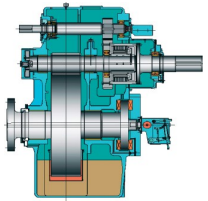
REDUCTION GEAR / CLUTCH



We believe more training is in order because of the number of subtle differences in the designs of marine clutches. With inflatable flexible gland clutches, either the elastomer (rubber) gland or the wear elements in contact with it (typically friction shoes) are known to reach the wear-out point unexpectedly. Depending on exactly what wore out and how it wore, this component has been the cause of "failure to disengage" as well as the obvious failure to engage. However, many clutch-related Loss of Propulsion and/or Maneuverability failures have been due to the loss of control air to the clutch.

CONTROL AIR VALVE

In addition to the valves, the entire control air system needs more attention because of the many different places where control air can leak; between the air supply and the clutch. Mechanical linkage has been known to come loose; most commonly between the pilothouse control and the air supply. The air regulators for the pilothouse throttle controls should have preventive maintenance plans and the vessel's master, pilot and engineer should all be conversant in the plan's language. Some degree of training might be in order.

PROPELLER AND SHAFT

Eliminating the entries where a propeller was fouled by a floating object or a line, there are numerous instances of actual propeller loss. When a blade was lost, we see that overspeed and/or shutdown often follows, but not always. When the entire propeller is lost, shutdown of its drive engine always follows promptly; be it a governor-controlled automatic shutdown or a manual shutdown. Assuming a twin-screw vessel, the immediate consequence is reduced maneuverability, possibly resulting in a collision, allision or grounding, until the speed drops to a point where single engine maneuverability can be achieved. Depending on the size & weight of the tow, this can take a few minutes. A broken propeller shaft, especially a break in the tail-shaft section, has the same effect as a lost propeller but with the added possibility of the shaft sliding aft such that the propeller jams the rudder. Single-engine handling training is recommended. Inspection of shafts, propellers and rudders by a diver after a flotsam strike is highly recommended.

Most of the failures that cause a towing vessel's diesel generator to stall or trip-off the line are related to the diesel end of the generator set. We have seen the same failures that we saw with propulsion diesels, in more-or-less the same proportions. Concerning the generator end of the set, the most common failure items are the voltage regulators and wires. The main leads and other wires should be inspected periodically; looking for cracked and/or oxidized insulation.

HULL PLATING

Sometimes when cracked or otherwise defective hull plating is found, the origin of the defect cannot be determined. Given the age of some of the vessels, it can sometimes be assumed that the defect occurred naturally; without a collision, allision or grounding. A good recommendation would be to inspect the underwater hull & bottom plating when the rudders, propellers & shafts are inspected; in drydock or by a diver.

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UNITED STATES COAST GUARD

TOP 10 TOWING VESSEL MATERIAL FAILURES

PURPOSE

We conducted an analysis of all material failures recorded by CG Investigators who investigated towing vessels after a reportable marine casualty. This brief study focused on the analysis of material failures that are the first events of marine casualties, specifically for the three types of uninspected towing vessels that are subject to the new rulemaking. These are: Towboats on rivers and other inland waters; tugs engaged in harbor operations, ship dockings & lightering barges; and tugs towing offshore barges on coastal routes. These material failures (as the 1st event) were analyzed from five years of investigation data, 2004-'08, and are not presented in any particular order.

FUEL FILTER

As a material failure, a fuel filter getting clogged with dirt, water or both dirt & water is more common on towing vessels than it is on other commercial vessels. Investigations of filter, purifier and/or separator failures indicate that these components need more attention (cleaning) than they are getting.

TOWLINE

The failure of a "towline" stands out as being the #1 item on the list. In many of these instances, the term "Towline" as the "Component Description" is referring to a facing wire. Additionally, as the term is used in our data, it also refers to any of the inter-barge connection wires; illustrated on the picture "Wires most Commonly Used and their Descriptive Names".* These wires are listed as components in the same sense that permanent parts of the vessel are components. In many instances, the failure of these wires is attributed to operator error in the handling of the boat or operator error on the part of the deck crew who might have fastened it incorrectly. It's also noted that, in some instances, the wire was either too small or it had been subject to too much wear & tear to be safe. Therefore, inspection of these towlines and training in their proper use is paramount. * Deckhand's Manual page 18.

STEERING GEAR

Linkage – We realize that the term "linkage" does not precisely identify a component in a steering system; as we cannot overemphasize the number of different mechanical connecting components that exist in a vessel's steering system.

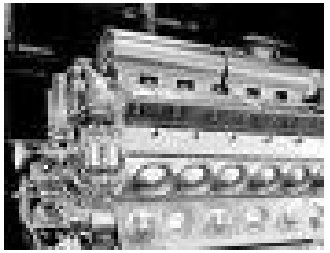
Hose – Most hose failures are that of a burst somewhere along the length of the hose. Operators should always inspect for the warning signs of oxidation and chafing wear. Additionally, the crimped-on end fittings fail, occasionally, without warning.

Rudder – Less than half of all rudder casualties are the direct result of groundings or flotsam strikes. The exact causes of most of these casualties are never attributed to one particular event. In over 20% of these casualties, the rudder has actually been lost. Having a diver inspect the rudder post and pintle, periodically, would be prudent.

Ram – Casualties related to this major component are both hydraulic and mechanical. The hydraulic failures are in common with other ram-actuated hydraulic machines: stuck pistons and blown seals. Mechanical failures are at parity with hydraulic failures, in that half of all ram-related failures involve the attachment of the ram to the rudder. Some of the mechanical failures could be considered structural failures, such as a disconnection of the ram from the rudder quadrant or the rudder post. We've seen threaded connection (nut/bolt) failures and weld failures.

Pump – The same mounting & connecting failures occur with the steering pumps as well as with the rams: 40%. Sixty percent of pump failures actually are with the pump internals: seals & bearings.

PROPULSION DIESEL



Concerning the failures of propulsion diesel internals, we compared the larger propulsion diesels with smaller engines and concluded that they're at parity with each other for failures related to their cylinders and cylinder heads. The failures that require a power-pack replacement for a cylinder perhaps indicate the lack of maintenance monitoring programs that would allow for planned power-pack replacement. Concerning cylinder heads, better monitoring of valve operation would also mean that cylinder heads would be inspected for cracks and leaking gaskets as part of the program.

GOVERNOR

The one noteworthy external component of a propulsion diesel is its governor. A governor malfunction that allows an engine to overspeed usually results in engine shut-down. The three most common causes of governor malfunction are inadequate lubrication, improper adjustment of control linkage and loss of pneumatic pressure (control air) to the governor.

GENERATOR

Most of the failures that cause a towing vessel's diesel generator to stall or trip-off the line are related to the diesel end of the generator set. We have seen the same failures that we saw with propulsion diesels, in more-or-less the same proportions. Concerning the generator end of the set, the most common failure items are the voltage regulators and wires. The main leads and other wires should be inspected periodically; looking for cracked and/or oxidized insulation.