UNITED STATES COAST GUARD
U.S. Department of Homeland Security

MARINE SAFETY ALERT

*Inspections and Compliance Directorate*

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# FUEL AND EXHAUST SYSTEM MAINTENANCE

Recently a 35,000 DWT product tanker suffered a major engine room fire in the Atlantic Ocean. The fire occurred in the early morning hours while the vessel's engineroom and machinery spaces were unattended. Upon onset of the fire, the vessel's smoke detection system activated the vessel's fire alarm. Moments afterwards other engineering alarms sounded throughout vessel. During this period crewmembers reported extensive smoke throughout the cabin passageways on different decks and in the bridge area. The vessel's crew escaped each deck by exiting doors at the rear of the house or via the bridge. Engineering personnel prior to exiting their living quarters managed to activate remote stops at a passageway control station. Their efforts resulted in the shutdown of various fuel and ventilation systems within the engineroom.

Initial reports indicate that due to the excessive smoke within the house and the inability to get to the firefighting locker, a decision was made to extinguish the fire using the vessel's fixed Carbon Dioxide extinguishing system. Prior to release, crewmembers fitted canvas coverings over engineroom intake and exhaust vents while others performed emergency functions such as communications and preparations for launching the vessel's two lifeboats. Eventually, the vessel's Carbon Dioxide system was activated and successfully extinguished the fire. During the course of these events, a salvage team and tug were requested by the vessel's master.

Several other vessels including one from the same operating company stood by to provide assistance. The following day the salvage team and tug arrived on scene. Using the tug they transferred non-essential personnel to the standby vessel and made preparations to tow the disabled tankship to port. There were no injuries or fatalities resulting from this casualty. However, main engine and machinery space equipment repair costs, associated salvage and towing costs associated are expected to be significant.

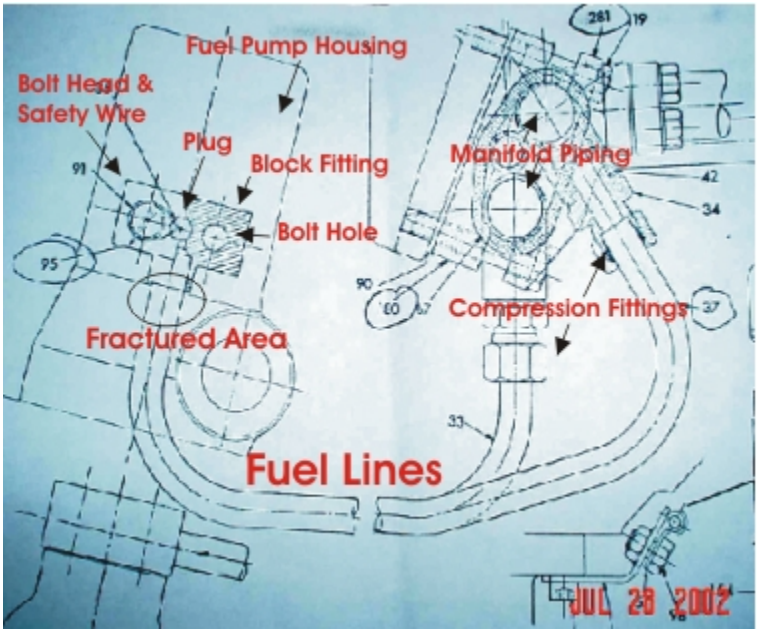
The investigation to this casualty is not complete. This safety information serves as a reminder and is provided only to assist vessel owners, operators, shore-support staff, crews and engineering personnel in assessing and understanding risks associated with the operation, maintenance and repair of their vessels.

**Main Engines**

The vessel is equipped with two vee-type, 14 cylinder, reversing, 7000 hp, turbocharged, medium speed, four stroke diesel engines capable of using multiple fuels.

**Fuel**

Each cylinder has its own cam driven fuel pump and injector. Each fuel pump is fitted with its own supply and return piping. The pre-shaped pipes are about 5/8ths of an inch in diameter and 1 1/2 feet long. Intermediate fuel oil when used is supplied under pressure at about 35 psig at a temperature near 215 degrees Fahrenheit. The supply and return piping attach to manifolds on each bank of cylinders using a compression fitting.




On the fuel pump ends, each pipe consists of a rectangular shaped block containing two bolt holes. Both blocks connect directly opposite one another on the fuel pump housing. Two metric bolts are used with spacers for each fitting. The heads of the bolts are drilled to receive safety wiring which when properly used prevents loosening. Also located on each block fitting directly between the two bolt holes is a viewing plug that is removed whenever necessary to time the fuel pump to the engine.

Investigators discovered that the supply line to the starboard engine number three cylinder fuel pump had fractured just below its connection into the rectangular block fitting. Additionally, shipyard personnel discovered the inboard bolt on the supply line fitting loose. Of 112 bolts securing the fuel pump fittings on the vessel's two engines, none were safety wired despite the availability of drilled bolt heads and indications of such wiring in engine schematics and diagrams.

Just under the block fitting of each connection, hose clamped around the tube joint is a rubber boot about four inches long. This boot is designed to deflect oil sprays downward should a break occur in this area. The boot on number three cylinder was destroyed in the fire.

**Heat Sources**

The exhaust piping begins at each cylinder head with a short section that contains a receptacle for an exhaust gas temperature pyrometer. Generally the piping consists of a series of ninety-degree fittings (ells), straight runs, flanges, gaskets, and expansion bellows as it continues the length of the engine to other ells just prior to entering the turbochargers. At sea speed loads, vessel engineers reported main engine cylinder exhaust temperatures near 850 degrees Fahrenheit.

Along the top center of the engines within the "vee" formed by the cylinder heads, all the exhaust pipes should be encased in an insulated casing or shrouding. Investigators discovered numerous disconnects of the casing, fallen sections and a general absence of insulation throughout the system. None of the short sections that connect to each cylinder head, nor any of the ells near the turbocharger end of the engine were covered with insulation. According to engine manufacturer schematics, every connection at the cylinder heads should have been both wrapped with insulation and covered with shields. None of the 28 connections on both engines were covered.

Investigators discovered numerous areas where intermediate fuel oil had contacted these hot surfaces.

The United States Coast Guard **strongly recommends** that owners, operators, superintendents, port engineers, shipboard engineers and crewmembers of vessels having similar equipment ensure the proper maintenance and repair of fuel and exhaust systems associated with main propulsion and diesel driven auxiliaries onboard their vessels.

To reduce the risk of fatalities, injuries, environmental damage and severe economic loss, diesel engines of all types and their associated systems should be maintained as designed unless appropriate personnel have authorized modifications.

The insulation of potential fuel oil ignition sources and the use of specialized fasteners and other devices to reduce the loosening of critical engine and systems components is essential for long term safe operations.

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