BENTOKOL

Composite Sand Conditioner

INTRODUCTION:

Traditionally, most small to medium size iron castings have been made in natural, semi-synthetic or synthetic green sand to which a very variable addition of coal dust has been made. The inclusion of coal dust in the mix ensures good strip of sand from the casting and a good surface finish. Opinions differ as to how this is accomplished but the following factors probably all play a part.

Combustion of some of the coal dust as the metal enters the mould may ensure oxygen-free reducing conditions, thus reducing oxide formation and aiding apparent fluidity. Evolution of gas from the heated coal dust is also said to produce a gas cushioning effect giving finish and polish to the casting. Strong heating of coal dust ensures the formation and deposition of a type of carbon layer, known as lustrous carbon, which is not wetted by metal and so produces improved surface finish in this way.

Beside these factors, sand expansion defects such as scabs, buckles, rat-tails etc, are much reduced. Unfortunately, coal dust is dirty to work with, mill and shake-out areas can be very dusty and the mixed sand is also dirty to handle.

Many of these objections can be reduced or removed by the use of a specially blended additive: BENTOKOL sand conditioner.

BENTOKOL is a blend of natural clay together with a unique combination of liquid and solid volatiles to produce a grey coloured, free flowing, virtually dust free product which moderates and in some circumstances may eliminate the need for other additions. The concentrated volatile materials in BENTOKOL together with the synergistic effect of blending provide an additive having a coal dust replacement ratio much better than unity.

Special manufacturing techniques reduce the light dust forming particles at source. A sealed unit ensures that the liquid components are encouraged to encapsulate and agglomerate dust particles, including clay, but without poisoning or waterproofing. The finished product is clean to handle and remains free-flowing so eliminating transfer and application problems.

BENTOKOL will replace the coal dust additions by a factor usually of 1.3 to 1.8 to one; i.e. 1 part of BENTOKOL will replace 1.3 to 1.8 parts of coal dust at the same time giving similar or improved surface finish and enabling the clay addition to be reduced. This varies with the particular BENTOKOL used but it will occur with all types to a greater or lesser extent. Sulphur content is low in all BENTOKOL types – an important feature when castling S.G. irons.
There are six basic types of BENTOKOL designed to cover the whole range of foundry requirements from hand moulded green sand jobbing work through mechanised moulding to the latest high pressure automated plants.

**DURABILITY:**

The bond in BENTOKOL is provided by a blend of natural bentonites. These bentonites exhibit high burn-out temperatures so smaller make-up additions are required and sand properties are more uniform. Greater thermal durability also means lower dead clay content, thus reducing moisture requirements, improved permeability and better all-round sand properties over a longer life cycle.

**RAMMED DENSITY:**

Coal dust fines, ash and dead clay decrease the density of a sand system. BENTOKOL therefore increases rammed density giving better casting definition and more accurate dimensions.

**BOND DEVELOPMENT:**

Dispersion agents are included in the BENTOKOL formulation so that the clay is rapidly spread and the bond quickly developed. This can permit shorter milling cycles or, alternatively, more uniform sand properties from a standardised cycle.

Note: The information on this page does not refer to a specific grade of BENTOKOL. It is provided for comparison purposes and to indicate the improved properties that might be expected compared to a conventional clay/coal dust sand mix used for the same purpose.

<table>
<thead>
<tr>
<th>BENTOKOL TYPE</th>
<th>VOLATILE: CLAY RATIO</th>
<th>TYPE OF APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>Medium</td>
<td>Grey, malleable and S.G. iron, mechanised foundries using synthetic sand systems.</td>
</tr>
<tr>
<td>71</td>
<td>Low</td>
<td>A general purpose BENTOKOL for use in hand moulding and mechanised plants. Suitable for all types of cast iron and thicker section Copper alloy castings.</td>
</tr>
<tr>
<td>72</td>
<td>Medium</td>
<td>A versatile general purpose product mainly used in mechanised foundries on synthetic and semi-synthetic systems. Gives very good surface finish.</td>
</tr>
<tr>
<td>80</td>
<td>High</td>
<td>For grey malleable and S.G. irons produced by high pressure machines such as Disamatic, Kunkei Wagner etc. Used in natural or synthetic sands. Very flexible in use and has coal dust replacement factor of 1.8 (i.e. 1 part BENTOKOL will replace 1.8 parts coal dust).</td>
</tr>
<tr>
<td>84</td>
<td>High</td>
<td>Again, suitable for high pressure moulding systems but with additional clay to approach one-shot addition situation. A very cost effective product.</td>
</tr>
<tr>
<td>90</td>
<td>Medium</td>
<td></td>
</tr>
</tbody>
</table>
HOW TO USE BENTOKOL:

The product will usually be introduced into the sand system at some convenient location - normally where the coal dust/clay additions were conventionally made. Expert guidance is available to determine the quantities to be used in the first instance, or indeed to meet the particular requirements of a foundry. It is recommended that full advantage is taken of these facilities.

ADVANTAGES OF USING BENTOKOL:

- Environmental - reduced dust and fire hazard.
- Improved sand properties - better finish, definition, strip and knockout.
- Consistency and reproducibility of sand properties.
- Fines and dead clay curtailed - reduced moisture content.
- Fully compatible with existing systems.
- Simplified sand additions - save storage space and handling costs.
- High rate of lustrous carbon deposition.
- Low sulphur content giving improved application to high duty and S.G. iron.
- Better working conditions.

OTHER TYPES OF BENTOKOL:

BENTOKOL 44, 72 and 80 remain the principal products in the range, but BENTOKOL 71, 84 and 90 have become established in certain foundries as the product group has developed and these will also undoubtedly be supplied and used for some considerable time. Other variations, largely in Experimental Product form also exist to cater for special requirements. The general information, including Health and Safety Precautions, given in this leaflet can also be extended to include these additional products. Should any specific problems arise in relation to any form of BENTOKOL or an associated Experimental Product version, please contact us immediately so that assistance may be given.

STANDARD PACKING:

25 kg. sacks

Bulk tanker.

July 1987

HEALTH AND SAFETY PRECAUTIONS‡:

All types of BENTOKOL contain carbonaceous materials that are combustible but will only burn with difficulty and at high temperatures. There is no hazard to health at ambient temperature but excessive inhalation of fume from the product in use should be avoided. Maintain normal levels of personal hygiene.

Products should be stored in a dry, cool location away from open flames or other sources of ignition. ‘No Smoking’ regulations should be observed. Care should be taken not to raise flammable or explosive dust/air mixtures when handling the materials. Small spillages may be collected by brush and pan; suction cleaners should have spark proof motors. Larger quantities for disposal may be tipped or buried in waste ground.

‡ Extracted from Material Safety Data Sheet No.32 copies of which are available on request.
CARSINEX

The Carsinex range of greensand conditioners is comprised of a blend of carbonaceous materials, conditioners and bentonites in the form of a relatively clean to use free flowing powder. The carbonaceous portion includes polymers with a high lustrous carbon index. The deposition of lustrous carbon at the metal/mould interface within a reducing mould atmosphere prevents iron/sand reactions, sand adhesion and resultant sand "burn-on".

Carsinex is not simply a replacement for traditional coal dust additions it is a complete sand conditioner enhancing moulding sand performance in addition to improving the working environment.

ADVANTAGES

- Airborne dust levels are reduced.
- Fire hazard is dramatically reduced.
- Batch processing ensures consistent product supply.
- Coke, sulphur and ash contents in the moulding sand are reduced resulting in improved sand texture and flowability. Moulds can be formed at lower moisture content whilst retaining a good mouldable range.
- The skin finish of castings can be maintained and often enhanced with all sectional thicknesses of grey, maibleable and modular iron castings.
- A lower operating volatile matter and less gas emission from the sand during metal pouring means less likelihood of gas defects in castings.
- The total weight of additions to the sand muller will be reduced easing any handling and storage difficulties.
- Carsinex is completely compatible with coal dust and the sand can be controlled using data obtained from the normal traditional laboratory test methods.
- Whatever the prevailing foundry conditions there is a Carsinex product within the range suitable for your needs. In addition, Steatley personne ensure CARSINEX is introduced to your sand system smoothly and optimu results achieved. A comprehensive after sales service helps maintai
PRODUCT DEFINITION

PRODUCT NAME
CARSINEX III

DESCRIPTION
A powder blend of carbonaceous constituents and clays for use in iron foundry green and systems to prevent sand burn-on and enhance sand performance.

CONTROL PROPERTIES

Grading (weight percent passing 85410 test sieves)
710 microns - Minimum 98% by weight passing

Moisture Content (weight percent dried at 100-110°C)
Moisture Content - 6.5-12.5% by weight

Volatile Matter (percent by weight)
Volatile matter is the weight percent loss of a pre-dried sample heated in a closed crucible at 910-940°C for seven minutes.
Volatile Matter - 27-34% by weight

Control properties are parameters that are measured at a frequency relating to the known variability of the process and are used to control the process.
Duracarb has been developed from the Voltrol range of greensand additives and Duraclay bentonite. Duracarb therefore is complimentary to a sand system which uses Duraclay bentonite. The carbon materials are high in volatiles, deposit a high proportion of lustrous carbon, have a very low coking tendency, and a low ash content. As with Voltrol the level of inactive fines in the foundry sand system are greatly reduced.

Duracarb has been developed to assist foundrymen to produce higher quality castings. Although suitable for all types of moulding sand systems, Duracarb is particularly recommended for high pressure moulding units, both flask and flaskless, and is beneficial in the production of SG iron castings as the buildup of sulphur in greensand systems is reduced.

The use of Duracarb together with a durable bentonite leads to even lower overall binder additions. Bentonite is developed much faster and more efficiently when coaldust is removed from the system sand, as coaldust and its products of decomposition, such as coke, ash and tarry residues, soak up the moisture required by the bentonite and retard bond development. Most sand systems using coaldust therefore carry excess clay and moisture levels. The use of Duracarb leads to lower overall binder additions, reduced sand moisture requirements and improved moulding sand properties with greater mould density and increased sand flowability. Due to the reduction of fines generated in the system, lower new sand additions are normally required.

The carbon blend used in Duracarb is up to four times more effective than coaldust, therefore excellent casting surface finish is achieved with reduced additions to the moulding sand system.

There is a noticeable reduction in smoke, fumes and dust levels giving improved foundry environmental conditions.

There are no known health hazards in using Duracarb and its use presents reduced fire risk when compared to coaldust in bulk storage silos.

Duracarb is completely compatible with coaldust and therefore presents no problems in its introduction to existing coaldust sand systems.

All specifications are typical and will not necessarily relate to any particular individual product batch.
PACKAGING

Duracarb is supplied in:
1. 50kg nett multi ply paper sacks on pallets
2. Bulk tanker up to 24 tonnes

HEALTH & SAFETY INFORMATION

GENERAL DESCRIPTION

This product is a free-flowing powder which can cause some dust in the atmosphere when handled, and therefore normal methods of control associated with handling dusty materials should be applied. Special protective clothing is not normally required, although it is recommended that heavily soiled clothing should be changed. Gloves should be worn when handling the product, particularly if personnel are sensitive to skin ailments.

HEALTH HAZARDS

There are no known health hazards associated with the use of this product, providing that a high standard of personal hygiene is maintained and adequate ventilation is provided in areas where the product is handled. It is recommended that face masks be worn by personnel who are physically handling the product.

FIRE HAZARDS

Duracarb presents less of a fire hazard than does coaldust, and is therefore resistant to spontaneous combustion. However, normal precautions against fire should be taken. CO₂ fire extinguishers should be used.

EYE PROTECTION

Duracarb is not injurious to eyes, but eye protection is recommended to prevent dust entering the eye and causing irritation.

SPILLAGE & DISPOSAL

Dry cleaning methods or vacuum cleaning should be employed. Disposal should be as landfill on site authorised by the local authority.

STORAGE

THE PRODUCT MUST BE KEPT DRY!
ADDITROL FCM COALDUST REPLACEMENT

Additrol FCM is a blend of carbonaceous materials and Bentonites, selected to provide optimum moulding properties and excellent casting finish for individual system sand requirements.

The active carbonaceous constituents encompass blends of hydrocarbons designed to provide a range of characteristics satisfying specific requirements imposed by variations in casting geometry, system sand constraints and environmental considerations.

The carbonaceous constituents are also selected for their ability to minimise contamination of moulding sand, with reductions in levels of Ash, Sulphides, Sulphates, Chlorides etc.

These provide improvements in sand quality with reduced moisture, improved flowability and enhanced bond development, thereby giving direct benefits of increased mould density, lower Bentonite demand and a reduction in erosion and expansion defects.

Similarly, the reduction in moisture content and volatile level requirements of the moulding sand lowers the potential incidence of gas related defects.

The low Sulphur levels in the sand substantially reduce the risk of surface de-nodularisation defects in SG iron.

The Bentonites used in Additrol FCM are selected to optimise moulding characteristics for specific operational and casting requirements.

Environmentally, the benefits gained in practice are marked reductions in dust, smoke and fume, plus the elimination of the potential for spontaneous combustion in bulk storage.

Major benefits of Additrol FCM coaldust replacement can be summarised as improvements in:-

a) Casting quality and surface finish.
b) Moulding sand condition and moulding quality.
c) Moulding flexibility.
d) Foundry environmental conditions.
e) Overall cost effectiveness.

TYPICAL PROPERTIES:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lustrous Carbon potential</td>
<td>12.1%</td>
</tr>
<tr>
<td>Volatile Matter</td>
<td>36.8%</td>
</tr>
<tr>
<td>Volatile Evolution Temperature Range</td>
<td>340-580°C</td>
</tr>
<tr>
<td>Fixed Carbon</td>
<td>38.9%</td>
</tr>
<tr>
<td>Ash Content</td>
<td>24.6%</td>
</tr>
<tr>
<td>Sulphur Content</td>
<td>0.6%</td>
</tr>
<tr>
<td>Chloride Content</td>
<td>&lt; 0.1%</td>
</tr>
<tr>
<td>Physical Appearance</td>
<td>Black Powder</td>
</tr>
<tr>
<td>Sieve Analysis</td>
<td>3.0 Max</td>
</tr>
<tr>
<td>(% Retained on 710 Micron sieve)</td>
<td></td>
</tr>
<tr>
<td>Bulk Density (in g/cc)</td>
<td>0.7 ± 0.05</td>
</tr>
</tbody>
</table>

The information and data contained herein are believed to be accurate and reliable. Volclay Limited makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information.
VOLATILE CHARACTERISTICS OF REPLACER MATERIALS

VOLATILES %

TEMPERATURE °C

300
400
500
600
700

10 20 30 40 50 60 70 80 90
<table>
<thead>
<tr>
<th>%</th>
<th>0.1 - 1.0%</th>
<th>1.0%</th>
<th>0.5%</th>
<th>0.3%</th>
<th>0.1%</th>
<th>0.05%</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 30%</td>
<td>35%</td>
<td>50 - 60%</td>
<td>80%</td>
<td>10</td>
<td>320 - 400°C</td>
<td>360°C</td>
</tr>
<tr>
<td>5%</td>
<td>1%</td>
<td>&gt;</td>
<td>&gt;</td>
<td>&gt;</td>
<td>&gt;</td>
<td>&gt;</td>
</tr>
</tbody>
</table>

Contamination of Bentonite

2. Generation of Dust

1. Moisture Demand/Tolerance
   Accumulated in Sand Indicating:
   Spent Carbon Residue
   Contamination of Sand

Ash Content

Fixed Carbon Content

Contamination of Coal

3. Durability/Viscace

Of Casting Sections

2. Reliability Over a Range
   Casting Section
   Efficiency Relative To
   Casting Surface Finish

Temperature Ranges

Volatile Content

Lustrious Carbon

Property

Key Characteristics of Coal Dust Alternatives
4. ADJUSTED MIX COMPOSITION

- Higher carbonaceous material content
- Blend of carbonaceous materials better suited to VRF operation

3. DIFFERENT BENTONITE

- Lower dry strength - better sand shake-out
- Lower ash, S & C1 - reduced contamination of sand
- Higher volatile/ashless carbon - more effective

2. CHANGED COAL DUST

- Higher softening point - non-dusting/other throwing
- Greater durability - lower usage
- Higher volatile/ashless carbon - more effective
- Less variable product - less variability

1. DIFFERENT ASPHALTENE

COMPARISON OF ADDITIONAL AGAINST VOLATILE (1991)
1. Lower Costs

2. Better casting finish and strip

3. Improved sand control

4. Better shake-out characteristics

ie Higher moisture/wider moisture tolerance

ie Appoximately 25%
Outline Proposal for VFM Moulding Line

Objectives

1. Reduce costs
2. Improve casting finish and strip
3. Reduced casting cleaning
4. Improved shake-out

Additional PFM 75% Replace/Coal Dust Blend

Proposition

25% Economixed 3

Replace Bentonite with Additional PFM