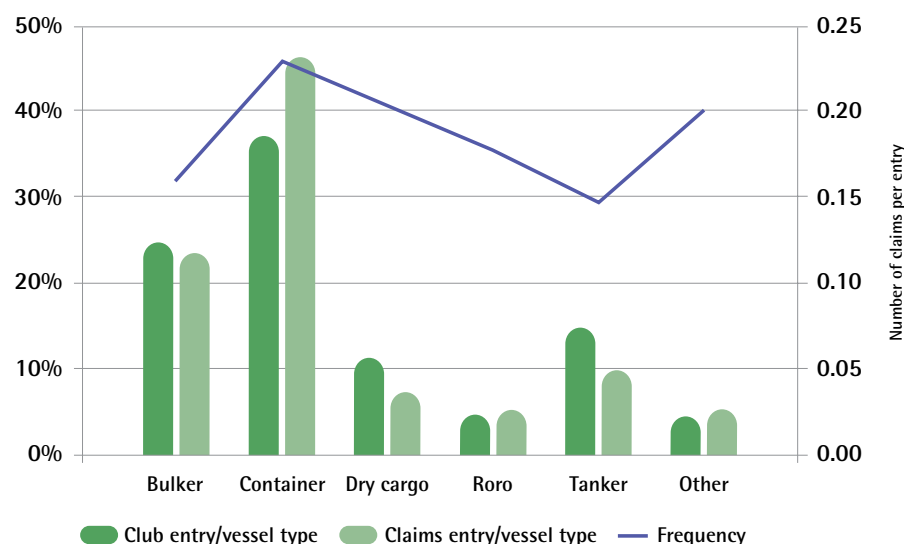
Seven claims categories are represented. It can be seen that as a proportion, the machinery claims have fallen since 2011. Machinery claims accounted for 50% of H&M claims in the earlier study, decreasing to 46% in the later period.

In cost terms the proportion of machinery claims remains almost the same. For the period 2005–2011, the cost of

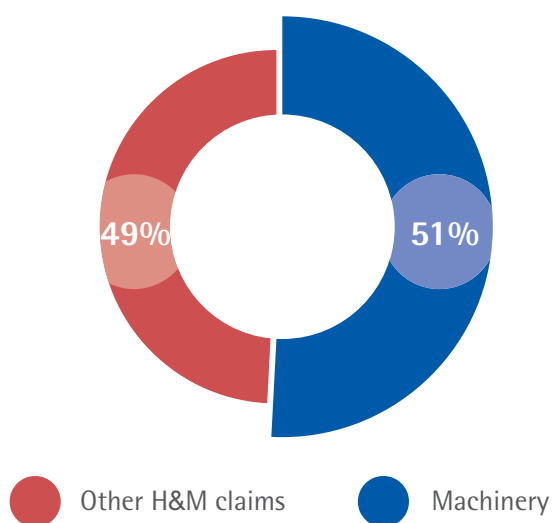
machinery claims accounted for 36% of the total H&M claims costs. In the most recent analysis this proportion remained similar at 37%.

In the comparison between total H&M claims cost and vessels entered for H&M by vessel type, container vessels are found to be overrepresented and account for 46% of the total cost while accounting for 37% of the fleet. Frequency of claims per vessel type is also presented in graph 1.

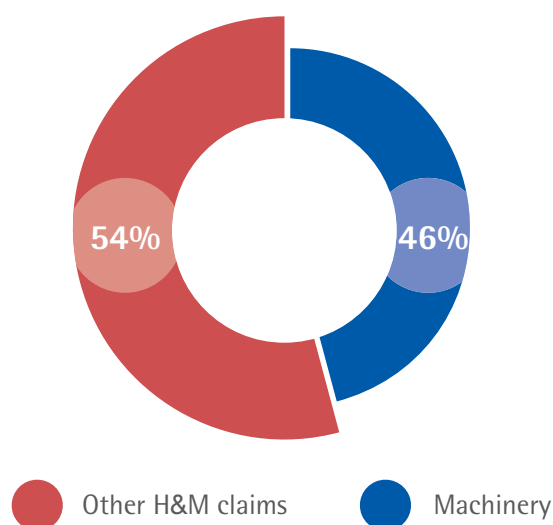
**Graph 1. H&M claims by vessel type, 2012–2014**



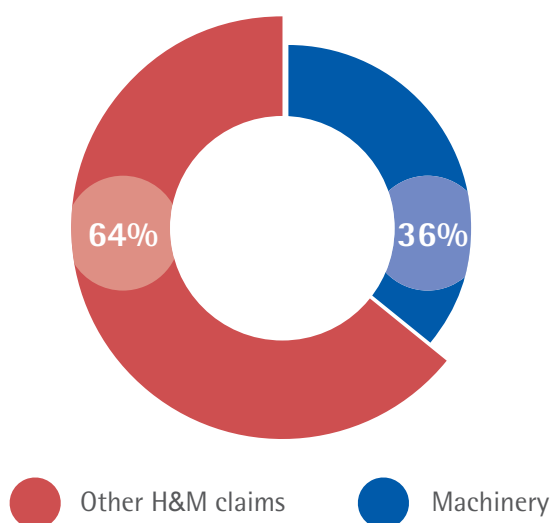
Graph 2. H&M claims by number, 2005-2011



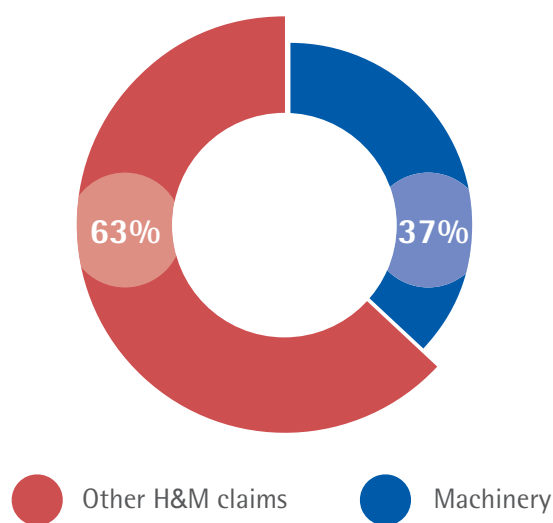
Graph 3. H&M claims by number, 2012-2014



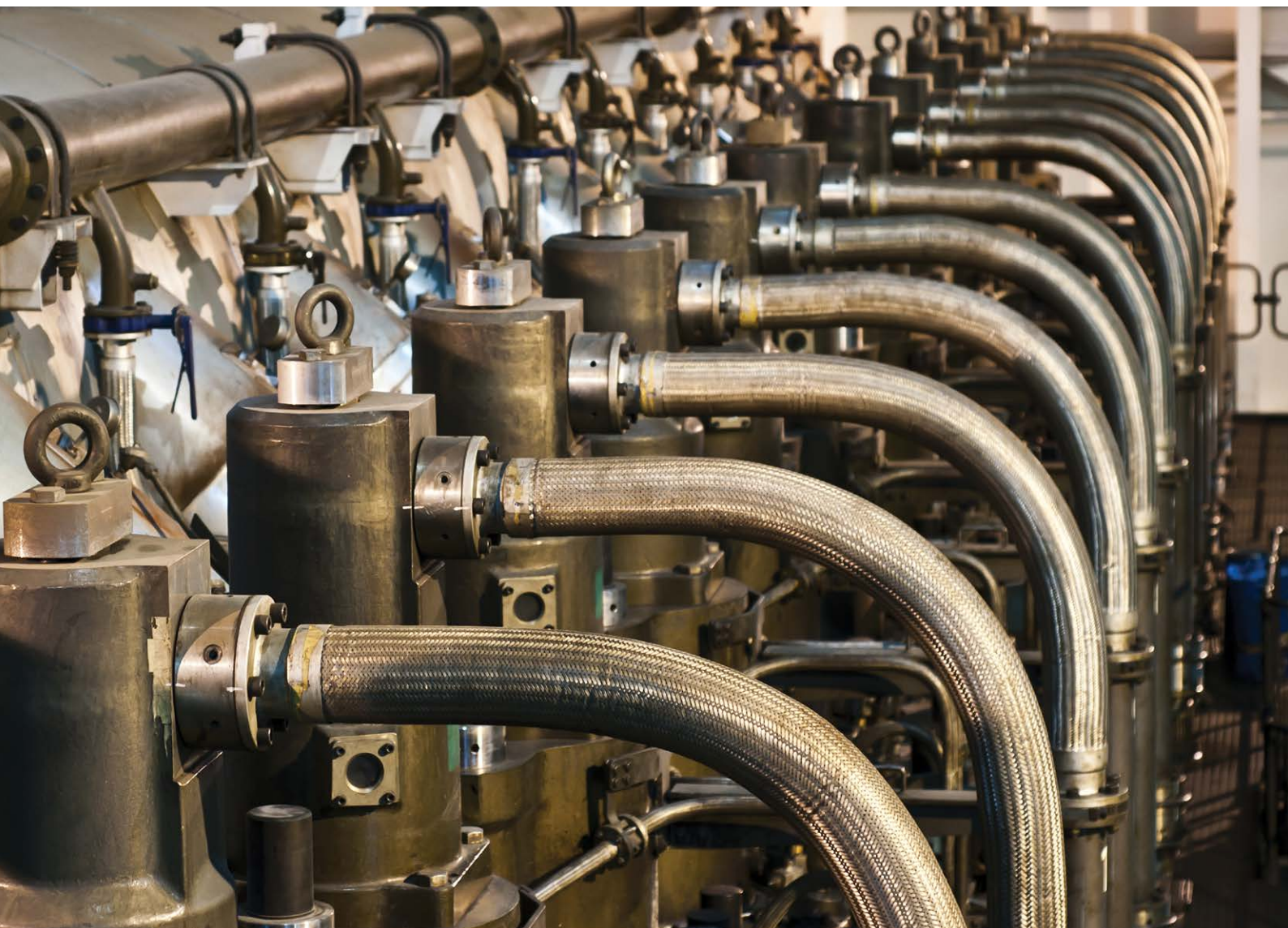
Graph 4. H&M claims by cost, 2005-2011, adjusted to 2014's level



Graph 5. H&M claims by cost, 2012-2014







## Machinery claims

The Swedish Club experienced 487 machinery claims in the 2012-2014 period, costing a total of USD 187.6 million.

Main engine damage remains the most expensive category, contributing 34.3% of total machinery claims cost (30.4% in the earlier period) and 12.7% (10.9%) of the total H&M claims cost. Despite the rise in claims cost share, the average cost of a main engine claim has reduced by 14.0% compared to the previous survey period.

The average cost of main engine damage between 2005-2011 was almost USD 634,000. The latest survey records 118 main engine claims averaging USD 545,000 which is a 14% decrease (Table 1).

**Table 1. Machinery claims, 2012-2014**

Claims Type	Number	Average cost (USD)	Change (%)
Main engine	118	545,000	-14%
Aux engine	79	326,000	-7%
Turbocharger	79	335,000	-8%
Propulsion*	109	442,000	-37%
Rudder/Steering gear	22	321,000	-48%
Boiler	22	247,000	-22%
Other**	91	235,000	-21%
<b>TOTAL</b>	<b>487</b>	<b>385,000</b>	<b>-19%</b>

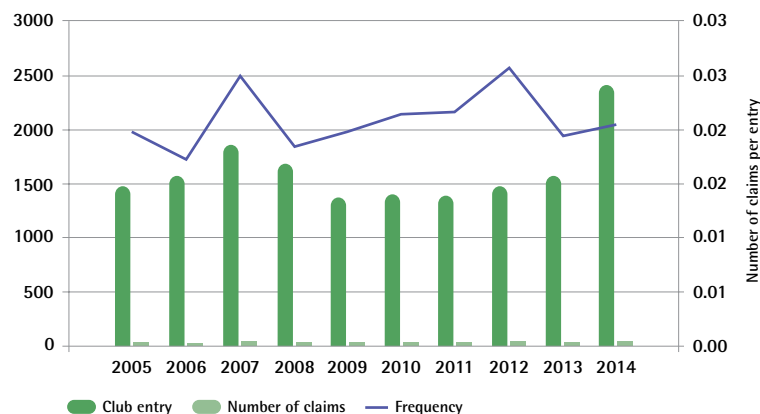
\*Propeller, shaft, gearbox etc

\*\*Machinery such as electrical equipment, cranes, cargo gear, deck equipment

# Main engine claims

An overview of the main engine claims frequency trend over a 10-year period shows minor fluctuations over the period and has stabilized to around 0.02 claims per vessel/year (graph 6 below).

**Graph 6. Main engine claims and trends, 2005-2014**



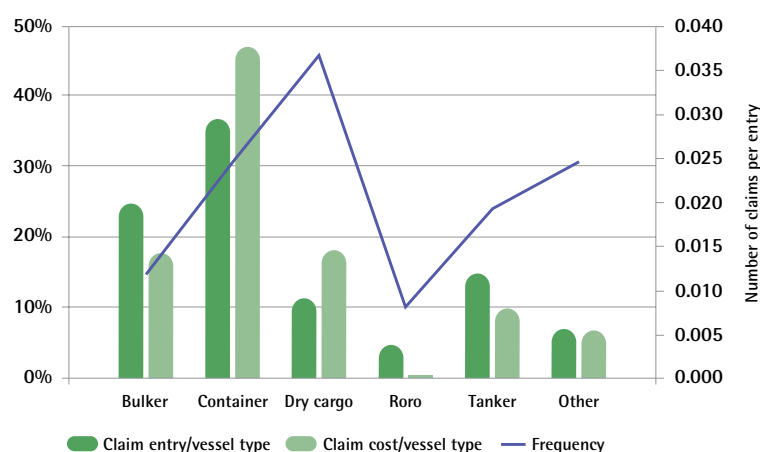
## Overview of main engine claims by vessel specifics

Container vessels account for more than 47% of the total cost of main engine damage claims but only 37% of the fleet, presented in Graph 7. This trend has broad similarities with Graph 1 where container vessels are also overrepresented. It can be concluded that container vessels are therefore particularly exposed to main engine claims. Conversely, Graph 7 shows that bulker and tanker vessels are underrepresented in the hierarchy of total main engine damage claims costs. Dry cargo vessels have the highest claims per insured vessel value.

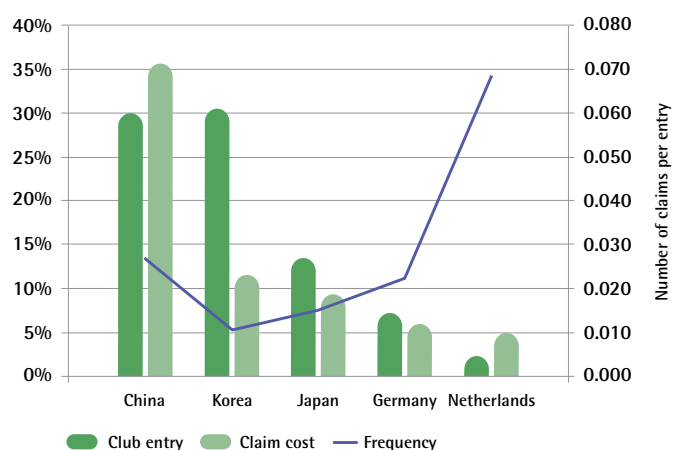
When comparing the relation between number of club entries and claims cost as well as claim frequency by vessel builder country, it is shown that Korea, which accounts for almost 31% of club entries, only shares 12% of the total main engine claims cost (Graph 8).

Conversely China is overrepresented by a large margin, with almost 30% of club entries and 36% of the total claim costs for all engine types.

**Graph 7. Main engine claims by vessel type, 2012-2014**



**Graph 8. Top five: Main engine claims by vessel builder country, 2012-2014**



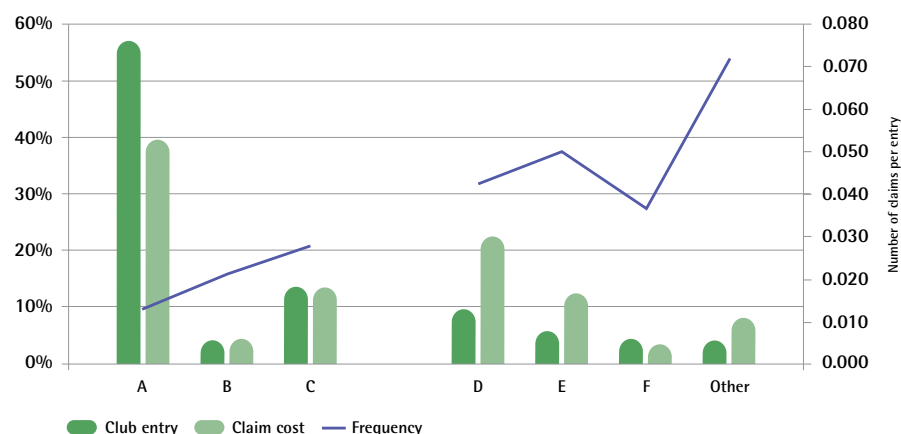


## Overview of main engine claims by engine specifics

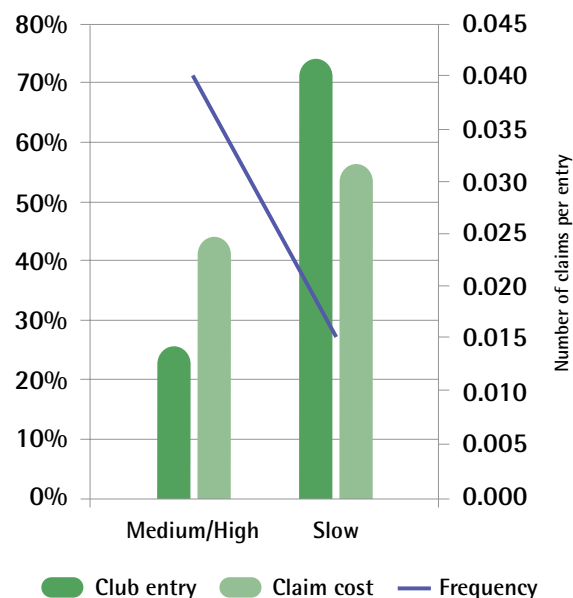
Main engine claims and entry by make of engine is shown in Graph 9, represented by the codes A-F. Codes A-C are low speed engine makes and D-F and 'Other' are medium/high. The identity of the manufacturers is available to Club members only, upon request.

The survey shows that despite accounting for over 57% of club entries, engine makers with code A represent only 40% of main engine claims cost. Codes D and E on the other hand are overrepresented with about 15% club entries in total and over a third of the total main engine claims costs together. 'Other' engine makes have extremely few vessels insured hence the disproportionate result.

**Graph 9. Main engine claims by engine make, 2012-2014**

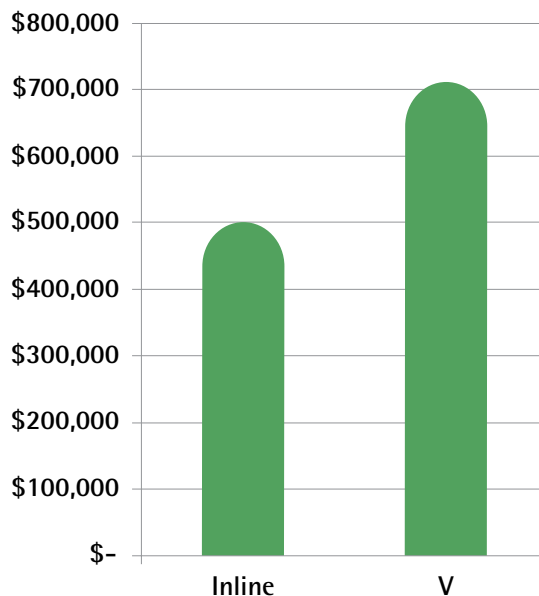


**Graph 10. Main engine claims by engine make, 2012-2014**

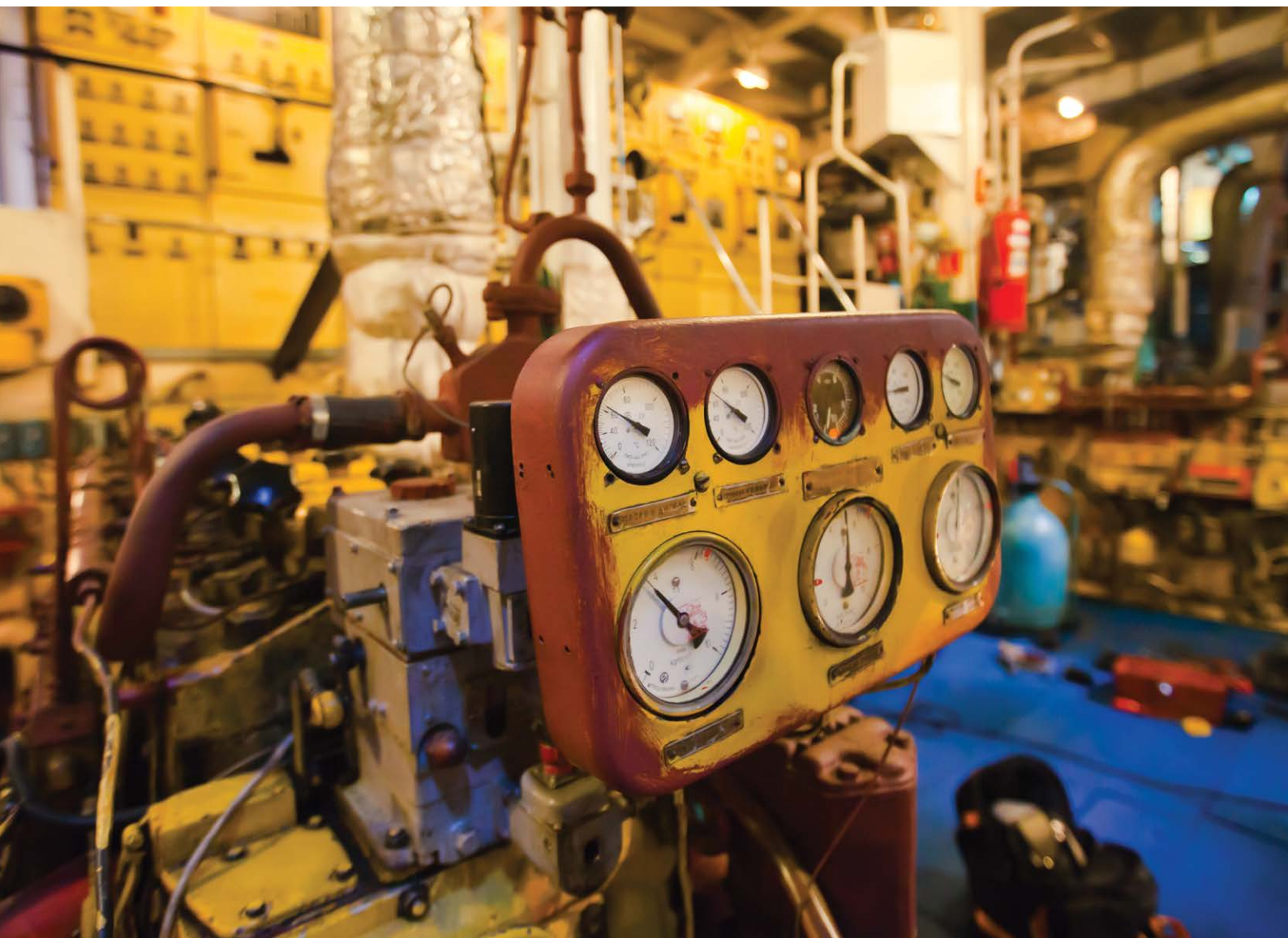


Graph 10 shows that vessels entered with The Swedish Club for H&M consist mainly of low speed engine vessels. However in terms of claim frequency it is shown that vessels with medium and high speed engines have a higher claim/entry ratio.

**Graph 11. Four-stroke-Inline versus V configuration, 2012-2014**



The configuration of medium/high speed engines relates to the claim cost. V configured engines have a 42% higher average claim cost than inline as shown in Graph 11. The frequency of claims is approximately the same.



## Damaged parts

Table 2 focus on the seven most common damaged parts in the main engine claims category. The tables show numbers and costs per damaged parts for claims for the 2012-2014 period. The latest survey shows that bearing damage now constitutes the part with the most expensive damage, with an average cost of USD 1.6 million.

**Table 2. The seven most common types of claims, 2012-2014**

Damaged parts	Number	Average cost (USD)	Change (%)
Bearing*	4	\$1,601,000	110%
Camshaft	13	\$1,050,000	-23%
Cylinder/liner	12	\$486,627	-18%
Cylinder cover	5	\$193,000	na
Fuel Pumps	5	\$410,000	na
Piston	6	\$528,000	33%
Multiple parts**	15	\$509,000	-20%

\*Includes crankshaft damage

\*\*Damage where multiple engine parts are involved and the proximate cause could not be established.



## Cause of damage

- ▶ Contaminated lubrication oil
- ▶ Experts not in attendance at major overhauls
- ▶ Using contaminated bunkers
- ▶ Purifiers not operated as per manufacturers' instructions
- ▶ Engine components not overhauled as per manufacturers' instructions
- ▶ Crew with insufficient experience/training

Tables 3 & 4 shows the top three most common causes of damage for the 2005-2011 and 2012-2014 periods respectively. Incorrect maintenance and/or repairs are the most frequent cause of damage in both periods. With an average cost per claim of USD 926,000, lubrication failure is still the most expensive cause of damage to the main engine.

**Table 3. Top 3 causes of damage by number, 2005-2011**

Cause	Number	Average cost (USD)
Incorrect maintenance and/or repairs	33	741,354
Fuel management	27	318,000
Lubrication failure	23	1,194,000

**Table 4. Top 3 causes of damage by number, 2012-2014**

Cause	Number	Average cost (USD)
Incorrect maintenance and/or repairs	17	849,000
Lubrication failure	13	926,000
Fuel management	8	342,000

### Maintenance

The latest survey has shown that most main engine claims are as a direct and indirect result of incorrect maintenance. Numerous cases have been noted where damage occurs shortly after the engines have been overhauled by ship or shore staff. This emphasizes the importance of correct maintenance.

### Recurring issues

- ▶ Insufficient planning.
- ▶ Insufficient experience/training.
- ▶ Non-compliance with company procedures.
- ▶ Procedures which are unclear, not comprehensive enough or have not been implemented.
- ▶ Experts not in attendance at major overhauls.
- ▶ Not having adequate follow-up methods after maintenance work.

### Limited experience

Shortage of seafarers with experience has been highlighted before in Club publications, but it is worth repeating. This fact emphasizes the importance of monitoring by shore staff. There is a significant risk that officers are being promoted before they have acquired the necessary experience for senior command.

It is also important that the maintenance of **all engine components** is included in the PMS (Planned Maintenance System).



## Prevention

- ▶ Implement onboard fuel management and fuel system audits.
- ▶ Verify that the various parts, including purifiers are tested for proper function and are operated in accordance with manufacturers' recommendations.
- ▶ It is imperative to monitor the quality of the lubrication oil. Samples of lubrication oils should be sent ashore for analysis at least every three months.
- ▶ During major overhauls it is highly recommended to have experts in attendance.
- ▶ It is important to only use spare parts approved by the engine manufacturer.
- ▶ Invest in employee training.
- ▶ Carry out comprehensive audits and inspections.
- ▶ Replace diaphragm sealings at crank case lube oil outlets at recommended intervals.

## Management

An in-depth investigation of machinery claims shows that a great deal of engine damage is related to insufficient management systems. In order to reduce machinery claims a well-implemented and proper management system is important.

It is essential that crewmembers have the necessary experience to ensure that ordinary daily work and maintenance is performed in accordance with company procedures. However it is of utmost importance to carry out comprehensive audits and inspections to prevent management plans from being compromised.

Insufficient reporting and follow up work is a major problem at the management stage. It is highly recommended that members have a PMS which is approved by a classification society and well-implemented both onboard and ashore, with annual controls put in place by the classification society to achieve best possible results.



## Loss Prevention

The Loss Prevention unit is placed within the Strategic Business Development & Client Relationship department and provides active loss prevention support, analysis and reports, as well as advice to members.



**Lars A. Malm**

Director, Strategic Business Development & Client Relationship

Telephone: +46 31 638 427

E-mail: [lars.malm@swedishclub.com](mailto:lars.malm@swedishclub.com)



**Anders Hultman**

Loss Prevention Coordinator

Telephone: +46 31 638 426

E-mail: [anders.hultman@swedishclub.com](mailto:anders.hultman@swedishclub.com)



**Joakim Enström**

Loss Prevention Officer

Telephone: +46 31 638 445

E-mail: [joakim.enstrom@swedishclub.com](mailto:joakim.enstrom@swedishclub.com)



## Contact

### Head Office Gothenburg

Visiting address: Gullbergs Strandgata 6,  
411 04 Gothenburg

Postal address: P.O. Box 171,  
SE-401 22 Gothenburg, Sweden

Tel: +46 31 638 400, Fax: +46 31 156 711

E-mail: [swedish.club@swedishclub.com](mailto:swedish.club@swedishclub.com)

**Emergency: +46 31 151 328**

### Piraeus

5<sup>th</sup> Floor, 87 Akti Miaouli, 185 38 Piraeus, Greece

Tel: +30 211 120 8400, Fax: +30 210 452 5957

E-mail: [mail.piraeus@swedishclub.com](mailto:mail.piraeus@swedishclub.com)

**Emergency: +30 6944 530 856**

### Hong Kong

Suite 6306, Central Plaza, 18 Harbour Road,  
Wanchai, Hong Kong

Tel: +852 2598 6238, Fax: +852 2845 9203

E-mail: [mail.hongkong@swedishclub.com](mailto:mail.hongkong@swedishclub.com)

**Emergency: +852 2598 6464**

### Tokyo

2-14, 3 Chome, Oshima, Kawasaki-Ku  
Kawasaki, Kanagawa 210-0834, Japan

Tel: +81 44 222 0082, Fax: +81 44 222 0145

E-mail: [mail.tokyo@swedishclub.com](mailto:mail.tokyo@swedishclub.com)

**Emergency: +81 44 222 0082**

### Oslo

Dyna Brygge 9, Tjuvholmen

N-0252 Oslo, Norway

Tel: +47 9828 1822, Mobile: +47 9058 6725

E-mail: [mail.oslo@swedishclub.com](mailto:mail.oslo@swedishclub.com)

**Emergency: +46 31 151 328**

### London

New London House, 6 London Street  
EC3R 7LP, London, UK

Tel: +46 31 638 400, Fax: +46 31 156 711

E-mail: [swedish.club@swedishclub.com](mailto:swedish.club@swedishclub.com)

**Emergency: +46 31 151 328**