

Graded coal - its role in iron casting production from greensand systems

Foundrymen have often regarded coal and carbonaceous additives to greensand systems for the production of iron castings as a 'necessary evil'. Here Alexander Brown of James Durrans & Sons Ltd takes up the story. It is perfectly possible to produce castings with little or no carbonaceous products but experience has shown this is limited to the smaller casting weights and such systems are generally characterised by poorer surface finish and lack of casting definition.

Fundamentally a greensand system is silica sand, bentonite and water. To improve the surface finish, improve casting dimensional stability and to have less sand carryover and cleaner castings at knockout, carbonaceous additives are used to good effect. Surface defects, gas related problems often associated with a poor choice of carbonaceous additive, normally results in reducing or removing this carbon additive as the 'lesser of two evils' and to spend more time at shot blast to clean the castings.

Looking across the foundry industry, coal is still widely used and is the most cost effective carbonaceous additive and even many so called coal substitutes or replacements contain a large percentage of coal. Coal has not only stood the test of time but its set of unique properties actually makes it ideal for iron casting production in greensand systems. It is accepted theory that coal not only provides a lustrous carbon barrier to metal penetration but its ability to produce coke helps create a filler between sand voids, resulting in good surface finish, with excellent knockout conditions.

With the correct choice of coal, the combination of low ash, high volatile and swell index properties coupled with the key element of grading size, ensures castings are produced free from metal penetration and surface related problems.

Coal, like bentonite has two moistures, which need consideration. Surface moisture and chemically combined moisture (inherent), which need to be



Horizontal greensand moulding line

treated with great respect in storage and processing. This particular property has often given coal a bad press and fires caused by spontaneous combustion have in the past led many foundrymen to seek alternatives.

By careful selection, safe handling and processing coal continues to offer a good simple cost effective solution. Coal is subject to regulations in storage, processing and transportation and then further subjected to safe handling and use by the foundry. Despite these handicaps, it is still economical to the end user and modern processing and grading methods ensure it is used in the optimum condition.

Safety consideration

Coal processing plants have to be compliant to the UK directive *DSEAR (Dangerous Substances and Explosive Atmospheres Regulations)* which is in harmonisation with the European *ATEX regulations* and in particular to *zone 21 and 22 for motorised values and controls*. Regular temperature monitoring during processing along with CO measurements ensures safety. Nitrogen purging is an additional safety feature and even after processing, the storage of coal, either in bulk silos or bags, is carefully monitored for temperature before release to the end user.

A further safety consideration is the *ADR regulations ECE/TRANS/140 Volume 1 & 2* (for the safe transportation of dangerous goods) under which coal and blended coal/bentonite/lustrous carbon are classed. Coal and products containing coal are classed as *S2 Organic (not otherwise specified) Solid* with a self heating property subject to *UN Number 3088 Class 4.2 regulations*. The *packing groups 2 & 3, bulk loads and bulk polybags* are covered. Currently paper bags, typically 25kg, are not subject to ADR.

As a general rule, tests show that blended coal products *have to contain 50% bentonite* to be out with these ADR regulation rules. Coal and blended products subject to the regulations need to be transported in *dedicated ADR road transport* and bulk bagged products need accredited *UN3088 ADR polybags*. Added to this, the drivers must be specifically trained and licensed and the transport vehicles must display the approved orange placard.

Types of coal

For iron castings in greensand systems, bituminous coals are the logical choice but these vary widely in