

# **NEWS**

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Compressive Stress v/s Unknowns

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**Badger Metal Tech, Inc.** N60 W15083 Bobolink Ave. Menomonee Falls, WI 53051 414-252-3804 FAX 414-252-3956  
TOLL FREE in the US and Canada - 800-366-1973 — **WEBSITE - badgermetal.com - published 6/17/98**



#1 - No Treatment



#2 - Stress Relief



#3 - Metalife



#4 - Stress Relief with Metalife

A frequent question asked by many of our customers is how often should Metalife be reapplied? Our 16 years of servicing **NEW** and **USED** tooling, along with thousands of field tests, shows this interval to be between 20-30,000 shots. The scientific argument to support this, however, is still a missing link. **No published data exists**, at present, to **confirm** how residual tensile stresses build under actual die casting production conditions. There is, however, **plenty of data that confirms** tensile stresses cause cracking and **compressive stresses** prevent it. Thanks to NADCA, its members, and DOE matching funds, test projects for 1998 and 1999 studies are in progress to attempt to learn what types of stresses build up in production tooling, how stresses concentrate, and to what magnitude they grow until fatigue failure occurs. We also hope to be able to model these stresses and sometime in the future be able to predict how, when, where, and why these stresses occur. This is a large task and could take many years until we have all the answers.

The four photos above are the actual production dies that are being used for first phase of this test. These particular tools (wiper arms dies) have a history of thermal stress fatigue cracking and breakout in specific areas on each end and some of the radii. There is also existing baseline data on similar sets of tooling that confirm the benefits of combined repeated applications of heat stress tempering in conjunction with **Metalife** for extending tool life.

**Test Procedure** - X-ray diffraction measurements (**PROTO MFG.**) of the surface are being taken at each of the critical areas on these inserts after initial sampling and approximately every 20,000 shots thereafter. The levels of stress at these historical sites are taken before production, after treatments, and after production. The #1 insert

**receives no processing** of any type through the entire test. **#2 is only heat stress tempered**. **#3 gets Metalife**, and **#4 gets both heat stress tempering and Metalife**. The temper is performed at 1030 degrees F with the inserts remaining in the oven after tempering to properly cool down. This allows maximum normalization of the existing built-up stresses. Based on the previous history of this tool and existing knowledge of stress cracking, we should expect to see the inserts fail in the same numerical order as shown above. First the "No Treatment" insert followed by #2 and so on. Since these are actual production tools it is not always possible to pull the tooling at exactly the desired 20,000 shot increment. To date the test has completed 5 cycles - Sampling... 25,000, 50,000, 70,000, and 90,000 shots.

Some interesting and as yet unexplained phenomena is being observed. The untreated insert and stress tempered insert (#1 & #2) are exhibiting high values of compressive stress both before and after stress tempering. The values average about -130KSI. This is definitely contrary to what we were expecting but could be attributed to the direction in which we are taking the X-ray measurements. These same inserts, however, are beginning to show characteristic heat checking. The general configuration of the tool could also be affecting our readings. Ideally we would like to measure a surface that is relatively flat affording more accessible measurement points. If you have a tool with a known history of heat checking and could afford out of production times to take these measurements, we would like to hear from you. By this newsletter and other inquiries, NADCA is petitioning die casters that would be interested in participating in this project. We will keep you posted on further developments.

## Residual Stress Part 4

after treatments, and after processing. The **PI insert** | regarding this and other DMC NADCA projects.

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