



## Collision with wharf and barge after steering power loss

### (1) Preface

In August 2009 and April 2011, Chemical Tanker and Bulk Carrier (both about G/T 20,000) lost steering power and then collided with wharfs and barges while they proceeded outbound in the river channel.

In the investigation into the causes leading to the accidents, causes of loss of steering power seemed transient trouble of similar parts on the steering equipment.

But the service engineers of the steering system maker could not specify any malfunctions of the steering system.

On the other hand, the respective duty crew on the bridge were in panic when the two accidents occurred and could not take an adequate emergency counter measure. (They could not execute an action following the steering system manual book and working instructions.) This was one of the reasons why the accidents occurred.



(This photo is not related to the article.)

We would like to discuss an outline of accidents and counter measures to prevent any similar accidents in the future.

### (2) Case 1 (Chemical Tanker)

After loading cargo in August 2009, while transiting the river with a pilot on board, the rudder stopped its motion at 10 degrees starboard position. The steering was changed to “non-follow up mode” from the manual steering and also changed the steering system from No.1 to No.2 by the duty officer and able seaman who were both in panic due to the steering trouble condition.

Unfortunately, the rudder movement could not be controlled and the vessel came in contact with the floating dock and caused extensive damage to the vessel and floating dock.

At the same time, the master and the pilot immediately gave orders to put the main engine in full astern and dropped the vessel's port anchor, but there was not enough time to stop the

vessel's course.

The steering alarm system was suddenly activated with the indicator lamp signal for “SYS FAIL” on the wheel stand panel as per statements of the duty officer/able seaman. This was later confirmed through analysis of VDR data.



(This photo is not related to the article.)

According to the initial investigation, an abnormal condition was noted in the solenoid valve\*. The steering system was supposed to fall into the condition “Hydraulic Lock\*”.

\* Solenoid Valve

Electric-Magnetic valve for system control: Receiving transmission signal of Steering order and controlling hydraulic line.

\* Hydraulic Lock

A phenomenon where a solenoid valve stays at the neutral position for unknown reason and does not move in the ordered direction due to the fact that the hydraulic power is not activated. This phenomenon occurs even though a steering order is given.

This abnormal condition was cleared automatically after the vessel had come in contact with the floating dock.

Although the service engineer of the steering system maker checked all the units of the steering system, but there was no previous similar problem on the system and he could not identify any malfunctions of the steering system.

For the sake of safety, the service engineer replaced the solenoid valve with a new one and no more similar problem occurred since then.

(3) Case 2 (Bulk Carrier)

After loading cargo in April 2011, while transiting the river with a pilot on board, duty crew suddenly could not control the vessel's steering at 8 degrees port rudder position.

Although duty officer on the bridge tried to re-set the steering systems by means of steering panel operation, he could not recover the steering systems. Consequently the vessel came into contact with barges and wharfs thereby causing substantial damage.

Similarly to case 1, the master and the pilot gave orders to put the main engine in full astern and dropped the vessel's starboard anchor, but again, there was not enough time to stop the vessel's course.

After the investigation, the following trouble of the steering system was observed:

Two minutes before the accident, the steering system alarm sounded with No.1 Hydraulic Lock indicator lamp on the steering control panel. The duty officer considered it to be a "False Alarm" and stopped the audible alarm by pressing the "Buzzer Stop" button and proceeded with the vessel's transit through the river.

About two minutes later, the same alarm was activated again and the duty officer on the bridge stopped the audible alarm without checking the steering system in detail. At the same time, he noticed that the Green power indicator light for No.1 steering motor was off and pushed the "Start" button of No.1 steering motor to re-start it. Unfortunately, no steering control condition occurred immediately after he pushed the "Start" button.

Upon an investigation and a statement of the duty officer, it was found that the same alarm with the indicator lamp on the steering control panel sounded several times, even at the time of the rudder testing before the vessel's departure.

However, the duty officer pushed the "Buzzer Stop" button to recover the steering system and did not observe any problem with the steering system. Therefore, once again, he considered this incident to be a "False alarm".

Case 2 is different from case 1. No-Voltage, Over load, Hydraulic Lock or other indicators were equipped on the steering panel so as to alert the crew with this particular problem. The "Hydraulic-Lock alarm" was activated when Hydraulic Lock conditions took place in the Solenoid Valve Unit.

Similarly to case 1, in case 2, the service engineer of the steering system maker checked all the units of the steering system, but as there was no previous similar problem on the system, he could not identify any malfunctions in the steering system.

For the sake of safety, the service engineer replaced the Solenoid Valve and the Main Valve (Control valve for the direction of the Rudder hydraulic line) with new ones.

As per manual book and working instructions, when No.1 Solenoid Valve fails while No.1 and No.2 pumps are in parallel operation, No.1 hydraulic lock alarm is raised on the wheel house

steering alarm panel. On hearing this alarm, No.1 pump must be stopped immediately so that the failed valve and steering can be continued by means of No.2 pump.

Therefore, the duty officer in panic tried to re-set the system, but failed to do so since he did not follow the manual book/working instructions properly and it is likely that such human errors led to the two steering motors being accidentally stopped by the duty officer.

#### (4) Root Cause Analysis

During investigation of the Maker Service Engineers, no malfunction in either of the two cases above was detected. However it is still assumed that Solenoid Valves issues were a direct cause of these accidents.

In addition, another possible cause of the problem may be as follows:

The duty crew on the bridge was in panic when the accidents happened and they could not execute an emergency action properly by following the steering system manual book and following the instructions, carefully.

Also, in case 2, the same alarm as the indicator lamp for “Hydraulic-Lock” on the steering control panel sounded several times before the accident. However the duty crew pushed the “Buzzer Stop” button to recover the system because they assumed it was a false alarm each time.

#### (5) Counter measures to prevent any similar accidents

Nobody can anticipate when problems with equipment may occur. In both cases 1 and 2, the rudder testing was properly carried out before sailing and the steering systems were found to be in good order.

In case 2, the same alarm as the indicator lamp for “Hydraulic-Lock” on the steering control panel sounded at the time of the rudder testing operation but the duty officer assumed it was a false alarm.

However, it is believed that an indirect cause of the incident was that the duty officers and able seamen could not take emergency action properly when the accidents occurred and they did not know how to solve the problem in both cases.

The master, all navigation officers and able seamen are requested to carry out the following steps to prevent any similar accidents caused by human errors:

1. As there are various types/makers of steering gear systems for each vessel, the master

and all officers/able seamen are advised to read and study the instructions of the Electro-Hydraulic Steering gear carefully.

2. The Emergency Action to be taken is described in the maker manual book. The master and all officers/able seamen should read the manual book carefully.

However, even though they understand individual counter measures following instructions of the manual book, it is very difficult to take an appropriate action immediately by crew in panic once emergency issues occur.

Therefore, "Procedure /Diagram" indicating how to operate the steering systems during an emergency is to be posted on the bridge.

3. Crew Training for officers and able seamen should be carried out repeatedly. "Steering Gear – Testing and drills" should be carried out strictly in conformity with SOLAS Ch. V. Reg. 26.

This includes testing of the "Emergency Steering Gear Operation".

The master is requested to carry out an "Emergency Steering Gear Operation drill" every three months as per above SOLAS regulation. This drill is mainly performed in the Steering Room to operate Emergency Steering next to the machine itself.

In addition, we recommend that the counter measure for individual steering system problems on the ship's bridge must be carried out by all officers and able seamen repeatedly, such as monthly and when there is a crew change.

4. Put some plastic covers on On/Off switches of the steering motors on the control panel.

An example aimed at preventing mishandling by human errors is to put some plastic covers on On/Off switches of the steering motor on the control panel, because the "Buzzer stop" switch and "On/Off" switch are similar in appearance on the panel.

#### (6) Epilogue

While one may think that it is very difficult to take appropriate action immediately once emergency problems referred to in the 2 cases above occur, problems may still be avoided or perhaps minimized by the master and the crew if they become familiar with the instructions.