



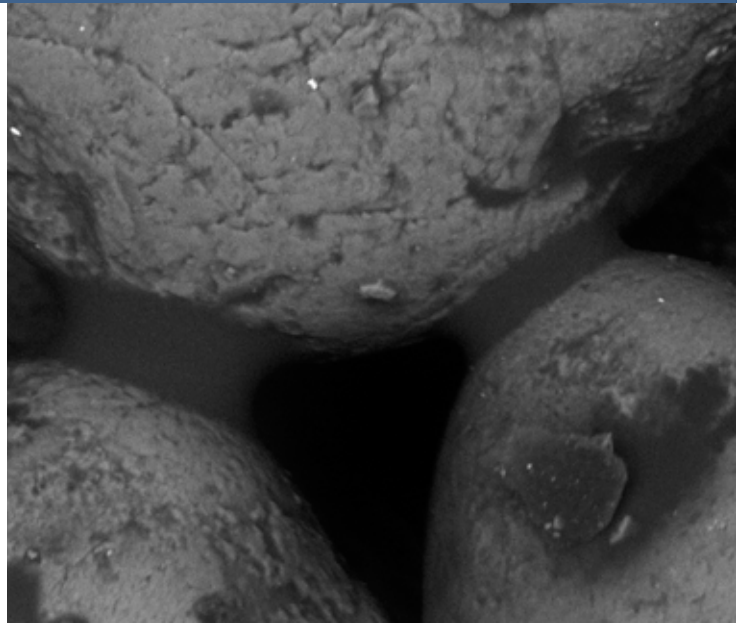
LOVOX™



LOVOX™ Binder Systems



AMERICAN COLLOID COMPANY



Lovox bond bridges between sand grains (650X).

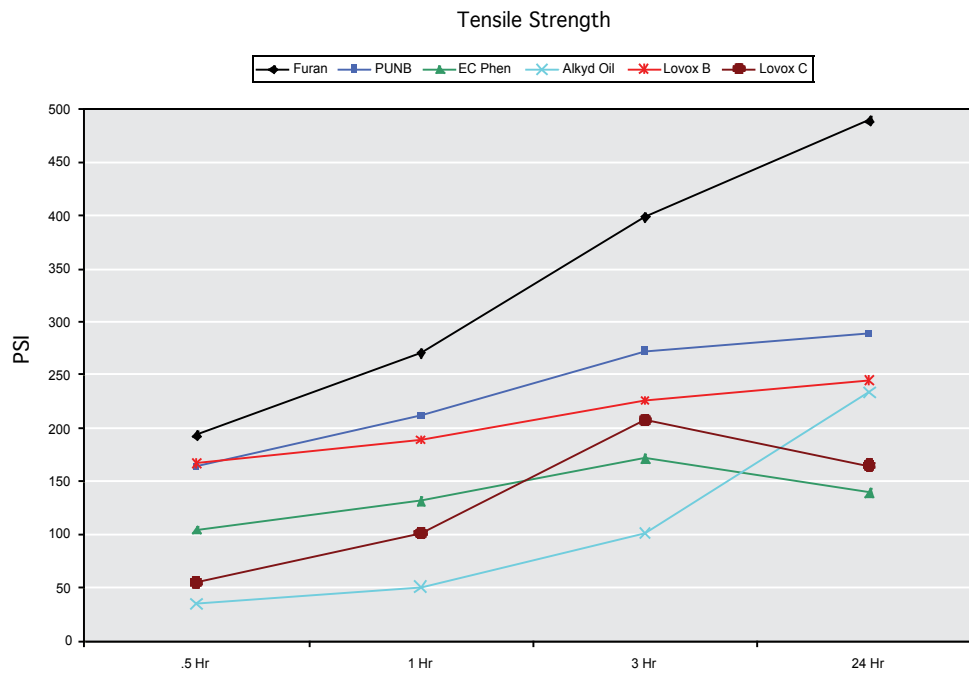
LOVOX™ Binder Systems

No matter which conditions within the foundry industry improve, one area which will probably never relax is the regulation of emissions from casting production operations. Improving the working environment within the foundry is and should be a constant pursuit. The ultimate goal is, obviously, no hazardous emissions at all. However, in the area of sand binders this can only be accomplished through inorganic systems which have yet to be developed into sand binders that can be universally applied. The Lovox resin systems offer a reliable means of bridging the gap between inorganic emission reduction and the performance features of organic systems. While not a zero emission system, HAP's have been measured at over 50% below standard low-emission phenolic urethanes.

The Lovox systems produce a urethane bond without the use of a phenol formaldehyde resin component. The phenolic Part 1 has been replaced with uniquely formulated resins which may contain either a naturally occurring mineral component blended in a polyol solvent as is the Lovox B resin. Another version of the resin consists of a bio-based liquid in a similar solvent package. This product is designated as Lovox C. In both cases, the solvents are reactants. Being reactive solvents there is no need for aromatic carriers. The Part 2 co-reactant consists of modified isocyanate resins which are also free of aromatic solvents. This phenol and aromatic solvent free chemistry results in a urethane binder which exhibits very low odor at the mixing station, marked reductions in pouring emissions, and significantly reduced VOC's and HAP's.

While the Lovox systems are based in urethane chemistry and are three part binders, they may be adapted to any conventional no-bake sand binder system. They are cured with modified amine liquid catalysts and offer work time/strip time ratios of .60:1 to .65:1. In practice, these systems do not require any special equipment or processing procedures.

Comparative Sand Properties



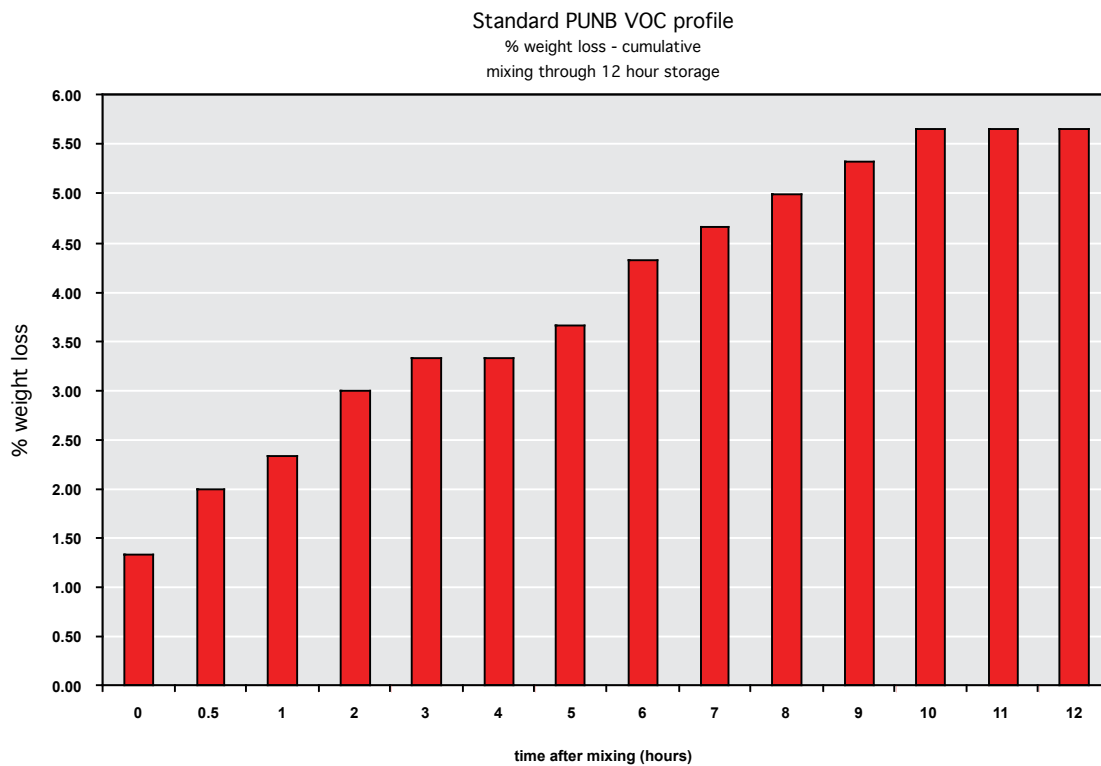
The above data illustrates the comparative strengths of the Lovox binders. This data was produced with standard dogbone tensile specimens which were made in a 55GFN silica sand. Total binder levels were constant at 1.20%. Catalyst levels were set to yield a strip time of around 10 minutes.

As seen in the graph, the Lovox resins perform in a similar manner to the current standard no-bake chemical binder systems. The Lovox B exhibits tensile strength development similar to that of phenolic urethane binders. The Lovox C follows a development curve more closely aligned with ester-cured phenolics. In both cases, molds and cores can be handled and processed in the same time frame as other chemical binder systems.

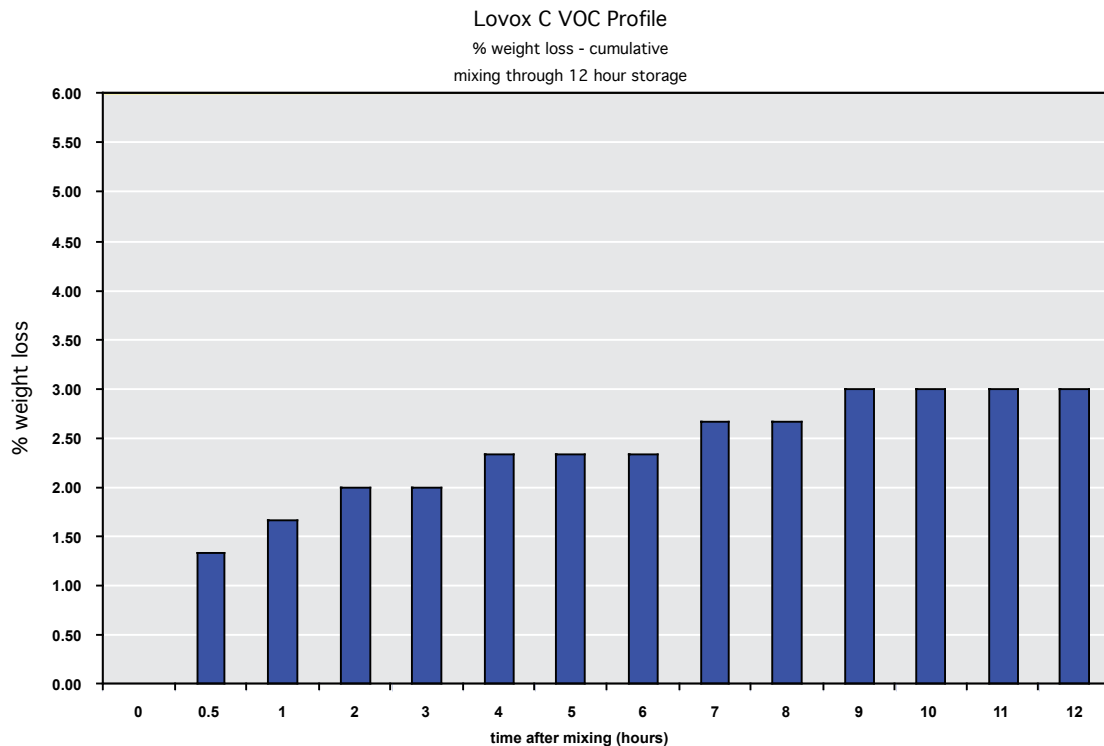
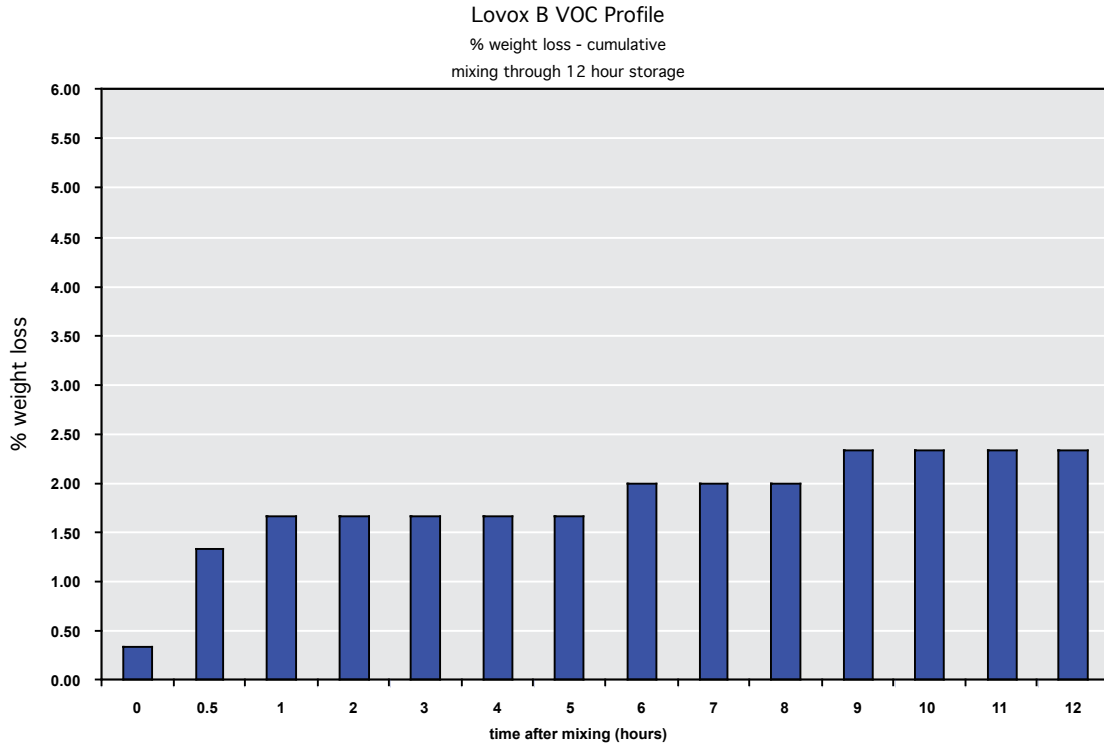
Volatile Organic Compounds

As the name suggests, Lovox resins are very low in volatile organic compounds (VOC's). The removal of the phenol and aromatic solvents results in a resin system which features a significant reduction in volatiles as illustrated in the accompanying graphs. These graphs represent data from a VOC test procedure developed by the Ohio Cast Metals Association. In this procedure, a known quantity of sand is mixed with chemical binders and a catalyst and left in the mixing vessel while stored for a 12 hour period. The weight of the mixing vessel with the sand and resins is recorded immediately after mixing and then at intervals of 30 minutes, 1 hour, and every hour following the first. Results are recorded as an accumulated percentage of lost weight, and these results are interpreted as the percentage of VOC's in a given binder system.

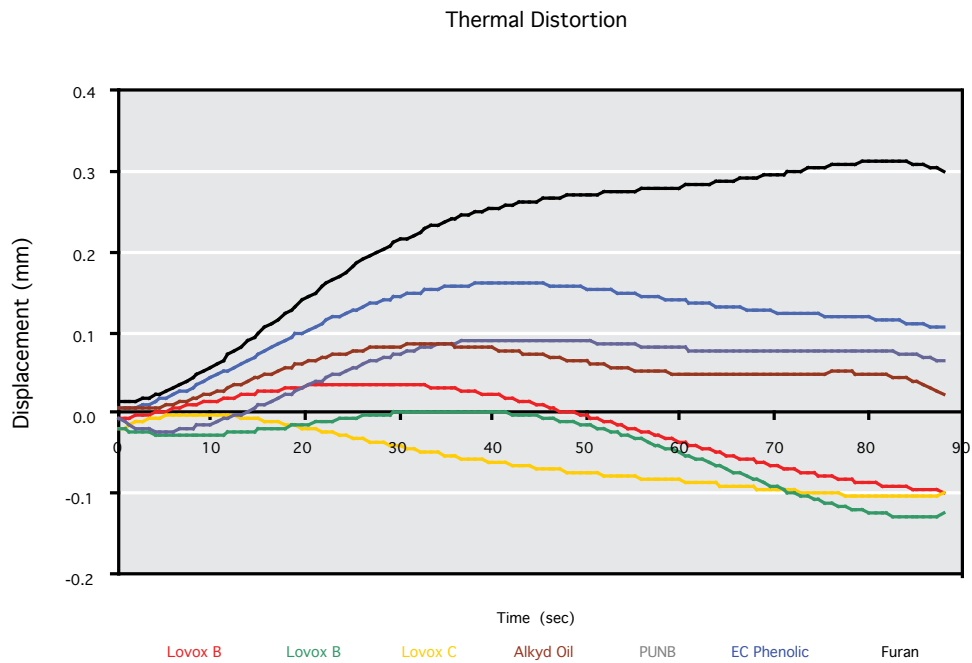
The "control" sample in this study was a standard phenolic urethane system at 1.0% total binder and 3.3% catalyst based on binder. As seen in the graph, total volatiles were measured at 5.67%.



Both Lovox B and C resins were evaluated according to the same procedure and at the same binder and catalyst levels. The results are presented in the following graphs. As seen, the total VOC content of the Lovox B was 2.33% and the Lovox C was measured at 3.00%. These results represent reductions in VOC's of 59% and 47% respectively. This characteristic translates into drastically reduced odor at mixing, an improved environment in the mold and core room, and a significant reduction in noxious fumes at pour-off.



Lovox Thermal Characteristics



Lovox resins exhibit thermal stability properties that are as good as or better than some of the more common conventional binder systems. The above graph represents thermal distortion data obtained in a recent study. All systems were tested with test specimens produced in a 55 AFS GFN silica sand at 1.2% total binder. The physical load used during the test was set to represent an 8 inch cast iron ferrostatic head height. Test temperature was set at 1000 degrees C to replicate a cast iron mold/metal interface. The points plotted for each system represent the maximum degree of expansion or distortion which was recorded during the 90 second duration of each test.

The above data indicates that along with the reduction in odor and emissions, Lovox binder systems can be expected to deliver excellent casting results in any application.

Exceptional Shake-out Properties

An additional feature of the Lovox resin system is its collapsibility properties. Although these binders exhibit similar hot strength characteristics to conventional resin systems, the shake-out properties are demonstrably superior. The right photo shows a set of vertical stack molds after being poured. These molds are produced with a conventional phenolic urethane binder system at around 1.0% binder. The molds pictured had been sitting in a cooling area for about one hour. As depicted, the binder system has gone through only a minimal amount of thermal breakdown.

This is typical of what this particular operation experiences with the production of this casting.



The photo to the right shows the same set of molds in the same fixture in the cooling area. Seven of the eight molds had been produced with the Lovox B system at 1.2% binder. Again, this photo was taken one hour after pouring. The mold which is still largely intact was a “control” sample produced with the phenolic urethane system described above.



In core applications, Lovox resins provide similar shake-out properties. The casting shown to the right is an iron housing casting in which a phenolic urethane bonded core produces the half-spherical cast shape. As seen in the photo, this is a heavy sand to metal ratio and even with much of the core sand removed from the center, there is little break down of the core mass.



The bottom photo shows the same casting as pictured above. The core for this casting was produced with the Lovox B resin system at the same binder level as the phenolic urethane system. All other parameters pertaining to pouring, cooling, and shake-out processes were the same. The shake-out properties depicted here are typical for this binder system and have been demonstrated in a number of applications. The net result from this product feature is a reduction in disposal of non-reclaimed mold and core butts, a potentially significant reduction in energy costs associated with sand reclamation, and a greatly reduced level of residual core binders being introduced into green sand systems.

Of course, odor and emission reduction, productivity, thermal stability, and binder collapsibility are only useful properties if the foundryman can produce a saleable casting. The Lovox binder systems have been proven to meet that test as well. Castings ranging in applications from aluminum pistons to large ductile iron agricultural components to alloyed iron wear parts have been produced successfully with little more than a change in the resin system. Lovox bonded sand is compatible with most types of mold and core coatings if needed for specific casting applications.



For more information or for questions about your particular application, contact American Colloid Company at 847-851-1723, or your regional American Colloid Company representative.

