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# WATER HEATER SUPPLY FAILURES ARE ON THE RISE AS THE RESULT OF A COMMON DEFECT



BY WYATT BELLMAN,  
WESTERN ENGINEERING &  
RESEARCH CORPORATION AND  
DAN HOGAN, LAW OFFICES OF  
ROBERT A. STUTMAN, P.C.

DAMAGES CAUSED BY WATER HEATER SUPPLY LINE LOSSES ARE TYPICALLY SIXTY PERCENT (60%) HIGHER THAN ANY OTHER TYPE OF DOMESTIC WATER HEATER LOSS.<sup>1</sup> MORE IMPORTANTLY, THESE LOSSES ARE INCREASING IN FREQUENCY BECAUSE SOLID PLUMBING SUPPLY PIPES ARE GRADUALLY BEING REPLACED WITH CHEAPER, FLEXIBLE, STAINLESS STEEL-BRAIDED LINES THAT ARE LESS EXPENSIVE TO INSTALL. UNLIKE SOLID PIPE, THE STAINLESS STEEL BRAIDED LINES CAN CATASTROPHICALLY FAIL DURING ORDINARY USE. THESE "NEW" FLEXIBLE SUPPLY LINES ARE FAILING AT AN ALARMING RATE BECAUSE THEY CONTAIN A TYPE OF RUBBER TUBING THAT IS HIGHLY SUSCEPTIBLE TO METALLIC ION DEGRADATION IN POTABLE WATER SYSTEMS.

### History

Two water supply lines are located on the top of every hot water heater. One supply line routes cold water to the bottom of the tank, and the other draws heated water from the top of the tank to supply the fixed plumbing within the structure.

Prior to approximately 2000, residential water heaters were predominately connected using solid copper pipes, cut to length and permanently soldered into place. (See Figure 1.) Over time, these lines proved to be reliable as they were durable and not prone to catastrophic failure.

In recent years, however, the price of copper has dramatically increased, thereby increasing the manufacturing costs associated with copper plumbing products, and copper pipe. In an effort to offset the increased manufacturing costs associated with copper supply lines, and reduce installation costs, manufacturers redesigned their product. In approximately mid-2000, manufacturers introduced into the market copper-free, flexible hot water heater supply lines ("flexible supply lines"). Since their introduction, flexible supply lines have steadily replaced rigid copper supply lines in many new construction and home improvement projects. (See Figure 2.)



The flexible water heater connectors are generally comprised of an 18” to 24” long hose with brass coupling nut assemblies on each end. Each coupling nut assembly consists of a rubber gasket, a stainless steel stem insert and external isolation gasket, with a brass nut for attachment. The flexible hose portion consists of two components: an inner tubing material made from a material called Santoprene™, which is a combination of EPDM rubber and polypropylene, and a braided stainless steel outer sheathing. The braided stainless steel outer sheathing is comprised of interwoven bands of stainless steel wire, as illustrated above.

### Failure Mode

Stainless steel braided water heater supply lines contain an inherent design defect which causes them to rupture during ordinary use. (See Figure 3.) Over time, during ordinary use, the rubber tubing is exposed to metallic ions. The metallic ions may be coming from the brass coupling assemblies. Low concentrations of chlorine typically found in treated drinking water, combined with the elevated temperatures produced by the hot water heater unit, cause metal ions to be released from the brass stem insert as water travels through the tubing. These foreseeable environmental conditions are hazardous to the tubing material because EPDM rubber degrades in the presence of metallic ions in a mild chlorinated aqueous solution (i.e. tap water).

Eventually and inevitably these environmental conditions cause the inner tubing to degrade from the inside out and fail, as shown above. The supply lines usually fail near the connection point to the hot water heater, as this is the area of the highest temperature.

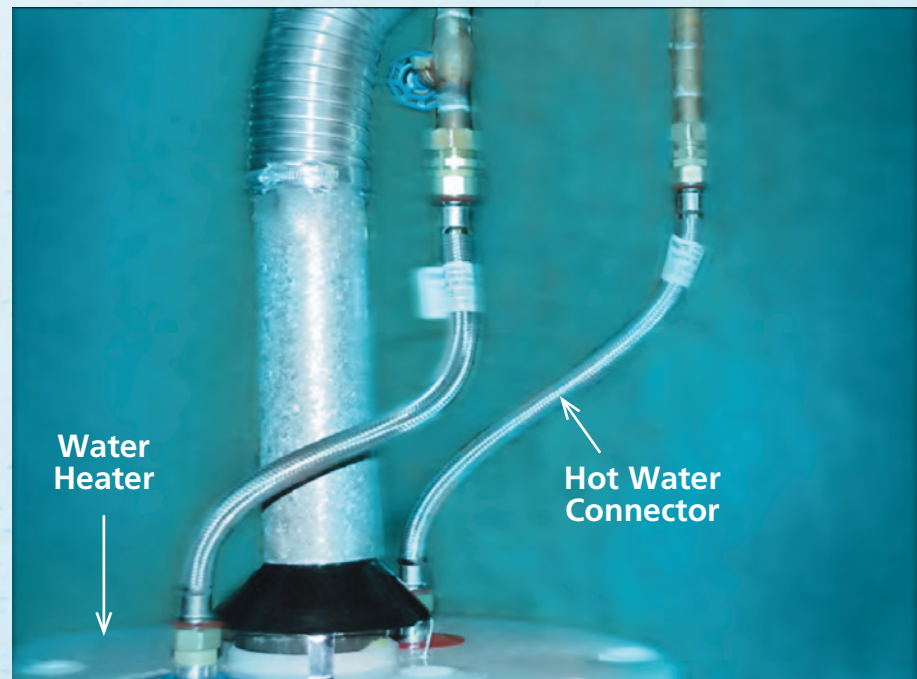
Figure 4 illustrates a thermal image of a water heater outlet connection showing the heat distribution along the assembly.

The water heater outlet nipple is the hottest area and the heat is conducted upwards into the coupling assembly.

Numerous failures of flexible supply lines have been analyzed and they all share the same characteristic mode of failure. Specifically, the rubber tubing displays evidence of interior rubber degradation in the area where the hose connects to the hot water heater. More importantly, the rubber hoses tend to fail after only a few years in service and well within the expected useful life for a water heater connector.

Independent testing has revealed that the catastrophic failure of flexible supply lines may not simply be attributable to a

**FIGURE 1:** Prior to approximately 2000, residential water heaters were predominately connected using solid copper pipes, cut to length and permanently soldered into place.



**FIGURE 2:** In approximately mid-2000, manufacturers introduced into the market copper-free, flexible hot water heater supply lines.

**Since their introduction, flexible supply lines have steadily replaced rigid copper supply lines in many new construction and home improvement projects.**



poor material choice by the manufacturers. Chemical testing and comparative studies have revealed that the EPDM rubber in failed water heater connectors is missing an important antioxidant compound. In the absence of this stabilizing compound, the EPDM rubber cannot withstand the degradation process caused by copper ion and chlorine exposure. Therefore, the root cause of flexible supply line failures is most likely a manufacturing defect with respect to the use of non-stabilized rubber tubing.

### Subrogation Recoveries

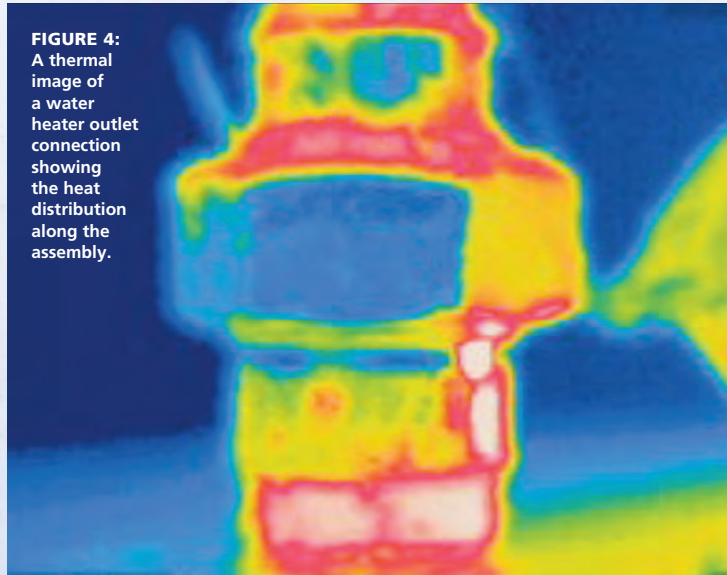
Though damages caused by water heater supply line failures are sixty percent (60%) higher than other water heater losses, they are still relatively small in size and often cannot be individually prosecuted in a cost-effective manner. As a result, insurance carriers either close water heater supply line cases without attempting to subrogate or pursue subrogation with a very limited investigation. Under either scenario, however, the result typically remains the same — no recovery.

Much like toilet supply lines, hot water heater supply line claims

lend themselves to the “aggregation approach” as they involve a common defect and common failure mode. To this end, hot water heater supply line claims can be grouped together as part of a mass tort initiative, as opposed to piecemeal litigation. As with any aggregation approach, an investigative plan should be implemented by carriers so that hot water heater supply line claims are properly indentified in the field; physical evidence is properly secured and preserved; and a uniform theory of

liability is developed and applied in a consistent fashion among all claims. If properly implemented, an aggregation approach will provide insurance carriers with a cohesive, cost-effective approach to pursuing and recovering on hot water heater supply line claims.

<sup>1</sup> *Institute for Business & Home Safety (IBHS), At the Forefront: Emerging Issues in Property Loss, Water Heater Failure Risks. (2007).*



**FIGURE 4:** A thermal image of a water heater outlet connection showing the heat distribution along the assembly.



**Stainless steel braided water heater supply lines contain an inherent design defect which causes them to rupture during ordinary use.**

**FIGURE 3:** Eventually and inevitably environmental conditions cause the inner tubing to degrade from the inside out and fail.