

NUTS & BOLTS

NH Materials Laboratory, Somersworth, NH • 800-334-5432 • www.nhml.com



GLASS VIAL SPRINKLER ACCIDENTS

Look over your desk. Do you see a sprinkler head? Look over your office server, another sprinkler head? How about over your NC milling machine? Now look carefully to see if any of these sprinkler heads has in its center a small, colored, glass vial or if it is all metal. If any of your sprinklers has a glass vial please read on since this issue of NHML's Nuts and Bolts discusses the unexpected release of an enormous amount of water when one of these sprinklers trips.

What causes glass vial sprinklers to trip? High temperature and mechanical damage are obvious. In our work we see more reasons for unexpected trips.

In this family of sprinklers the glass vial is captured between the adjusting screw on its outboard end and a plug or insert that fits into the body. The water seal is created around

either a slightly cupped stainless steel washer or between the plug and the body. With the washer, the ID of the washer is tightly fitted around the plug. The washer's OD rests in a shallow counterbore in the body.

Tripping by the sprinkler head necessarily involves failure of the glass vial. We encounter these causes of failure.

1 High temperature vaporizes the liquid in the glass vial and it bursts at the intended temperature.

This is what's supposed to happen. All of the remaining trips are definitely undesirable.

2 A scratch or nick in the glass vial slowly grows due to adsorbed water molecules, thereby reducing the burst temperature more or less in proportion to the size of the crack.

This is the same phenomenon as bursting glass table tops. If

the glass has been tempered then its surface compressive stress prevents this phenomenon. If the glass part is small, such as a sprinkler vial, then the ordinary type of tempering through rapid surface cooling doesn't work nearly as well and this type of failure is possible.

3 Mechanical impact on the glass with either immediate or delayed fracture.

Even though it may be important to your insurance company in deciding who bears responsibility for the loss, there's no way we can look for mechanical damage in vial fragments we don't have.

4 Corrosion on either the face of the adjusting screw or on the face of the cup that increases the axial force on the vial until it bursts.

At NHML we can evaluate this type of failure and, because it is a "wear and tear" type of failure, some insurance policies

do not cover! You can help! If you see any corrosion on one of these sprinklers, replace it immediately!

5 For those sprinkler heads in which there are seals around a stainless steel washer, we have seen an accumulation of expanding corrosion product between the stainless steel washer and either the plug or the sprinkler body counterbore that increases the axial force on the vial until it bursts.

Again, if you see any corrosion around a glass vial sprinkler head, replace it immediately.

6 Mechanical damage to the frame indirectly overstresses the vial.

The brass bodies are so soft that they bend easily. The stainless steel bodies are much stronger and therefore resistant to mechanical damage. If the sprinkler head appears to be bent, replace it immediately!

7 Overtightening of the sprinkler head during installation may overstress the glass vial. The trip can be either immediate or delayed.

We have seen distorted sprinkler bodies due to over



Typical sprinkler head of the glass vial type. Pressure from corrosion on the ends can break the vial.

tightening during installation. Some brass sprinkler bodies are vulnerable to this type of failure while other brass bodies and all the stainless steel bodies we have seen are so proportioned that they are resistant to this type of distortion.

8 For the all-metal sprinkler heads there is just a single seal between the plug and the body.

The failures we have seen in this category are preceded by weeping that leave stains on the metal.

Always replace a weeping sprinkler without delay!

Suggestions:

Losses due to uncommanded sprinkler trips are inconvenient at best and terribly expensive at worst. Plus, there is no protection while the system is down, witness the Mill #2 fire in Dover, NH where the sprinklers on the top three floors were down for service.

If a glass vial sprinkler head is weeping by the slightest amount, or if it shows any corrosion around the vial, replace it immediately! If you don't have a spare sprinkler head, don't leave the system unpressurized but consider

having the technician install a plug until you get the replacement head.

Follow exactly the manufacturer's tightening instructions. Sometimes they are given in terms of torque, so a torque wrench must be used. Other instructions are given in terms such as "3/4 turn after hand tight" or "torque to ___ in. lbs. then tighten 1/2 turn". Never, ever, let the installing technician tighten until "it feels right". And don't let the technician tell you that "because he/she is a master plumber he/she knows how it is supposed to feel". If, after tightening according to the manufacturer's directions the joint is weeping, never ever "just tighten it a little more". Something is wrong. Take it apart and fix it. If the installer isn't carrying a pipe tap to clean up the threads then put in a plug until he/she gets one, but don't reinstall the sprinkler head. If the sprinkler head's threads are suspect then don't use it. Get a new sprinkler head.

Never bump a glass vial sprinkler head.

Never hang anything on any sprinkler head.

Whether they have a glass vial or are all metal, replace all distorted sprinkler heads and replace any that are weeping.

by Fred Hochgraf.

Passivation

There is a host of people that wants to believe that passivation is some sort of magic film that enhances the resistance to rust spots on all sorts of corrosion resistant metals. But life doesn't work that way. A passivated metal is one that has no exposed iron/steel particles on its surface. So the magic potions that grant passivity are in reality only removing iron/ steel particles.

Loose particles can be blown or wiped away.

Lightly bonded particles are removed by an electrolyte, either acid or base. The requirement is that the combination of the substrate and the "passivating" solution render the substrate cathodic with respect to the anodic iron/steel particle. Vigorously circulated, warm nitric acid solutions meet the need for many 200, 300, 400 and PH stainless steels. Cutlery grades need a gentler electrolyte such as sodium chromate.

Embedded particles originate from contaminated cutting fluids, contaminated grinding wheels, exposure to dirty environments followed by pressing, squeezing, rolling or drawing, wear particles shed by inappropriately chosen tooling, and contaminated media in abrasive cleaning machines. With embedded

WHAT'S NEW AT NHML

Passing of the hands... Tim Kenney, President/CEO acquired full ownership of New Hampshire Materials Laboratory on January 8, 2008. Senior Scientist, Fred Hochgraf remains an active participant here at NHML

If you haven't already heard, we now accept credit cards. Connie will gladly accept American Express, Discover, Master Card and Visa.



particles passivation can never be successful.

So successful passivation involves separate cutting fluids and abrasive cleaning systems for each alloy system, meticulous house-keeping, and a well informed work force.

by Fred Hochgraf.

Our Philosophy

New Hampshire Materials Laboratory has one goal—to help you solve your technical problems at a reasonable cost. Tests help, but are not always enough. Our team of dedicated and experienced professionals have the skills and the backup facilities to serve in the following:

- Failure Analysis
- Material Certification/Compliance
- New Product Testing
- Mechanical Properties
- Tensile/Compression Testing
- Heat Treat Problems/Verification
- Reverse Engineering
- Weld Testing
- SEM & EDS
- Full Chem Lab Facilities



Glass Vial Sprinkler Accidents

Passivation



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LABORATORY, INC.

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Contact us at:
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 email: lab@nhml.com
 PH: 800-334-5432 or 603-692-4110
 FAX: 603-692-4008

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