

log m-233

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

ISSUED: December 7, 1983

Forwarded to:

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SAFETY RECOMMENDATION(S)

M-83-86 through -88

About 0410 on September 26, 1982, the outbound Dutch bulk carrier M/V AMSTELVOORN, owned by Nedlloyd Bulk Shipping of Rotterdam, Holland, experienced a steering gear malfunction and rammed the pier facility of the Bayou Steel Company, located 2 miles south of LaPlace, Louisiana, on the left descending bank of the Lower Mississippi River at mile 132.4 above Head of Passes (A.H.P.). The ramming severely damaged the 961-foot pier used for vehicular traffic and destroyed the 275-foot T-wharf and associated cargo handling equipment. The AMSTELVOORN sustained moderate damage to the bow above the waterline. There were no deaths or injuries, but total property damage was estimated at over \$8 million. <sup>1/</sup>

The steering gear system installed on the M/V AMSTELVOORN had been in service 14 months. The system was of a modern design with redundancy provided through two separate electro-hydraulic steering systems; it conformed to Lloyd's Register of Shipping Rules and Regulations and international standards. However, the system had experienced a history of excessive vibrations, failures of pipe and fittings, and hydraulic system leaks from the day following its delivery to the owners to the day of this accident.

During the initial 14 months of service, the steering gear had been operated in accordance with Nedlloyd fleet instructions and the recommended marine practice of operating one main hydraulic steering pump while the vessel is at sea and both main steering pumps when navigating in confined waters. Nevertheless, extensive research by electrical and hydraulic engineers has shown that simultaneous operation of both main steering system pumps of the Hydroster model MS-800-TE-1 steering gear is a potential safety hazard. The failure of the port or starboard solenoid-actuated hydraulic control valve can result in the hydraulic lock of the steering system and in the loss of rudder control. This failure is more likely to occur when both pump units are operated simultaneously. When this hydraulic lock occurs, no alarm will be activated to indicate the source and type of failure.

The steering system failure on September 26, 1982, probably was caused by the sticking of the spring-centered spool piece in the starboard solenoid-actuated hydraulic control valve. The malfunction occurred while the port and starboard main steering

<sup>1/</sup> For more detailed information, read Marine Accident Report—"Ramming of the Bayou Steel Pier Facility by the Dutch Bulk Carrier M/V AMSTELVOORN on September 26, 1982, (NTSB-MAR-83-08).

pumps were both operating simultaneously in the follow-up control mode. Sticking of the spool piece in the aft position opened ports within the control valve which allowed hydraulic oil pressure to hold the rudder in the port position. When the helmsman moved the helm to starboard to bring the rudder to midship, only the port side solenoid-actuated hydraulic control valve positioned its spool piece for starboard rudder movement. Consequently, one-half of the hydraulic control system was positioned for a port rudder movement and the other half of the control system was positioned for a starboard rudder movement. The existence of this condition prevented rudder movement because equal hydraulic forces were acting in direct opposition to each other, thereby creating a hydraulic lock.

The sticking of the spool piece may have been caused by foreign particle contamination of the hydraulic fluid. The main steering gear system is equipped with four strainers. Each strainer consists of a doughnut shaped magnet, surrounded by a shaped screen of 25-micron mesh. The port and starboard solenoid-actuated hydraulic control valves have operating clearances of 4 microns, so nonmagnetic particles passing through the strainer could cause sticking of the control valve spool piece. The repeated repairs to the hydraulic oil side of the system, the pipe and flange fractures, and the removal and replacement of pipe created conditions which favored the introduction of foreign particles into the hydraulic oil system.

As a result of its investigation of this accident, the Safety Board recommends that the Hydroster/Ship Machinery Works:

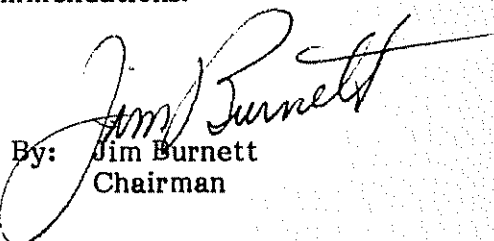
Contact ship owners/operators of vessels that are outfitted with the Hydroster model MS-800-TE-1 steering gear and inform them of the hazards involved with simultaneous operation of both main steering pumps. (Class II, Priority Action) (M-83-86)

Provide revised operating instructions for simultaneous pump operation of the Hydroster model MS-800-TE-1 steering gear for all vessels that are outfitted with this type of steering gear. (Class II, Priority Action) (M-83-87)

Review the steering gear system design of the Hydroster model MS-800-TE-1 and design an effective alarm which will activate when the system fails due to hydraulic lock. (Class II, Priority Action) (M-83-88)

The National Transportation Safety Board is an independent Federal agency of the United States with the statutory responsibility "...to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations, and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.

By:   
Jim Burnett  
Chairman