

Water Pipe Failure Analysis

by

Charles C. Roberts, Jr. Ph.D., PE

Failed water pipes can cause substantial property loss as well as personal injury. The following case studies show what to look for when reconstructing the water pipe failure scenario.

Figure 1 is a view of a failed solder joint on a 3 inch pipe. The water drained into the basement of a large office complex causing



Figure 1

significant damage to a telephone switching system and computer complex. The failed joint was a result of insufficient heat during the solder process causing poor solder penetration and a weak joint. Figure 2 shows a similar cold solder joint that caused a substantial water loss in an apartment complex.

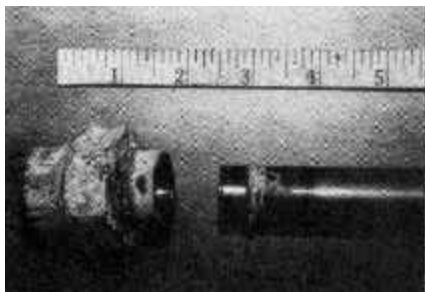


Figure 2



Figure 3

Figure 3 is a view of an elbow taken from a 4 inch line. The pipe suddenly fractured causing water to drain downward through several floors in an office building. Microscopic analysis revealed a casting defect as shown by the arrow. This tended to raise the stress in the pipe wall resulting in final failure. The fracture surfaces were well preserved by field personnel facilitating the analysis.

Figure 4 shows a typical sprinkler head that was found to have an unusually high

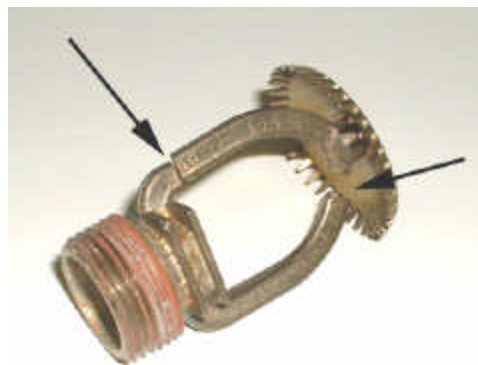


Figure 4

failure rate. Several heads had activated for no apparent reason watering down offices and industrial facilities. In Figure 4, the arrows point to cracks in the bronze support frame. This was probably a result of shrinkage during the casting operation, a manufacturing defect.



Figure 5

Figure 5 shows over stress related cracks as a result of excessive tightening of a pipe fitting. This eventually resulted in leakage and significant property loss to a residential building.

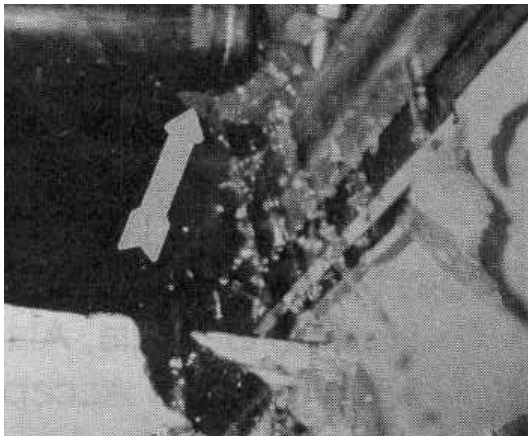


Figure 6

Figure 6 shows a leaking grooved coupling that failed due to severe strain on a pipe from poor installation. This was a 5 inch water line that flooded an office building basement nearly drowning the janitorial staff.



Figure 7

Figure 7 shows the classic "fish mouth" fracture associated with excessive localized hoop stress consistent with freezing in the water pipe.

Figure 8 shows fittings that vibrated loose on a water pump motor causing substantial water damage to a residential building. The pump couplings were not secured properly to withstand the pump vibration.

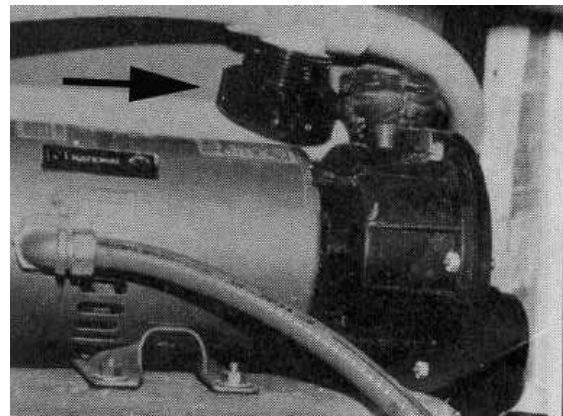


Figure 8

Charles C. Roberts, Jr. PhD. is a registered professional engineer at C. Roberts Consulting Engineers, Inc., Big Rock, IL 60511 and may be reached at 630/556-3039 or CCR@croberts.com