

## Residual Stresses in High Pressure Aluminum Die Casting Dies

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High pressure die casting is the process of using high pressure to inject molten aluminum into cooled steel molds called dies. The process is able to produce castings with complex geometries at quantities of about 1,000 per day on a single machine. Aluminum is injected at temperatures about 650 °C and then cooled to a solid in a matter of seconds. Repeating this process thermally cycles the steel dies. The constant expansion and contraction of the die surfaces from thermal cycling induces tensile residual stresses in the surface which, over a long enough time, can cause cracking in the die. These cracks can lead to die failure due to breakouts (when part of the die breaks off) or coolant leaks when cracks propagate to cooling passages that exist internally in the die core.

Stress relieving is done as part of regular maintenance to relieve the residual stress from use, machining, or welding to prevent cracking in dies. A greater understanding of the difference between traditional thermal stress relief to that of vibratory stress relief is needed. Progress to date: X-ray stress measurements will be presented.