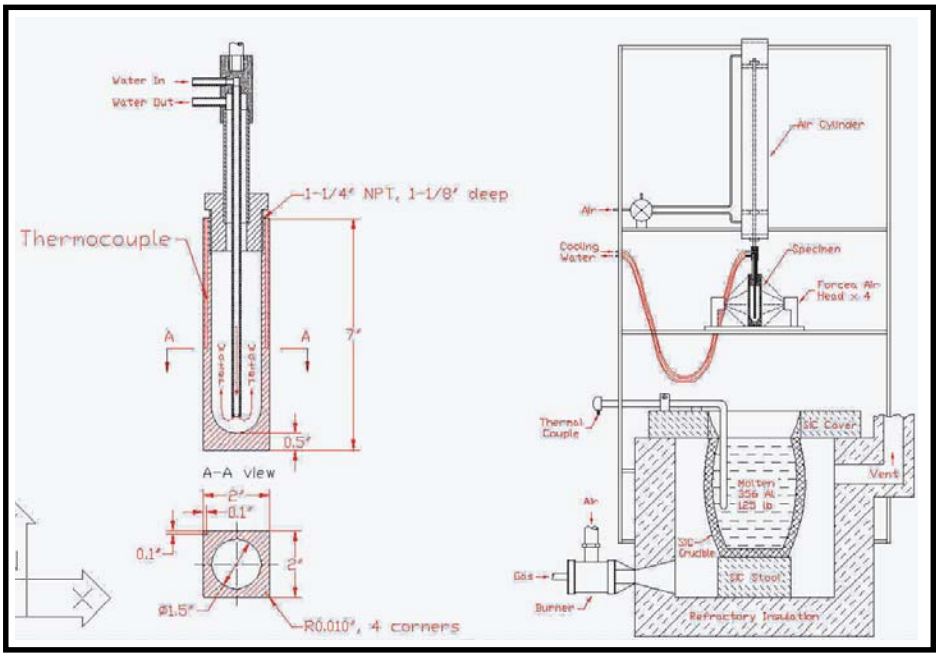
# Improved Die Casting Process to Preserve the Life of the Die Casting Dies

The die casting process uses dies that amount to 20 percent of the casting cost on average. The life of these dies varies significantly. It can be extended by a factor of two to three by improving the selection of steel and by the use of the rapid cooling during the heat treating process. The net result of these changes has reduced the cost of producing and maintaining the dies in service. However, other features can be considered to further improve the life of die casting inserts. Several design and operating aspects of the die casting process will affect the maximum life of a given die. In an effort to increase production rates, die casters will often employ operating conditions that are harsh on the dies and shorten their life. A frequent method of shortening cycle time is to flood the dies with excessive die lubricant, thus creating large thermal fluctuations that cause cracking.

Through optimized die design and improved internal cooling, production rates can be increased without sacrificing die life. A research team led by Case Western Reserve University will study the combined effects of die design, proper internal cooling and efficient die lubricants on die life. The combination of die design, proper internal cooling and the efficient utilization of die lubricants will provide much longer die life. Data developed in this project will be of great value to the die casting industry in developing die life extension methods. The impact of these methods on energy consumption is very significant. By proper internal cooling of the die, a more stable, higher die temperature can be maintained thus not only extending die life but also preserving energy by using lower pouring temperatures.




**Schematic of the Immersion Thermal Fatigue sample and test rig at Case**

## *Benefits for Our Industry and Our Nation*

- *Increased die life*
- *Reduced costs of production and die maintenance*
- *Increased production*

## *Applications in Our Nation's Industry*

*This research will provide die casters with guidelines addressing die design, proper internal cooling and the efficient utilization of die lubricants. This will lead to an increase in productivity and die life.*

## Project Description

The goal of this project is to develop methods of optimized process control for extended die life. The project is broken down into two basic stages:

1. ***Optimized die design for reduced surface temperature***.

   The life of dies is significantly shorter when the die is exposed to elevated temperatures for significant periods of time. Any die operated under conditions leading to surface temperature in excess of 1050° F undergoes structural changes that reduce strength. Optimized die design can improve die life significantly. This improvement can be accomplished by means of cooling lines, baffles and bubblers in the die. Use of one or more of these devices can maintain low die temperatures during processing and substantially improve die life in the process.

2. ***Die life extension by optimized die lubrication.***

   The life of die casting dies is affected by additions made to its surface with the proper lubricants. These lubricants will protect the surface from considerable temperature peaks that occur when the molten melt enters the die. Dies will reach a significantly higher temperature without this lubricant being applied. The type of lubricant and the amount used are critical variables in the die casting process. However, these lubricants must not corrode the die surface.

## Milestones

### *Results to Date*

1. Die inserts for thermal evaluation have been designed and analysis of thermal stresses was performed
2. Components from five steel types were machined and heat treated for subsequent testing
3. Evaluation of thermal performance of die inserts was completed for three steel types
4. A thermal fatigue testing system has been designed for evaluation of heat transfer in bubblers and baffles
5. Data is being collected to characterize thermal barrier build-up for various die lubricants

### *Future Milestones*

1. Incorporation of bubblers and baffles in the die inserts
2. Thermal performance of dies with bubblers
3. Thermal performance of dies with baffles
4. Develop guidelines for selection and use of die lubricants

### *Project Partners*

*Case Western Reserve University*
Cleveland, OH

*North American Die Casting Association,* Wheeling, IL

*Cast Metals Coalition Partnership*
Charleston, SC

*Bohler Uddeholm*
Rolling Meadows, IL

*Dunn Specialty Steel*
Warren, MI

*Hayes Lemmerz*
Northville, MI

*Rex Buckeye*
Cleveland, OH

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