OWENS/CORNING FIBERGLAS

intra-company correspondence

to	R. F. Shannon - Granville	from	J. L. Helser - Granville
		date	December 22, 1971
subject	LARGE SIZE K-17 FYRCOR REPORT	cc:	F. O'N. Brisley - Toledo 12 N. C. Nielsen - Bloomington K. O. Preston - Bloomington D. O. Richards - Granville 5W T. R. Schuman - Toledo 26 H. A. Waters - Bloomington M. K. Weaver - Bloomington

Summary and Conclusions

We were requested by marketing to develop a large size K-17 core product for the fire door market. As the Technical Group of this project, our objectives were to run plant trials to (1) determine the feasibility of pan casting large size pieces of K-17 core, (2) determine the suitability of the Fyrcor facility to cast K-17 core, and (3) produce several large size panels for shipment to a door manufacturer for evaluation. These specific trials were conducted over the last five months at our Bloomington Plant.

The project has been cancelled by marketing for economical reasons. I feel reasonably sure this product could be made at Bloomington with the proper equipment modifications.

Recommendations

If, in the future, our marketing re-evaluates the fire door market and wants to produce large size K-17 core panels, then the following process modifications would be necessary to obtain high quality and efficiency levels. The following recommendations should be considered to produce these large panels on a full-scale production basis.

1) The present ribbon mixer should be elevated four or five feet vertically. This will allow clearance to install a large 5-inch by 7-inch centrifugal pump directly underneath the ribbon mixer. This pump should be capable of pumping the K-17 slurry at a high volume level with very low velocity to eliminate turbulence. This will minimize the entrapped air in the slurry ending up as air holes and pouring folds in the final end product. This pump should be driven by a variable speed drive to control slurry delivery uniformly to the mold, due to the differences expected in batch consistencies of the K-17 core formulations. I would also suggest using a 7-inch butterfly valve and a 7-inch short pipe sweep into the 7-inch inlet side of the pump to eliminate starvation.

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2) The ribbon mixer should have faster agitation by possibly changing the drive or additional mixing paddles to improve agitation. It becomes necessary to have fast agitation to properly slake quicklime and to obtain an overall homogeneous mixture.

3) The 5-inch outlet side of the pump should be plumbed with 5-inch pipe on a horizontal plane directly to the pouring station. It is preferred to use pipe sweeps rather than 90° elbows on any transfer pipe lines. This helps eliminate slurry build-up in the elbows on transfer lines.

4) The 5-inch pipe line should be reduced gradually to a 3-inch line at the pouring station. The 3-inch flexible rubber hand squeeze valve should be installed after the pipe line reduction to 3-inch at a position for the man pouring to operate. The 3-inch gemline pouring hose can be attached for mold pouring. This pouring hose should be flexible and smooth on the inside with rib reinforcement on the outside of the hose.

5) Some type of pouring table with a sump system would be required to reclaim over-pour and excessive screeded-off slurry in leveling the pan cast molds. This slurry should be returned to the slurry holding mixer for reclaim.

6) Some type of pouring hose suspension system will have to be built to support the pouring hose. Also, a pan cast pouring nozzle would be required, which would be attached to the suspended gemline pouring hose.

7) A large screed would be required heavy enough to level off casted slurry pans after pouring.

8) Some type of rigid hoist system will have to be designed to transfer the large pan casted mold to the autoclave trucks. This hoist should help in stacking the molds properly on the autoclave trucks.

9) The pan cast molds should be designed with at least a half-inch clearance between pans for good steam penetration. They should also be tapered enough on the sides for easy product release after autoclaving. The molds must be designed to handle warpage during processing.

10) The autoclave controls must be modified to obtain properly controlled pressure cycles, especially down cycles or depressurizing of the autoclave. This will eliminate any chance of blow-ups on the K-17 core. The door needs adjustment and modifications to improve opening and closing.

11) The autoclave transfer car and jumper track will have to be leveled to eliminate pan cast slurry spillage during transferring and loading the autoclave in the wet slurry stage.

12) The transfer track should be plumbed, leveled and secured to the floor.

13) The vacuum head should be redesigned for increase in vacuum and sealing to help in stripping large size molds after autoclaving. This vacuum system should be a rigid hoist, plumb and level to eliminate any possibility of damaging the product at this point in the process.

14) The vacuum head stripper and hoist assembly must be plumb and level with the oven drying cart to eliminate damaging by handling.

15) The oven drying spacers should be spaced 12 inches apart, when stacking wet K-17 core boards on top of one another for drying. A minimum of eight spacer bars per piece of wet core (4' x 8') will be required.

16) Better drying oven controls and air flow will be required to improve drying rates and efficiencies.

Batches

I. The standard K-17 core "no dust" formulation batch was used to pour several trials during this five-month period. The formulation used was as follows:

Material	Vendor	Lbs. as Received	%/Wt.
S-33 Amosite Asbestos	NA Asbestos Corporation	54.4	5.33
7D5 Chrysotile Asbes.	Carey Canadian Mines	27.1	2.66
4T7 Chrysotile Asbes.	Carey Canadian Mines	74.7	7.32
Quicklime (RKP)	Warner Lime Co.	402.0	39.41
Supersil	Pa. Glass Sand Co.	461.8	45.27
Water		3570	428 gals.

C/S Ratio	.922
W/S Ratio	3.50
Density Slurry	73 pcf
Above Batch	60 cu. ft.

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II. During the last two days of plant trials, an experimental K-17 core batch was tried purposely to improve handleability characteristics of the large size panel. A higher percentage of longer amosite asbestos fibers was used to help the impact resistance. The formulation used was as follows:

Material	Vendor	Lbs. as Received	%/Wt.
S-33 Amosite Asbestos	NA Asbestos Corp.	25	1.66
DX Amosite Asbestos	NA Asbestos Corp.	30	1.99
4T7 Chrysotile Asbestos	Carey Canadian Mines	112	7.44
7D-5 Chrysotile Asbestos	Carey Canadian Mines	45	2.99
Quicklime (RKP)	Warner Lime Co.	600	39.88
Supersil	Pa. Glass Sand Co.	692.7	46.04
Water		5291	635 gals.

C/S Ratio	.917
W/S Ratio	3.52
Density Slurry	73 pcf
Above Batch	90 cu. ft.

We lost many pieces in handling these large size panels during the trial period. The material (K-17 core) out of the autoclave is completely saturated with water, approximately 600 pounds per piece; therefore, the handleability becomes critical in transferring the wet panels from pan to oven drying carts. It was the consensus of all working on the project that possibly a higher percentage of longer amosite fibers would improve the wet handleability problems. Unfortunately, we had other process problems (autoclave) in evaluating the longer amosite fiber in the core formulation. If this project ever becomes active again, then the above formulation concept should be re-evaluated.

Batch Mixing

Several changes were made in the batch mixing procedure as we progressed through the plant trials. The first batch was mixed and handled as the present 36R mixing procedure for Fyrcor. We had problems in wetting out the dry powders in the mix after total water and asbestos were present in the mixer. The ribbon mixer agitation was not fast enough to rapidly carry the powders into the mix and as a result, we did not achieve a good homogeneous mixture. It becomes difficult to properly slake quicklime to obtain high surface area $Ca(OH)_2$ for reactivity in producing K-17 core by not having rapid agitation. The mixing procedure was changed on the second batch to overcome the wetting out problem. The quicklime was added to the total cold water prior to any asbestos fibers which improved this problem.

A batch consistency problem continued to cause problems off and on as we progressed through the trials. In order to control the batch consistency, due to the extremely cold water (56°F) on the last trial day, another mixing procedure change was in order to control batch consistency.

To accomplish this, we introduced the quicklime into a six-to-one water/solids ratio for lime slaking in the ribbon mixer. It slaked to ten minutes, then we introduced the remaining total cold water to the mixer continuing with the above mixing procedure. The final day of trials showed proper lime slaking and batch consistency control. By adjusting the mixing procedure, we can continuously produce K-17 core batches at a certain consistency range through the existing ribbon mixer. But, I would still recommend the modifications to the mixer for a "full out" production basis on producing large size K-17 core panels.

Batch Transfer System

The first series of trials we used the existing Pyrcor transfer equipment as to valves, plumbing, pumping and pouring hose. It produced boards with large amounts of air holes and fold planes adding to our breakage problems experienced throughout these trials.

It was decided to ship a centrifugal pouring pump from the Berlin Plant to Bloomington for the next series of trials. A 3" by 5" centrifugal pump with a variable speed drive and transfer line was plumbed up for trials. We still had air holes and pouring folds and were unable to control the slurry flow into the molds. In checking back through the plumbing, I found it was not plumbed properly, causing a pump starvation condition. I also found the flexible pouring hose contained rib reinforcements on the inside diameter causing extra turbulence in pouring the slurry into the molds.

On all the pouring trials prior to the last series, the mold pouring pattern was to fill across the four-foot dimension of the mold until it was completely filled for screeding. Since breakage was predominate in all previous trials, it was decided to check pouring patterns and screeding patterns after we succeeded in controlling the slurry flow. We poured several pieces across the four-foot mold dimension, across the eight-foot dimension, and cross-hatched by pouring the eight-foot dimension and back across the four-foot dimension. Screeding the excessive slurry off the molds after casting was also evaluated. We screeded the four-foot and eight-foot dimensions. The pouring patterns and screeding patterns indicated that they were not critical. The important point in pouring is proper volume and velocity slurry control into the molds to minimize air holes and fold planes which weaken the structure. Also, control the batch consistency batch after batch to eliminate different pump settings to fill the pouring hose and mold.

Slurry Mold Handling

The mold handling hoist and motorized system would not be satisfactory for production. We were able to temporarily transport the molds to an autoclave transfer car for autoclaving. A rigid hoist system would be needed to evenly transport and stack the slurry filled molds to the autoclave car.

Autoclaving

We continued to have problems in controlling the autoclave cycle especially in depressurizing the vessels after the cycle completion. We actually blew the ware apart on several runs due to depressurizing too fast for this type product. This type of autoclave control system may also be very detrimental to the present Fyrcor autoclave cycles. In processing K-17 core through on autoclave, the "down" cycle must be controlled to a half-pound pressure release per minute to eliminate blow-ups. Therefore, the autoclave control system would have to be changed to produce K-17 core panels.

Vacuum Head Stripper

The present Fyrcor vacuum stripper did strip the K-17 core molds, but it caused problems. Several panels were broken or cracked in this stripping operation. On the last series of trials, I observed two of five panels broken by this stripping head. The hoist and vacuum lift platform was not plumb or level with the casted molds or the oven drying carts. Several pieces were fractured in trying to remove the heavy, wet K-17 core slabs from their molds by this vacuum lift and hoist transfer operation. The stripping of the wet slabs was probably the most critical part of this operation due to the wet weight factor after autoclaving. After oven drying, the slabs are much lighter and easier to handle.

Oven Drying

It definitely would require many support spacer bars between the slabs for transportation through the drying ovens. Since the slabs are wet and very heavy, the less movement in stripping and transferring the better chance of eliminating breakage. Through trial and error experiences, I would recommend spacer bars be placed twelve inches or less apart to absorb the transfer and transport shock through the drying ovens. The ovens would require better controls and air flow to improve drying rates.

Finishing

The existing Fyrcor finishing equipment seems adequate in finish sanding and cutting the surfaces of the large K-17 panels. Possibly some changes in vacuum head lifting and transferring would be necessary to eliminate manual handling of the panels to and from the finishing line conveyor.

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