

## Sump Pump Failures

Water loss is a significant source of property damage and resulting insurance claims. The direct source of water can come from many places including frozen pipes, corroded plumbing components, sub-surface moisture intrusion through walls, surface water coming through doors or windows, or even a leaky roof. Invariably gravity flow causes the water to seek the lowest point of the structure, often a subsurface basement, causing damage along that path ranging including ruined property and often most significantly mold growth and subsequent remediation.

To help mitigate the damage, most basements are equipped with a sump pump which is typically located in a pit at the lowest point of the floor. The sump pump, if sized and working properly, will pump water out of the structure, typically through a discharge pipe that egresses outside of the house or to a storm sewer (it should never discharge to a sanitary sewer). While structures and possessions along the path from the water source to the sump pump may still be damaged or destroyed, the sump pump can greatly reduce damage within the basement. If, on the other hand, the sump pump fails to operate, the damages can be much more extensive and costly as the water level rises.

Unfortunately, sump pumps are typically out of sight and out of mind hidden in a covered pit in a forgotten corner of a basement. Although it is highly recommended by most plumbing professionals and the manufacturers to test sump pumps regularly - typically by pouring five gallons of water into the pit and observing proper operation – these tests appear to be rarely performed. More advanced sump pumps contain secondary pumps in case the primary pump fails, battery backup if power is also lost, and even monitoring systems, but these pumps are not as common and can also suffer multiple failures rendering them inoperative as well. A failed pump is often only discovered after an incident when it was needed and failed – too late to mitigate damages.

When a forensic engineer is engaged to investigate the cause of a water loss, the engineer typically investigates the root cause of the water intrusion – what caused the water to enter the structure. And in some instances the sump pump was the direct cause of the loss. But, the investigation of other water losses should also, on many cases, involve an investigation into the sump pump. A secondary failure of the sump pump may have greatly exacerbated the damages. Did the pump operate, and if it did not why? A subsequent finding of neglected pump maintenance may lead to different outcomes and subrogation paths as compared to a product failure.

Sump pumps consist of three basic subsystems: an electrical motor, a float switch, and the physical pump. Failure can occur in any of the three systems with root causes from simplistic (the pump was not plugged into an electrical outlet) to complex (contaminated water corroded the metallic housing and electrically shorted the motor windings). If a sump pump failure is suspected, the pump(s) and related hardware (i.e. backup battery or controller) should be carefully collected and retained for future laboratory inspection with all the usual precautions taken to avoid any allegations of spoliation. Care should be taken during the retrieval process to first document the condition and orientation of the float switch(es) which may have been obstructed prior to collection but free to move after handling. Similarly, a blocked discharge pipe will prevent proper operation of the pump but may not be readily retained (i.e. buried underground or behind the building's foundation). When possible, the investigator should evaluate

the condition of the discharge pipe, especially at the exterior access which is the mostly likely area to be clogged. A word of caution, in cold weather situations the pipe may have been frozen with ice which has then subsequently melted. Documentation of the discharge area and potential for this scenario should be undertaken. The on-scene investigator should also verify electrical power at the outlet in which the sump pump was plugged into and to ensure that its circuit breaker (or fuse) has not tripped.

Depending on the condition of the hardware, non-destructive/non-intrusive testing may be performed to provide a preliminary diagnosis of the failure. Some defects may be readily visible such as a damaged or corroded housing or electrical cord. Unfortunately, after long term use sump pumps are often covered in dirt and grime that precludes careful examination without first cleaning the pump. If the investigator decides to clean the pump for examination prior to a joint laboratory exam, careful documentation must be undertaken. It is also a good idea to collect and preserve as much of the removed material as possible in case it contributed to or is evidence of the problem, especially if corrosion is suspected. Depending on the condition of the pump, other tests can be considered which may not pose a significant risk of (further) damaging the sump pump. For instance, does the sump pump motor turn on when energized and the float switch is raised, and subsequently turns off when lowered? This test is then a good indication that the electrical system and float switch are functioning properly. When a cursory inspection of the pump is unable to identify a specific cause of the pump failure, a detailed laboratory examination may be required.

If you are investigating a water loss case which involves a sump pump and are interested in engaging an expert witness to support your case, please contact us at Aither Forensic Engineering.

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