

Plumbing System Failures

*Investigating & Diagnosing Water-Related
Damage Claims*



Overview

- ❑ The Plumbing System
 - ❑ What is it?
 - ❑ What is its purpose?
 - ❑ What is it comprised of?
- ❑ Variations
- ❑ Sources & Examples of Failures
 - ❑ Common symptoms
 - ❑ Verification methods
 - ❑ Causes & complications

The Plumbing System

In simple terms it is...

- ❑ The system of piping, fittings, pumps, valves and fixtures that control, condition and transport water within a structure.

The key functions of the plumbing system are to:

- ❑ Control, condition and transport potable water for drinking, cooking, washing and sanitary purposes
- ❑ Collect and transport wastewater and sewage

Components

Supply Line Network

- ❑ The supply line network brings clean water into a building from the municipal water supply or a private well. This system operates under pressure to deliver water to all of the different fixtures and appliances throughout the structure.
- ❑ Supply lines are usually made of copper or cross-linked polyethylene (PEX).

Components

Drainage System

- ❑ The drainage system carries wastewater and sewage away from the structure. Unlike supply lines, drain-pipes rely on gravity to move water.
- ❑ These pipes are larger in diameter than supply lines and are typically made of polyvinyl chloride (PVC) or acrylonitrile butadiene styrene (ABS) plastic in modern structures. Older homes may have cast iron pipes.

Components

Vents

- ❑ Vent pipes allow air to enter the drainage system, preventing vacuums from forming that could slow or stop water from flowing down the drain lines. Proper venting ensures that each fixture has its own air supply, which is necessary to prevent losing water seals in plumbing traps under sinks and toilets, preventing sewer gases from entering the structure.

Bathroom Flooding

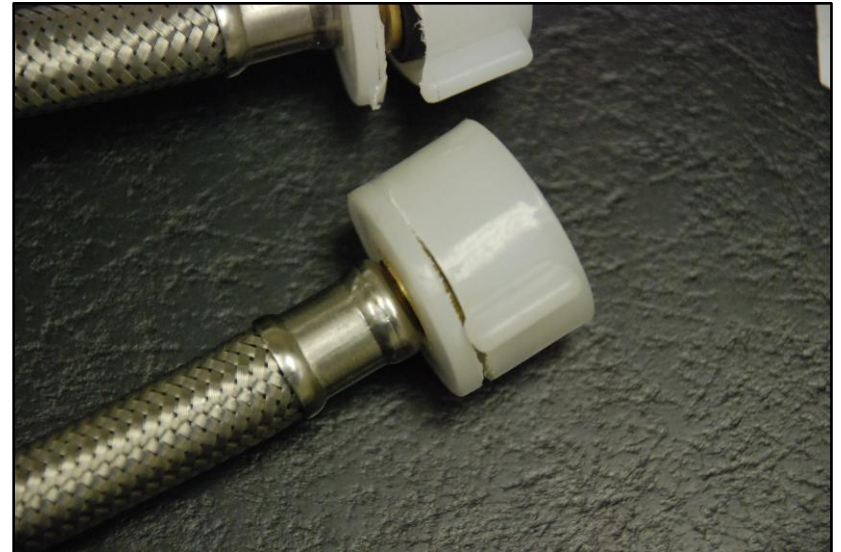
Symptoms:

- ❑ Pooling of water on bathroom floor
- ❑ Sudden onset with no witnesses

Verification:

- ❑ Location – near toilet or sink
- ❑ Hot or cold water?
- ❑ At a fixed or braided connection?
- ❑ At a fitting or valve?

Bathroom Flooding



Bathroom Flooding

Cause:

- ❑ Polymer nut fracture at toilet tank or faucet
- ❑ Valve or connection failure under sink

Complications:

- ❑ Water takes least path of resistance & is subject to gravity, thus visible damage may be far away from the source
- ❑ Often similar apparatus or connections in other areas of the home

Hidden Piping Failure

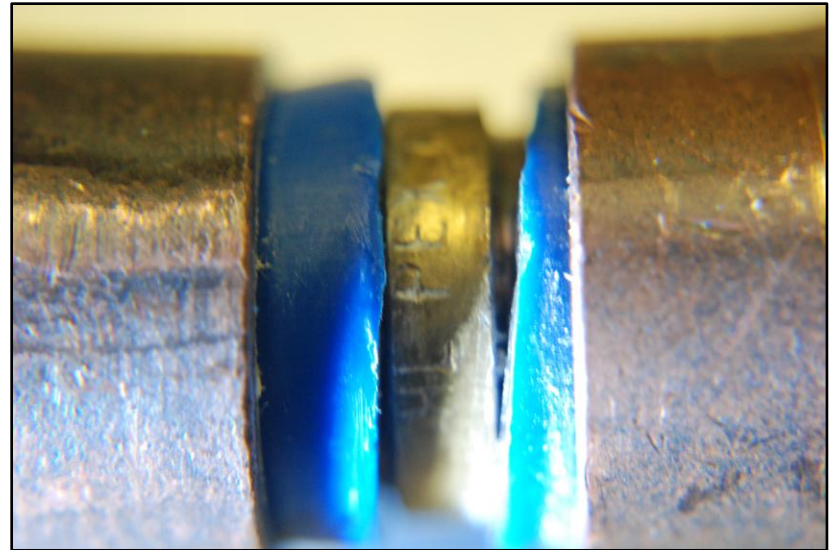
Symptom:

- ❑ Staining, deterioration or wetness on walls or ceilings, away from plumbing fixtures

Verification:

- ❑ Hot or cold? Thermographic imaging can help
- ❑ Trace the lines, open the walls to expose piping
- ❑ Test for dampness by touch and look for visible signs of water damage

Hidden Piping Failure



Hidden Piping Failure



Hidden Piping Failure

Causes:

- ❑ Improper crimping at joints/connections during installation
- ❑ Access to perform crimping action may have been restricted leading to loose connections
- ❑ Improper/faulty soldering procedures

Complications:

- ❑ Access to verify and repair
- ❑ Checking all connections – especially PEX
- ❑ Replacement of similar piping throughout building?

Plumbing Fixture Connection

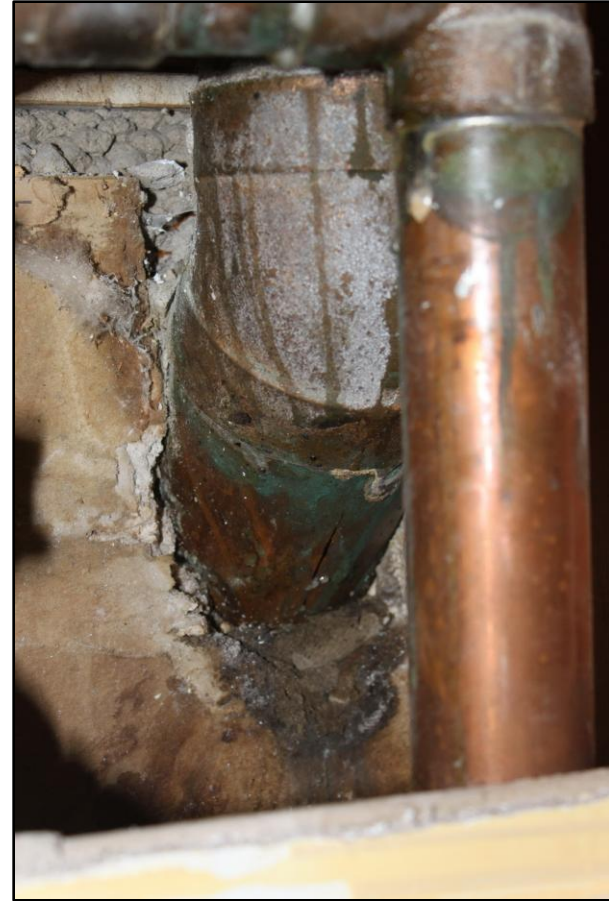
Symptoms:

- ❑ Dripping noises away from fixtures
- ❑ Stains on ceilings and walls, away from fixtures

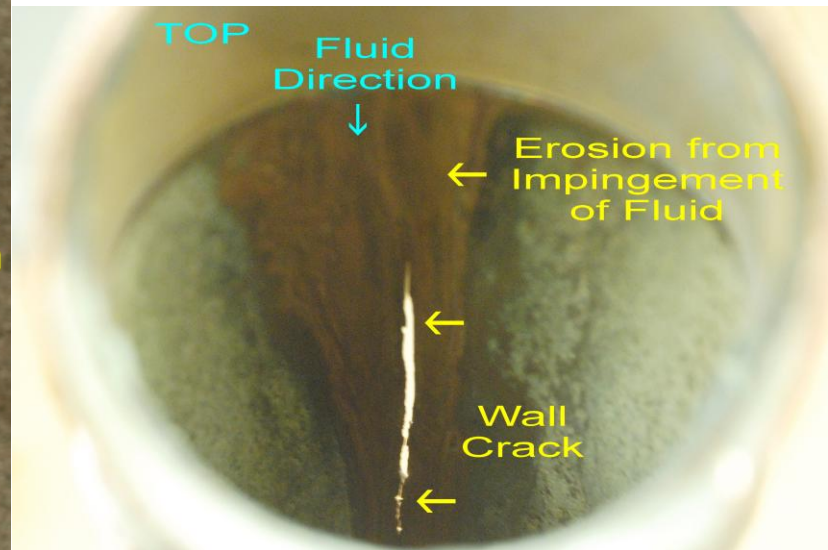
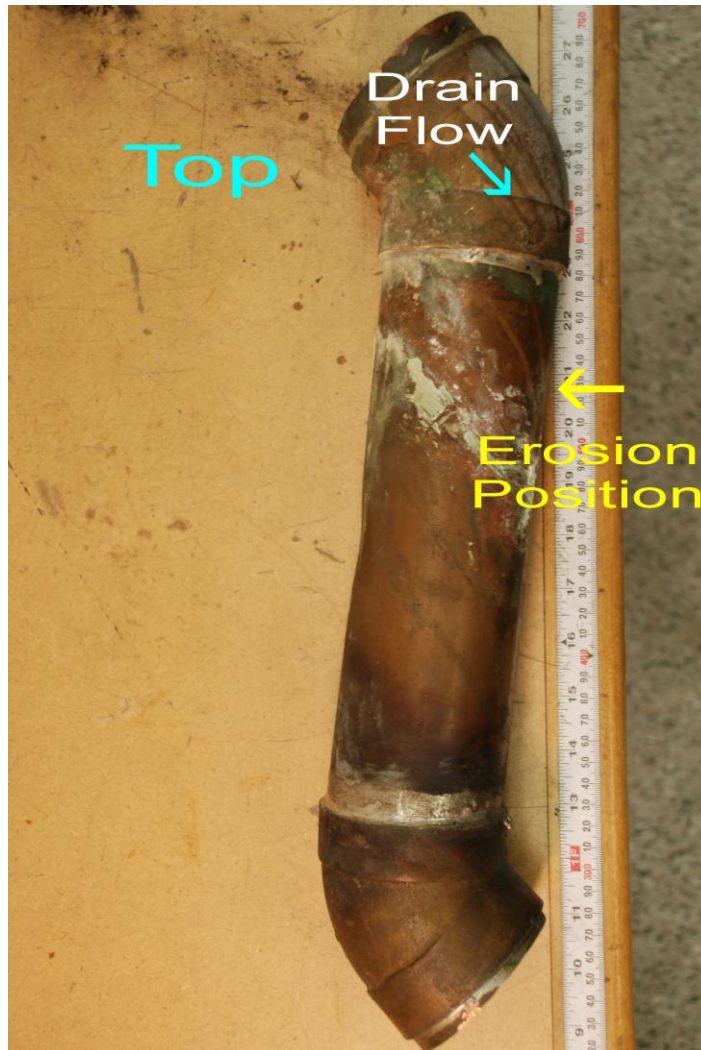
Verification:

- ❑ Thermographic imaging
- ❑ Cutting open walls and ceilings
- ❑ Monitoring water progress and volume
- ❑ Visual inspection of fixture

Plumbing Fixture Connection



Plumbing Fixture Connection



Plumbing Fixture Connection

Causes:

- ▣ DWV pipe with long term erosion
- ▣ Cracked PVC between plumbing fixtures
- ▣ Gasket deterioration

Complications:

- ▣ Do all piping sections have similar issues?
- ▣ How to get access to do replacement?

Hot Water Tank Leak

Symptoms:

- ❑ Flooding in the basement/utility room but not upper floors (depends on location of tank)
- ❑ Water near water softener or hot water tank

Verification:

- ❑ Cold water? Hot water?
- ❑ Pressure relief valve?
- ❑ Vessel wall or weld seam?
- ❑ Bottom perforation?

Hot Water Tank Leak



Hot Water Tank Leak

Causes:

- ❑ Piping or fitting connections
- ❑ Zinc anode at end of life
- ❑ Pressure relief valve failure
- ❑ Generalized corrosion of tank bottom
- ❑ Tank weld seam crack

Complications:

- ❑ Hot water tank replacement by leasing company
- ❑ Mold formation if not detected soon after leak

Sewer Back Up

Symptoms:

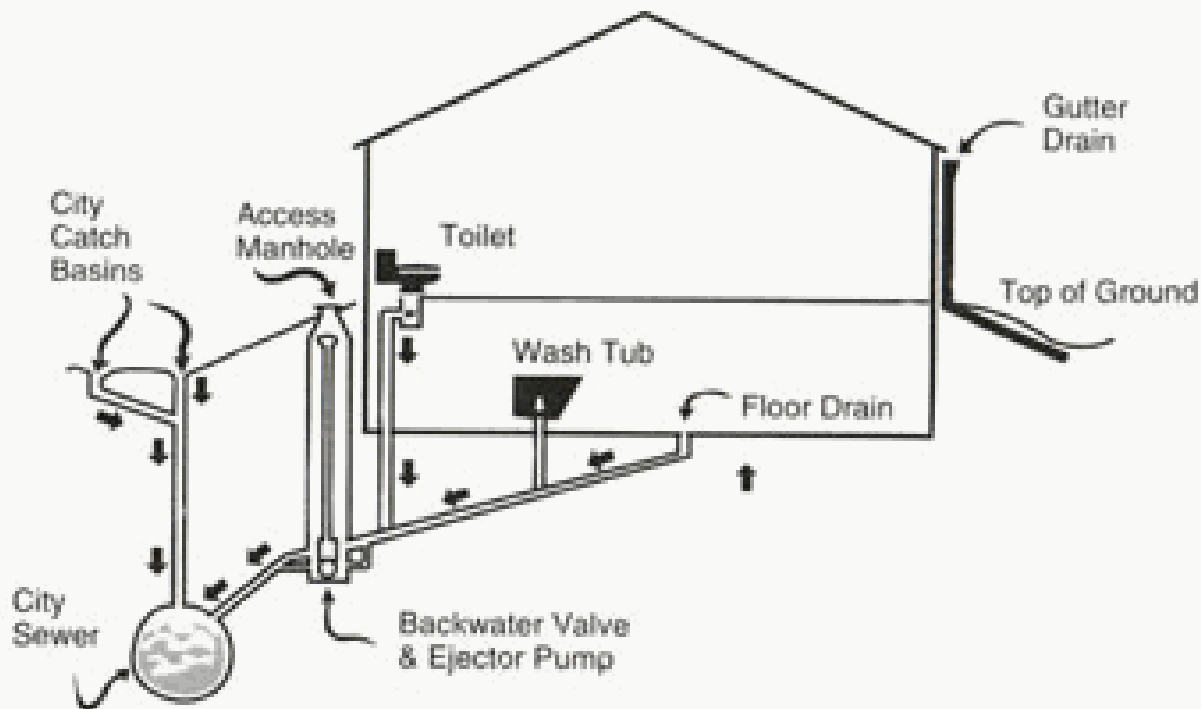
- ❑ Blackwater in basement levels
- ❑ Sewage smell by basement drains

Verification:

- ❑ Does home have a sewage backflow preventer?
- ❑ Are there trees adjacent to sewer pipes?
- ❑ Is the water confirmed to have sewage in it?

Sewer Back Up

Typical Residence Backwater Valve



Sewer Back Up

Causes:

- ❑ Tree root intrusions into sewer pipe
- ❑ Significant water-related weather event
- ❑ Changes of volume of flow (visitors)
- ❑ Malfunction of a backflow preventer

Complications:

- ❑ Black water with health considerations
- ❑ Interaction with the City when blockage is beyond the property line
- ❑ Excavations and renewal of piping

Hose Bibs

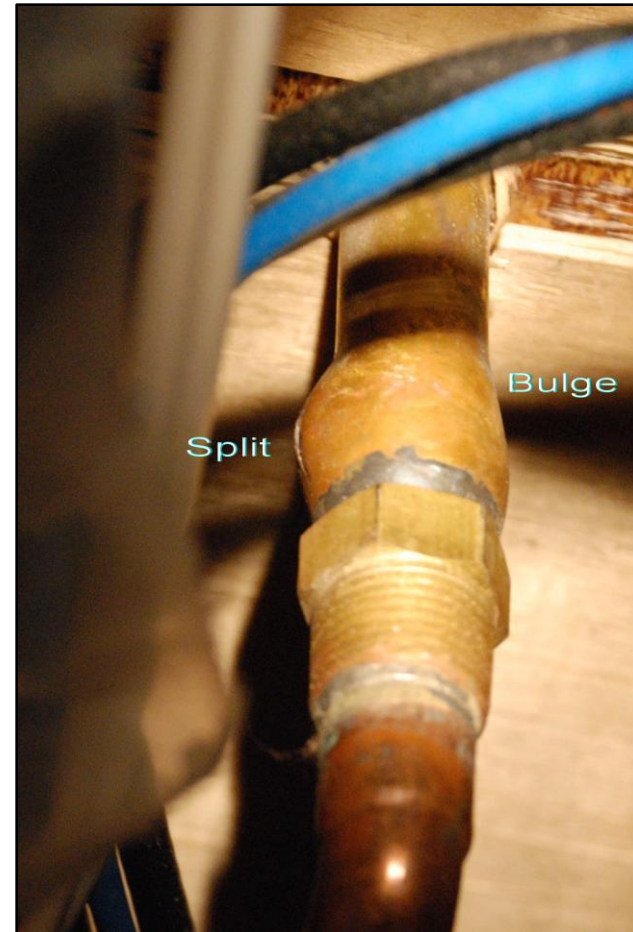
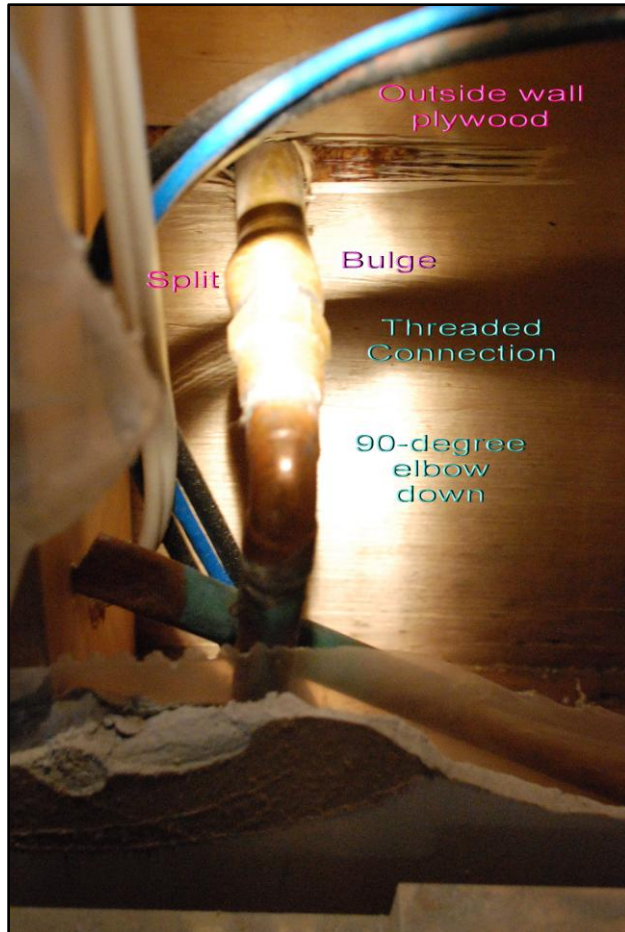
Symptoms:

- ❑ Cold water inside walls or by the foundation
- ❑ Water released after a thaw period, in spring

Verification:

- ❑ Does home have hose bibs? Visual inspection.
- ❑ Are these frost-free design?
- ❑ Was a procedure in place for preparing for winter?

Hose Bibs



Hose Bibs



Hose Bibs

Causes:

- ❑ Frost front pushes ice against water
- ❑ Water is pressurized (can't be compressed)
- ❑ Hydraulic pressure bursts the line

Complications:

- ❑ Breaking through the wall to extract the hose bib
- ❑ Ensuring other connections have not frozen
- ❑ Carefully thawing all connections

Frozen Pipes

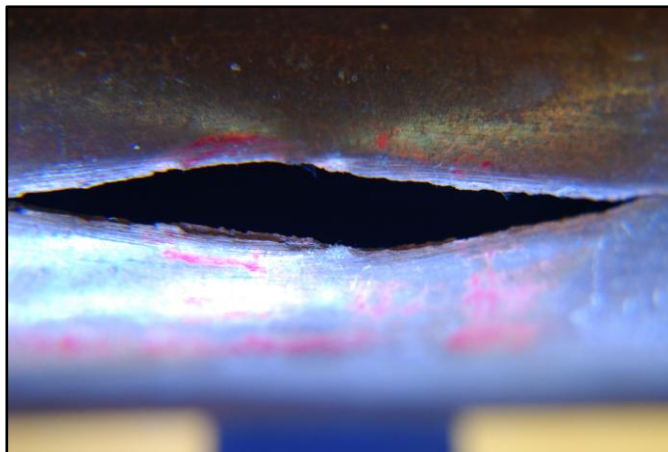
Symptoms:

- ❑ Multiple failures of piping throughout home
- ❑ During late winter or early spring after a thaw
- ❑ Water in the basement at furnace

Verification:

- ❑ Was home actually heated? Check electricity and gas consumption for the involved period
- ❑ Thermographic images throughout home
- ❑ Cutting out wall and ceiling sections to confirm

Frozen Pipes



Frozen Pipes

Causes:

- ❑ Furnace failure – ignition system or pilot light
- ❑ Open window near a plumbing fixture
- ❑ Forgot to move control switch from “cool” to “heat”

Complications:

- ❑ Pressure testing of the lines
- ❑ How much of plumbing needs to be replaced?
- ❑ Cutting out wall & ceiling sections to gain access

Appliances

Symptoms:

- ❑ Water pooling around appliance
- ❑ Stain or dampness on ceiling underneath location of appliance
- ❑ Unusual operating noise (no water in unit)

Verification:

- ❑ Visual inspection of supply line & connection
- ❑ Sound of running water

Appliances

Causes:

- ❑ Faulty installation
- ❑ Loose clamp
- ❑ Blockage in drain
- ❑ Solenoid / control panel failure

Complications:

- ❑ Ability to isolate unit – water shut offs
- ❑ Age of unit

Summary

There are many sources of potential water leakage in a building.

Maintenance of appliances, fixtures and valves can help but will not eliminate the potential for water damage.

Shut-off valves on supply lines in advance of a failure source will help mitigate damage.

Be curious about staining and odd noises.