PATRIOT – The New Benchmark for Large Ductile Iron No-Bake Molding

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Don’t Ride The Roller Coaster!
…. At Least Not The Financial One.
Furan No-Bake = Inherent Volatility

**Furfuryl Alcohol Volatility**
Baseline Price = 2008 - CQ3

- **NOTES:** Upward Trend
- 60% Volatility

Market Reaction: Phenolic Modification & Reduction in Performance Properties
Furan No-Bake Volatility Drivers

- Increased Industrial & Consumer Demand
- Governmental Policy / Material Resources
- Regulation & Tariff Inequalities
- Climate Change
- Limited Agricultural Resources
Phenolic Urethane No-Bake Volatility

NOTES: Upward Trend
< 40% Volatility

Market Reaction: Improved Product Performance @ Lower Cost
Dynamic Shift: PUNB is Now The Lowest Cost Technology Platform

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Phenolic Urethane No-Bake Drivers

- Increased Usage of Bio-Based Materials
- Abundant Gas & Oil / Decreased Demand
- Consolidation of Multiple Operations
- Improved Manufacturing Efficiencies
- Short & Efficient Supply Chain
Flake Skin Graphite & Sulfur Defects

Molding Process = Acid Cured Furan
1.00% Binder Level BOS
30% TSA Based Catalyst BOR
Common 65% TSA Catalyst

0.03- 0.04% Sulfur @ Mold : Metal Interface
3X That Value With Mechanical Reclaim Sand
Flake Skin Graphite & Sulfur Related Defects

Molding Process = Phenolic Urethane
1.00% Binder Level BOS
6% Catalyst BOPI
Common 15% Amine Catalyst

0.00% Sulfur @ Mold : Metal Interface
Elimination of 1º Sulfur Source in Reclaim Sand
Elimination of Sulfur Related Defects

Dynamic Shift: Superior Process for Large & Safety Critical Ductile Iron Castings

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OPACITY DEFINITION: “The amount of light which is blocked by a medium such as smoke or a film of tint on a window. It is a visual determination made by a trained & certified observer.”

APPLICABILITY: The US EPA supports opacity measurements because they believe that these measurements provide an indication of the concentration of pollutants leaving a smokestack or point source within a manufacturing facility.

NUISANCE ODORS: Nuisance odors have become a top 5 issue for most large no-bake molding operations in North America.

APPLICABILITY: Odor is a measurable and quantifiable property via ASTM Standard of Practice E679-91. This standard identifies (7) objective odor measuring techniques including the type of odor detected. Sulfur odors fall into the “Character Descriptor” category.

Environmental Shift: Low & No Sulfur Resin Technologies Improve Opacity & Odor Reduction.

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Core & Mold Strength Comparison

Technology Shift: Equivalent or Better Core & Mold Strength Properties When Compared to Modified Furan Technology

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Mold-Making Productivity Band

Technology Shift: Superior Productivity Attributes (WT : ST Ratio) Resulting in Lower Costs to Produce Per Unit Molds & Castings
Mold-Making Safety Margins

Real Work Time Safety Margin Profile
PATRIOT vs. Furant Technologies
100% Resin on 60 AFS/SGN Silica Sand
(66 Minute Cure Times)

CAUTION!

Technology Shift: Superior Safety Characteristics / Instantaneous Through Cure

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Initial Casting Trials

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Summary: The New Benchmark

Minimize Price Volatility
- No Furfuryl Alcohol
- No Dependence on China / Tariffs
- No Climate Change / Agricultural Influence

Superior Operational Performance
- Higher Productivity
- Superior Safety Margins
- Reduced Opacity & Nuisance Odors

Superior Casting Attributes
- Elimination of Sulfur Related Defects
  - Flake Skin Graphite
  - Shrinkage

PATRIOT = “Made in America”
- R&D – Created in America
- Raw Materials Made in America
- Product Made in America

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Thank You