Comparative advantages of a Simpson Multi-Mull® versus batch mullers in medium to large capacity sand systems

The G series Simpson Multi-Mull is considered by many foundry executives and engineers to be the heart of the modern, world-class foundry. Today's foundrymen recognize that in order to achieve maximum profitability in an automated molding plant it is crucial to select sand preparation equipment which will maximize the profitability of the line in terms of the initial capital invested, skilled labor required and ongoing maintenance & operating costs. The continued success of the Simpson Multi-Mull in this equipment selection process is a result of its ability to supply the features and performance essential to meeting the profit maximizing goals of the modern foundryman: high performance, high efficiency, reduced initial capital expenditure, low costs in

terms of ongoing power and maintenance and minimal skilled labor requirements. Most importantly, the Simpson Multi-Mull delivers a proven ability to prepare consistently high quality molding sand while maintaining the flexibility to adjust to the shift-to-shift or mold-to-mold changes that typically occur in any foundry operation.

When compared to batch mixers in medium to large sized sand systems, the unique features of the Simpson Multi-Mull offer a number of well documented benefits and the Simpson Multi-Mull can consistently prepare high quality molding sand more efficiently than any batch muller or mixer.

BENEFITS IN SAND CONTROL

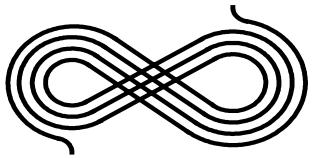
If your total daily requirement of sand could be mulled in one big batch, stored in a sealed bin and fed to the system only as required, sand properties of the last mold of the day would be as consistent as those of the first; primarily, because all sand variations are eliminated. In large sand systems, continuous mulling in a Simpson Multi-Mull approaches this ideal situation more effectively than systems based on batch mullers.

The control of compactability is extremely important in the preparation of molding sand for consistent, close tolerance molding in automated molding lines. To attempt to compensate for variations in return sand many foundries rely exclusively on automatic compactability control devices. The basic problem encountered by automatic controls is the difficulty to produce uniform results when the return sand to the muller has wide variations in properties such as temperature, moisture content, burn-out, etc. In a batch muller, a recipe of sand, bond and other additives are usually metered into the machine on a constant volume or weight basis; the same amount being added to each batch regardless of any variations in incoming sand temperature, moisture, or degree of additive burnout. The result is that some batches are over-treated and some are under-treated. In addition, to meet the capacity requirements of the molding line the muller is typically programmed to operate at the minimum, pre-set cycle needed under "normal" conditions. Automated mixer controls, such as the Simpson #3818-NT compactability controller, can overcome these problems to a great degree but only at the expense of longer cycle times and reduced mixer capacity. If this is permitted, the quality of sand produced remains relatively consistent but the hourly capacity and relative efficiency of the batch muller is further reduced.

In batch mullers, the relatively small size of the batch allows for any inconsistencies in the return sand (temperature, moisture, etc.) to have a relatively significant effect on the composition of any one batch. Conversely, sand entering the Simpson Multi-Mull is rapidly intermingled with the relatively much larger prepared mass of sand inside the machine. Consider, for instance, that a #23G-250 Simpson Multi-Mull has a theoretical retained sand capacity of six short tons or over 12,000 pounds. When operating at 175

tph the 23G is being charged with about 100 lbs. of return sand every second. On average, it will take over 2 minutes for a particular sand grain to be discharged from the muller. Any variation in a few hundred pounds of sand will be quickly diluted when charged to a retained "batch" of 12,000 pounds. The compactability controller, therefore, compensates only for the small change from the average condition of the sand in the Simpson Multi-Mull, thus permitting more accurate control.

The important difference between the batch muller and the Simpson Multi-Mull, from a standpoint of both productivity and capability for controlled sand uniformity, is "back-blending." The back-blending feature of the Simpson Multi-Mull incorporates a mixing action wherein a portion of the prepared sand ready to leave the muller is continuously recirculated back to be mixed with the shakeout sand entering the machine – similar to a "figure-of-eight" path. This action eliminates the control problems of "first-in, first-out" continuous flow through mixers and effectively averages out the variables inherent in shakeout sand.

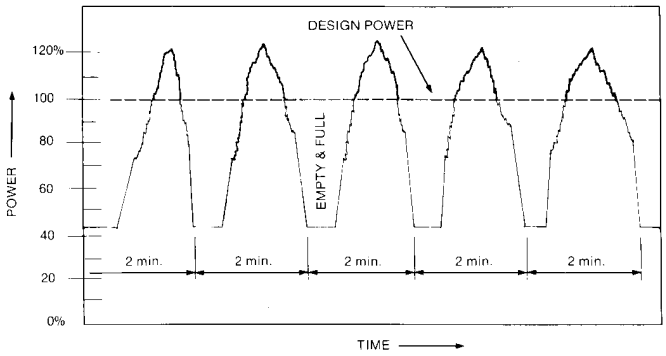


In the Simpson Multi-Mull the variations in the relatively small amount of return sand being added at any given moment to the large retained mass of sand in the muller are diluted and "averaged" so that a continuous addition of additives at a predetermined rate is accurately correcting the additive deficiency of the returned sand and thereby providing properly reformulated sand.

With the Simpson Multi-Mull a control rate discharge door is provided which automatically adjusts and maintains the muller retention time to compensate for minor variations in the consistency or rate of the sand entering the muller. This feature improves the operation of any type compactability controller by automatically maximizing the mulling time on drier sand (that which requires more water, bond and mulling action) and/or in periods of inconsistent sand flow.

BENEFITS IN THE MECHANICAL OPERATION AND INSTALLATION

In a properly designed sand system and molding line, running without unexpected failure, the Simpson Multi-Mull is mulling 100% of the time. No valuable time or energy is lost as in a discontinuous batch type operation that requires constant batch charging and discharging of the machine. Consider a high speed batch muller operating on a 90 second total cycle including 20 seconds for charging and discharging of the muller. In this case a full 22+% of the cycle time and energy of the muller is consumed in non-value added activities. If 30 seconds is required for charging, control and discharging the non-value added component of the operation grows to a full 1/3 of the cycle. This expensive and useless time and energy is completely eliminated with the continuous Simpson Multi-Mull. Primarily due to this fact, the



Batch Mulling

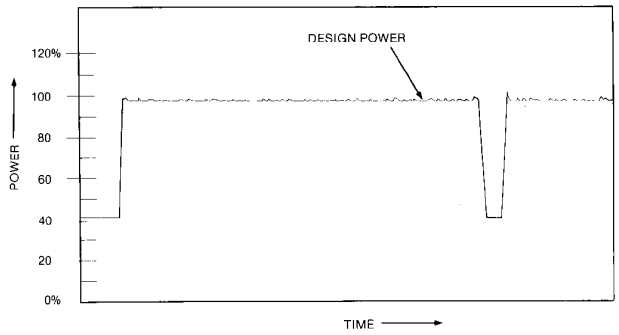
continuous Simpson Multi-Mull is more efficient in the production of a pound, kilogram or ton of prepared molding sand than any other muller (batch or continuous) in the world.

The accumulative effects of stopping and starting any machine can have a significant cost on the maintenance and useful life of the equipment. Consider a batch muller operating on a 90 second total cycle time. If operating continuously over an eight-hour shift the machine and all its components (valves, switches, motors, air cylinders, etc.) will cycle through 320 operations. In the course of a two shift, five day week the machine will experience 3,200 cycles. In a fifty week year the total is 160,000 cycles. Under the same ideal conditions the Simpson Multi-Mull may only start and stop once a shift, or 500 cycles a year. You can imagine the reduced maintenance and wear & tear on the Simpson Multi-Mull.

The Simpson Multi-Mull does not require a muller hopper to receive the full "batch" of sand. Sand may be discharged directly into a relatively small chute over a prepared sand distributing conveyor or into the boot of a prepared sand elevator. Conversely, a batch muller is designed to discharge a large volume of sand in a few seconds which must be retained in a relatively large muller hopper and metered to the sand distributing system. Usually, an engineer will size the hopper under a batch muller to receive 1 ½ to 2 full batches of sand to allow for upset conditions.

The Simpson Multi-Mull is equipped with a pneumatic clutch, or electronic soft start, which permits stopping and starting the muller under full load. Most batch mullers are directly connected to the

reducer through a "V" belt drive, and it is recommended that they never be started under load. The clutching feature of the continuous muller provides a number of advantages:



Simpson Multi-Mull

1. It is easier to set up an automatic unattended system due to the fact that no prepared sand storage, other than the molding machine hopper, need be provided with a Simpson Multi-Mull. When sand demand is satisfied, the muller clutch is disengaged by a "full" signal from the probe in the molding machine hopper. When the molding machine again demands sand, the muller is already full of prepared sand and may be restarted immediately

2. In a batch operation, the muller must complete its cycle and discharge its batch even though the molding machine hopper may be full. Storage of this batch must be provided in the form of a prepared sand bin or a muller hopper. When the molding line again demands sand, it may be necessary to wait through a complete batch cycle before sand is again available.

3. In the event of an overload on the muller due to the malfunction of any other equipment in the line or from any upset condition, the automatic clutch control disengages the clutch and protects the majority of the muller, gear reducers and motor from catastrophic damage.

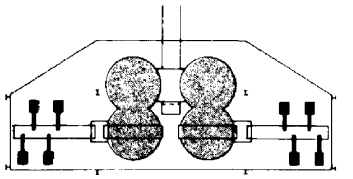
4. On restarts, the clutch permits starting the muller motor completely disengaged from the muller, thus increasing motor life and reducing maintenance costs.

5. When comparing a system using one Simpson Multi-Mull with one using two or more batch mullers, the Simpson Multi-Mull system does not require multiple compactability control systems, weigh hoppers, additive hoppers, platforms and structural components, thereby reducing the overall cost and complexity of the sand system.

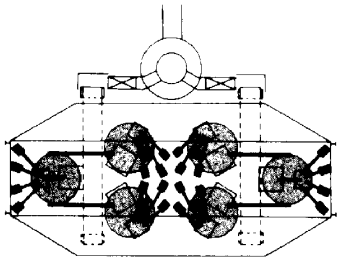
SUMMARY

In medium to large capacity sand preparation plants the use of a single Simpson Multi-Mull has the following advantages over a plant using multiple batch mullers in the preparation of molding sand for automatic molding systems:

- The installation is simpler, requiring less foundry space and material handling equipment - reducing overall cost.
- Less labor for operator oversight and maintenance is required.
- Automatic operation is made easier and more economical.
- More automatic protective devices guard the equipment, reducing maintenance cost and down time.
- More economical and “just-in-time” preparation of high quality molding sand can be accomplished.
- Simplification of the system - less primary, auxiliary and control equipment reduce the complexity and cost of maintenance and operation.



TWO MULTI-MULLS AND
MATERIALS HANDLING EQUIPMENT



SIX BATCH-TYPE MIXERS AND
MATERIALS HANDLING EQUIPMENT

BENEFIT: Reduced mechanization costs.
The Multi-Mull system easily exceeds the combined output of several batch-type mullers . . . eliminating expensive, space-robbing belts, hoppers, batching components and control equipment.

Comparison of Equipment Components for Identical Capacity Automatic Sand Preparing Plants

	Single Multi-Mull System	Single Large Batch Muller System	Two Small Batch Mullers System
MULLER:	1—Multi-Mull 1—Motor 1—Cleanout door air cylinder 1—Air line lubricator and filter 1—Dust hood	1—Batch muller 1—Motor 1—Discharge door air cylinder 1—Air line lubricator and filter 1—Dust hood	2—Batch mullers 2—Motors 2—Discharge door air cylinders 1—Air line lubricator and filter 2—Dust hoods
SAND FEED:	1—Constant speed feed belt under bin 1—Motor	1—Batch hopper for sand 2—Air operated hopper gates (1 for bin, 1 for hopper) 2—Air cylinders for gates 1—Air line lubricator and filter	2—Batch hoppers for sand 4—Air operated hopper gates (2 for bin, 2 for hopper) 4—Air cylinders for gates 1—Air line lubricator and filter
BOND FEED:	3—Variable speed feeders 3—Motors	3—Air operated volumetric feeders 6—Air cylinders 1—Air line lubricator and filter	6—Air operated volumetric feeders 12—Air cylinders 2—Air line lubricators and filters
DISCHARGE:	1—Discharge chute to prepared sand belt or elevator	1—Mill hopper to receive full batch 1—Mill belt to meter sand to prepared sand belt or elevator 1—Motor for mill belt	1—Mill hopper to receive 1½ to 2 batches 1—Mill belt to meter sand to prepared sand belt or elevator 1—Motor for mill belt
CONTROLS:	5—Motor starters 1—Moisture control 1—Solenoid pilot valve 1—Pilot oper. water valve 1—Hand operated air valve for cleanout door	2—Motor starters 1—Moisture control unit 2—Solenoid pilot valves 2—Pilot oper. water valves 1—Mulling cycle sequence control timer 1—Solenoid Valve for discharge door cylinder 1—Solenoid valve for hopper gates 6—Speed control valves for hopper gate cylinders 2—Speed control valve for discharge door cylinders 3—Solenoid valves for bond feeders	3—Motor starters 2—Moisture control units 1—Solenoid pilot valves 4—Pilot oper. water valves 2—Mulling cycle sequence control timers 1—Muller programming timer 2—Solenoid valves for discharge door cylinders 2—Solenoid valves for hopper gates 12—Speed control valves for hopper gate cylinders 4—Speed control valves for discharge door cylinders 6—Solenoid valves for bond feeders
	23—Components	**45—Components**	**85—Components**

CONCLUSION

In a modern foundry utilizing good sand system design and engineering practices, either a properly sized batch muller(s) or a Simpson Multi-Mull based sand system can be designed with advanced automatic controls and sensors to produce a high quality molding sand satisfactory for the most demanding automatic molding operations. In medium to large sized sand systems the primary advantage of continuous mulling will be that dramatic savings can be realized in the upfront and ongoing costs of procuring and operating the equipment to prepare a given quantity of sand.

The Simpson Multi-Mull has the inherent characteristic of being able to produce a more uniform sand in spite of variations in the shakeout sand being returned from the molding operations. It is less costly and simpler to apply automatic controls to the Simpson Multi-Mull than to a batch muller.

In the long run, it is concluded that the Simpson Multi-Mull has a greater potential for savings through improved casting quality, more consistent trouble free operation and labor savings in operating and maintenance.