



R.J. Collins Incorporated White Paper

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Optimizing DC Billet Casting Seeing the Full Picture

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Holistic

A wide-reaching term, designating views in which the individual elements of a system are determined by their relations to all other elements of that system.

Introduction

R. J. Collins Incorporated was founded in 1998 with the purpose of helping billet casters optimize their total casting operation. This is accomplished by holistically analyzing and troubleshooting the complete casting process rather than individual components.

This white paper addresses the R. J. Collins approach to help casthouses operate at optimum performance.

Problem Statement

The performance of DC billet casting systems declines over time resulting in increased scrap generation and higher production costs. Declining performance is caused by everyday changes in the process that impact the complex interactions and interrelationships between six primary aspects of the casting environment that is shown in Figure 1.

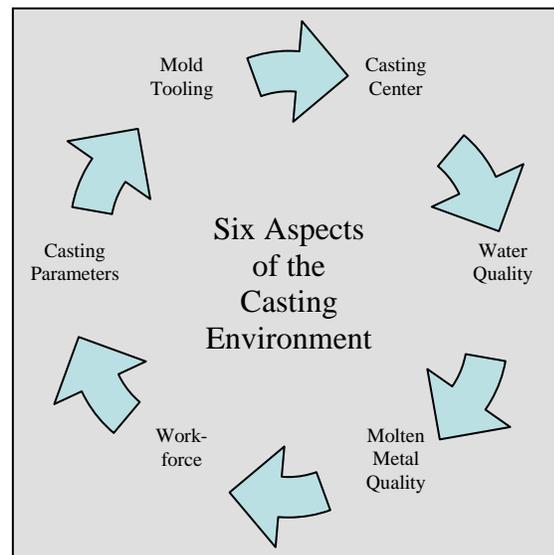


Figure 1 Six Primary Aspects of the Casting Process

Previous Options

Technical service support has been traditionally provided on an equipment-by-equipment basis (e.g., furnace, de-gassing system, or mold tooling). Specialists from the original equipment manufacturers are available to provide assistance on their specific equipment; however, their expertise may not include how their equipment affects the billet casting process. This can leave OEM technical specialists pointing at each

other as to why the casting facility is not operating optimally.



R. J. Collins Solutions

This solution has been years in the making. It was developed out of necessity to solve specific problems by analyzing, troubleshooting and understanding the types of defects and their causes. Always in search of the one root cause but typically finding that it is a combination of contributing problems in any of the six areas of the casting environment. The six areas include:

1. Mold tooling design and maintenance
2. Casting machine layout, design and maintenance
3. Water quality
4. Metal quality
5. Workforce motivation and training
6. Casting parameters optimized

Therefore, the first step is to perform an audit to recommend enhancements, modify procedures and practices, train operators, improve documentation, and optimize parameters if needed. In other words provide the technical help with all of the issues and problems discovered.

This requires a team approach from all parties to be successful. Casthouses that have followed this advice have instituted a program of ongoing training, improved measurement systems, and equipment upgrades that have improved billet quality, reduced operating costs and scrap rates. This is a process that takes time to make sure the necessary improvements are in place to insure continuous success and sustainability. This is why R. J. Collins has developed the following products and services that help improve the process in the shortest possible time frame.



Figure 2 Casting Audit

R. J. Collins Casting Audit

R. J. Collins offers an audit program to assess and improve casthouse operations. Typically there are four parts to this audit:

1. Defect identification and process troubleshooting
2. Detailed analysis of casting data and documentation
3. Operator training
4. Recommendations for short and long term action

1. Defect Identification and Process Troubleshooting

Visiting the plant and meeting with operators, the technical team, and managers

is the initial step to establish a baseline for improvement.

The first step is to inspect billets and identify defects (Figure 3) and then troubleshoot the probable causes.

This includes reviewing the operation on a macro level that



Figure 3 Scrap Billet

includes water, molten metal, casting pit layout, and casting machine.

Metrics and Record Keeping

“What you don’t measure you can’t control” sums up a fundamental of the R. J. Collins approach. Data collection methods and data analysis are put into practice based on years of experience.

The next step is to focus on the details of the casting system, mold maintenance, and mold components which include the casting ring, transition plate, and the overall condition of the mold, starting head, and refractory components.

2. Detailed Analysis

Casthouses generate significant data relating to billet production. The challenge is assimilating the information and analyzing it to see the full picture. This is where R. J. Collins offers casthouses an important service because of the experience of seeing the complex interactions and interrelationships between the key elements of the

casthouse. Analyzing the data can uncover issues such as:

1. If the defect is a mold problem, table problem or the casting process problem.
2. If the defect is caused by a mold or graphite ring design or material issue.
3. If the defect is caused by an operator or process control problem.

3. Operator Training

The training program provides expert mold room and casting pit operator training that focuses on defect prevention.

The training includes:

- Expert classroom instruction
- The “How and why we need to do it”
- Hands-on in the pit operator training
- Hands-on mold room training
- Key elements of furnace batching
- Tests that verify knowledge and understanding
- Supervisor training for implementation and ongoing follow-up

4. Recommendations

At the conclusion of the audit, R. J. Collins provides an audit report that gives recommendations on how to keep the casthouse running properly after the consultants have left the facility. Examples include:

1. Recommended enhancements that make casting much easier and safer for the operators.
2. Short and long term procedure changes that insure ongoing improvement.
3. Training and monitoring systems that proactively troubleshoots casting problems and defects.

R. J. Collins Enhancements

Accu-Set™ Mold Calibration System

A need existed for improved casting gas control on air-casting systems. R. J. Collins pioneered an upgrade system (Figure 4) that is now in use in plants around the world. Casting recovery improvements in the range of 5% have been achieved and are likely from this modest upgrade investment.



Figure 4 Accu-Set™ Mold Calibration System

Accu-Test™ Billet Mold Testing System

There is now a better understanding of casting rings and the critical role they play in efficient casting. R. J. Collins has



led the way in developing a means of measuring the casting characteristics of a graphite ring to insure better performance (Figure 5). This is the first time such equipment has been available.

Figure 5 Accu-Test™ Billet Mold Testing System

New Accu-Test™ Graphite Ring Testing System

The new Accu-Test™ Graphite Ring Testing System measures the uniformity airflow of a graphite ring before it is installed into a mold. The graphite ring is



the heart and Achilles heel of the air-casting process and is only tested at 4 points when manufactured. This system provides the airflow uniformity flow every 25 mm (1") around the inside diameter of the graphite ring to make sure it is within specification before it is installed into a mold. The uniformity data is converted, displayed and stored on a computer using software included with the system. This software program stores all testing data by size and graphite ring number and displays a graph showing the uniformity airflow of all tests taken. Start-up assistance is recommended with this product and includes the software disk and cables necessary to connect to the USB port of a customer supplied computer.

Figure 6 Accu-Test™ Graphite Ring Testing System

Accu-Test™ Billet Mold Oil Charging Station

The Accu-Test Oil Charging Station was developed because too much oil in a graphite ring tends to plug its pours over time and shorten its lifespan. In fact it is not recommended that oil be charged into any new graphite ring until just prior to it being put into service. Therefore it is important to charge a mold with oil just before it is installed into a table and purge the mold just removed of excess oil before service and storage. This machine can charge up to 3

molds at a time. Simply connect the air and oil clamps to the molds, turn on the air supply, program how many pulses the oil injectors actuate based



Figure 7 Billet Mold Oil Charging Station

on its size, and then push the start button. To purge excess oil from the molds just removed, simply connect the air and oil clamps and just turn on the air supply. This station can be mounted on a moveable cart that can be easily moved from one casting pit to another or to the mold room whatever is needed. In addition it only requires an airline connection for it to function as described above. Note: The injectors used on the charging station will be the same type that is used on the mold table. Start-up assistance is not required on this product.

Accu-Guide™ Proactive Billet Troubleshooting Program

The R. J. Collins team has developed a thorough understanding of casting operations and methods for keeping a plant operating at peak efficiency. Now this expertise is available in the Accu-Guide™ Casting Optimization System (Figure 6), a PC-based program that follows the proven R. J. Collins approach for proactive troubleshooting of casting problems. This system is upgraded and revised on a regular basis to address all of the issues and changes in casthouses as they occur.

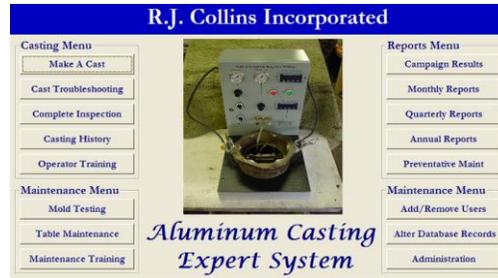


Figure 8 Accu-Guide™ Proactive Billet Troubleshooting Program

Summary

The R. J. Collins philosophy is based on looking at the whole casthouse to see and then unravel the complex interactions and interrelationships between primary aspects of the casting process. This is accomplished through:

1. Conducting an on-site audit
2. Data and documentation expert analysis
3. Process enhancements
4. Operator training
5. Completing short and long term recommendations

Subscribers to the R. J. Collins approach are achieving world class billet quality, casting recovery and lower operating costs.