



Maritime and Coastguard Agency

Hull Stress Monitoring Systems

Notice to Shipowners, Ship Operators, Charterers and Managers; Ships' Masters, Ships' Officers, Engineers, Surveyors and Manufacturers of Hull Stress Monitoring Systems

Summary

- Recommendation for the fitting of hull stress monitoring systems on bulk carriers of 20,000 dwt and above.
- Arrangements for type approval of hull stress monitoring systems

1 The International Maritime Organization (IMO) recommends the fitting of hull stress monitoring systems to facilitate the safe operation of ships carrying dry cargo in bulk. Use of the system will provide the Master and Officers of the ship with real-time information on the motions and global stress the ship experiences while navigating, and during loading and unloading operations. The IMO recommendations are published in the Maritime Safety Committee circular, MSC/Circ.646, which is annexed to this Marine Guidance Note.

2 The Maritime and Coastguard Agency (MCA) supports the IMO's recommendations, and invites owners to fit hull stress monitoring systems on bulk carriers of 20,000 dwt and above. Consideration should also be given to fitting such systems to other types of ship.

3 The MCA requests all parties to return information on the reliability of hull stress monitoring systems, their performance relative to the actual and predicted stress levels, their application to other types and sizes of ships and any other relevant experience gained in the use of such systems. Such information should be returned to the Ship Construction Division Section quoting reference MS070/014/0007. This information will be used to inform future deliberations at the IMO, which may include the development of performance standards.

4 The IMO's recommendations call for the hardware and software of the hull stress monitoring system to be approved by the Administration. In this respect, the MCA will accept type approval certification of compliance with MSC/Circ.646, which has been issued by one of the Nominated Bodies, listed in Table A of the annex to MSN No. M.1645 "Type approval of Marine Equipment", who are authorised to examine, test and certify equipment. The terms of M.1645 shall apply. The type approval of hull stress monitoring systems will be included in the next revision of M.1645.

5 Since the adoption of MSC/Circ.646 in 1994, the design of hull stress monitoring systems has developed and some of the Nominated Bodies are developing standards for such systems. Such development is beneficial and to be encouraged. Consequently, the MCA will accept type approval certification which has been issued by one of the Nominated Bodies in accordance with its published

standards or rules, provided that any deviation from MSC/Circ.646 is recorded on the certificate and notified to the MCA.

6 In designing hull stress monitoring systems, consideration should be given to the IMO Performance Standards for Shipborne Voyage Data Recorders (VDRs), published as Resolution A.861(20). Paragraph 5.4.14 of this standard states:-

“5.4.14 Accelerations and hull stresses

Where a ship is fitted with hull stress and response monitoring equipment, all the data items that have been pre-selected within that equipment should be recorded”

Owners are invited to ensure that hull stress monitoring equipment is compatible with the VDR fitted and that all monitored data can be transmitted to the VDR.

7 Approval of the hardware and software of the hull stress monitoring system is the first stage but it is essential that the assigning authority for the International Load Line Certificate be consulted regarding the installation of the hull stress monitoring system and the determination of maximum permissible stresses and accelerations. They will also need to be consulted over the frequency of system verification, taking account of the manufacturer’s recommendations.

8 Further information on this Note may be obtained from:-

Maritime and Coastguard Agency
Spring Place
105, Commercial Road
SOUTHAMPTON
SO15 1EG

01703 329100 (tel)
01703 329204 (fax)

February 1999

[MS070_014_0007]



*An executive agency of the Department of the
Environment, Transport and the Regions*



Ref. T4/3.03

RECOMMENDATIONS FOR THE FITTING OF HULL STRESS MONITORING SYSTEMS

1 A number of bulk carrier losses in the late 1980s prompted the Organization to take various steps to improve the safety of such ships, including interim measures to improve the safety of bulk carriers (resolution A.713(17)) and the enhanced programmes of surveys (resolution A.744(18)). Concerned over the continued loss of bulk carriers, often without forewarning, trace or apparent cause, the Maritime Safety Committee agreed to conduct a feasibility study on the use of voyage data recorders on board ships so as to provide a record of the ships' loading condition, motion and global stress levels, thus enabling the determination of the cause of loss.

2 The Committee, at its sixty-second session (24 to 28 May 1993), noted the opinion of the Sub-Committee on Ship Design and Equipment that, although technically feasible, the fitting of voyage data recorders was not considered vital since the cause for loss of the bulk carriers had been established by the Administrations and IACS Members.

3 The Committee recognized that part of the input data recorded by voyage data recorders would include global stress and ship motions, as provided by a hull stress monitoring system, and considered that such a system would be useful as an aid to the master during navigation and as a means to verify global hull stress during loading/unloading operations, but not necessarily as an immediate means to rectify conditions which might lead to the loss of bulk carriers.

4 The Committee, at its sixty-third session (16 to 25 May 1994), approved recommendations for the fitting of hull stress monitoring systems for improving the safe operation of ships carrying dry cargo in bulk, set out at annex to the present circular. Member Governments are invited:

- .1 to consider the fitting of hull stress monitoring systems on bulk carriers of 20,000 dwt and above;
- .2 to collect data with a view to establishing reliability and performance of the systems relative to the actual and predicted stress levels;
- .3 as experience is gained, to consider fitting such systems to other types of ships; and
- .4 to submit to the Organization information on experience gained in the use of such systems to enable the Committee to consider any additional relevant action which may be necessary, including the development of relevant performance standards.

ANNEX

**RECOMMENDATIONS FOR THE FITTING OF HULL STRESS MONITORING
SYSTEMS FOR IMPROVING THE SAFE OPERATIONS OF SHIPS
CARRYING DRY CARGO IN BULK**

1 OBJECTIVE

Hull Stress Monitoring System (HSMS) is a system to provide real-time information to the master and officers of the ship of the motions and global stress the ship experiences while navigating and during loading and unloading operations. The HSMS is to be considered as an aid to the master. It does not replace his own judgement or responsibility.

2 SYSTEM SPECIFICATION

2.1 System components

In order to monitor the global longitudinal stress and ship motions, the following system components should be used:

.1 Sensors

The system sensors consist of:

- .1.1 Long-based gauges for strain measurements, located on the main deck at different positions along the ship's length, to detect stresses during loading, unloading navigation, e.g., the gauges for strain measurement should be located on the main deck in way of each cargo hold and, if necessary, at the location where the maximum hull girder wave bending stress can be expected during navigation, loading and unloading.
- .1.2 One accelerometer for measuring vertical accelerations at the bow.
- .1.3 Two accelerometers for measuring roll and sway, suitably located at the centre line of the ship.

.2 Microprocessors

A microprocessor that can interpret sensor signals and compare these with the allowable levels approved by the Administration. To verify intermediate and final stages of loading and unloading operations, the HSMS can be linked to the loading calculator. The system visual and audible indications to indicate high stress or motion levels approaching threshold values.

.3 Visual display

A graphical display, supplemented by digital display as appropriate, suitable for the presentation of the sensor information, taking due account of the importance of the human interface.

.4 Data storage

An electronic data storage recording device suitable for accumulating statistical information for feedback purposes.

2.2 Sensor information

.1 The strain gauges on the main deck, taking due account of temperature effects, are to give information on the stress levels during navigation, loading and unloading. They are to give information on the wave induced stresses and the mean value of still water stresses. By analysing an offset to a mean value, an indication of water ingress into the holds can also be provided.

.2 The signals from the accelerometers are to describe the vertical and transverse motion of the ship. By analysing the frequency ranges of the signals from the vertical gauge, slamming information can also be provided.

2.3 System verification

Means for ensuring the integrity of the data are to be incorporated. Checks of the total system have to be done at intervals as agreed by the Administration.

2.4 System approval

The hardware and the software of the monitoring system should be approved by the Administration.

2.5 Training

All appropriate officers should be fully trained with regard to the use and limitations of the monitoring system.