

# ICRI PANEL - CASE STUDIES IN CONVERTING IRON TYPES IN PRODUCTION

(Dan Weiskopf)  
(Neenah Foundry



DIS Annual Meeting, May 31 – June 2, 2017  
Chattanooga, TN



# Neenah Foundry Today



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# Pressure Pour Conversion Ductile Iron to Gray Iron

- Most reliable approach is to remove all the ductile iron and replace with gray iron of the correct chemistry from holding furnace.
- Turn off power and lock out pressure pour furnace.
- Rod the inductor channels, and slag furnace.
- Dump out the iron.
- Put correct chemistry iron back in and pour.





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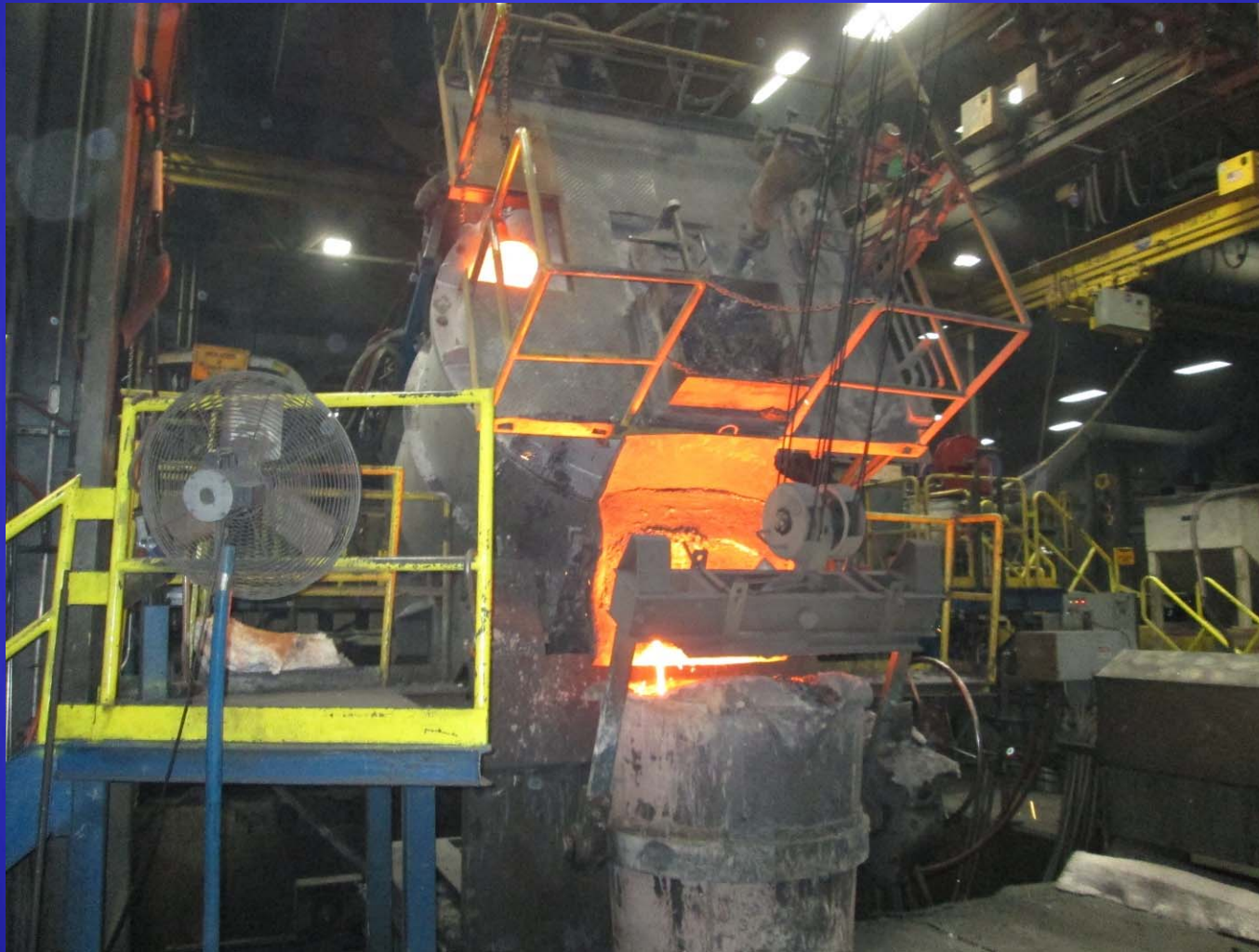


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# Pressure Pour Conversion Ductile Iron to Gray Iron

- Put the furnace back down and refill with 2 ladles of correct chemistry gray iron from holding furnace.
- Remove lockout locks.
- Turn power back on and ready to go.
- Questions?



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- Traditional approach for foundries that cannot dump the pressure pour.
- Faster method to convert if enough iron can be pigged through the molding line or poured into a component that is not chemistry or mechanical property dependent.





# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

Alloy Factor Equation (AF)

$$=[\%Ni+\%Mn+(2.6*\%Cu)+(3.2*\%Cr)+(20*\%Sn)+(26*\%Sb)+(25*\%Mo)+(32.5*\%V)+(6*\%P)+(25*\%Ti)-0.056]$$

- This is the number that takes in account all elements as far as their contribution towards hardness of casting(s).
- Good place to start for hardness but does nothing for Tensile properties.



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- Need to control all the elements that impact making the minimum tensile properties of the grade of iron to be made according to ASTM-A48. Includes carbon and silicon.

CALCULATED TENSILE =Using our data regression analysis.  
(Will need to be adjusted for individual foundries.)

$$133.2 - ((20.33 * (C + (Si/4) + (P/2))) * (1 + (0.137 * Si) - (0.002 * (Mn - (1.7 * S)))) + (25 * Ti) - (Ni + Mn + (2.6 * Cu) + (3.2 * Cr) + (20 * Sn) + (26 * Sb) + (25 * Mo) + (32.5 * V) + (15 * P)))$$

- We attempt to have 3 KSI higher than the Min Tensile to make sure we do not have failures.





# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- 15 ton pressure pour with ductile iron inside.
  - Run as much iron as possible out of the furnace into production molds. Target 12,000#-15,000# heal of iron in the furnace.
- Gray iron holding furnace to have Low Carbon/Low Silicon Iron. Less than 3.20% carbon, Less than 1.90% Silicon. Temp 2750F Min.
- Lower is better to dilute High C and High Si Ductile



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

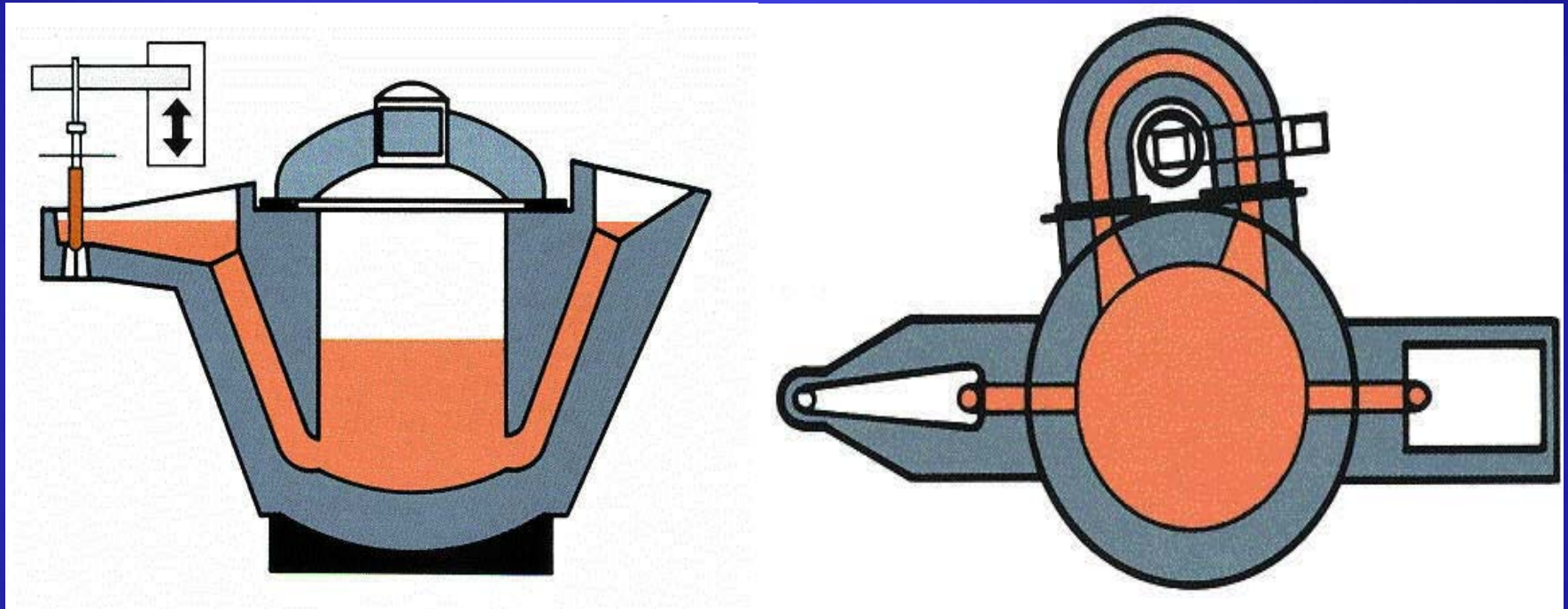


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# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- Preparation for Conversion
  - First ladle Additions
    - 60# FeMn
    - 45# FeCr
    - 30# FeMo
    - 60# Cu
    - 50# Iron/30% sulfur pressed pellets
  - Label all alloys with amount type and ladle#
- Preparation for Conversion
  - Second ladle Additions
    - 10# FeCr
    - 15# FeMo
    - 15# Cu
    - 50# Iron/30% sulfur pressed pellets
  - Label all alloys with amount type and ladle#



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- Preparation for Conversion
  - Preheat gray iron 10,000# transfer ladle
  - Prepare “A” and “B” size test bars to be poured.
  - Confirm switch to pig pattern or pattern to be run with conversion iron.
  - Notify lab that conversion samples have priority.
  - Confirm with Pressure Pour operator to empty furnace prior to conversion.





# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping



- 60 Ton 1200 kW Channel furnace
- Used to Hold both CL35 and CL30 Iron.
- Iron from Furnace put into Junker 300 kW Pressure Pour on mold line.



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- 1<sup>st</sup> Ladle of conversion.
  - Add alloys to ladle and fill with iron from holding furnace.
  - Pour into pressure pour.
  - Pressure pour operator pressurizes furnace and relieves 5 time to mix and homogenize iron.
  - Take thermal analysis sample and spectrometer sample and have Lab analyze.
  - Pour as much iron as possible into pigs.
  - Review chemistry results from ladle 1.
    - (are they what was expected?)



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- 2<sup>nd</sup> Ladle of conversion.
  - Add alloys to ladle and fill with iron from holding furnace.
  - Pour into pressure pour.
  - Pressure pour operator pressurizes furnace and relieves 5 time to mix and homogenize iron.
  - Take thermal analysis sample and spectrometer sample and have Lab analyze.
  - Pour as much iron as possible into pigs.





# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- 3<sup>rd</sup> Ladle of conversion.
  - Review chemistry from 2<sup>nd</sup> ladle.
    - Does the CE meet target? (Y/N)
    - Does the Calculated tensile meet target? (Y/N)
    - If NO to any one, Repeat process for 2<sup>nd</sup> ladle.
    - If YES get 3<sup>rd</sup> ladle of iron
  - Pour into pressure pour.
  - Pressure pour operator pressurizes furnace and relieves 5 time to mix and homogenize iron.



# Pressure Pour Conversion Ductile Iron to Gray Iron Without Dumping

- 3<sup>rd</sup> Ladle of conversion. (Continued)
  - Take thermal analysis sample and spectrometer sample and have Lab analyze.
  - Pour A & B tensile test Bars.
  - Switch to production Castings.
  - Review Chemistry Results to ensure chemistry is stable and within range of the parts being poured.



Pressure Pour Conversion Ductile  
Iron to Gray Iron Without Dumping

Have a Productive  
and Safe Day.



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