

interested in a hot melt. We are attaching a diagram of the hot melt type joint they are looking for. After consulting with you we decided to offer a hot melt similar to one that had been prepared in the past. This formulation was suggested to them:

Opalon 300	141 parts
OMB	104 "
Santicizer 9	28 "
Aroclor 5460	104 "
Chlorowax 70	76 "
Santicizer 141	19 "
Di-isodecyl adipate	28 "
BSWL	7 "

In September Cannelton sent us the first specifications and we began corresponding directly with them.

In January of 1955 several of the numerous companies now interested told us that the National Association of Clay Sewer Pipe Manufacturers was located at 1520 Eighteenth Street, N.W., Washington 6, D.C., and that they had taken out a contract with Battelle to formulate this compound. They agreed that Monsanto should contact Al J. Reed, Director of Research for the above mentioned company.

On April 9, 1955, Mr. Martinez, an engineer for Cannelton, replied to our formulation in this vein:

1. It was difficult to get the BSWL into solution - it never did quite go into solution.
2. They were unable to add that much Opalon 300 since it made the mixture so viscous it was impossible to pour.
3. Upon heating at 290° the mixture turned to tan color.
4. When the mixture was heated over 300° it began to burn.
5. When it was poured and cooled, it was very soft - softer than perhaps the softest sponge rubber. They need something in the diameter of about 50.

In May of the same year, after consulting with the laboratory, we replied stating that Opalon 300 was in error and that it should be a softer compound resin. We tried to answer all their questions about stability and recommended this formulation:

Copolymer resin	100 parts
BIDA	25 "
Santicizer 160	100 "
Aroclor 1254	17 "
MB-80	10 "
Paraphen 8-62	10 "
Stark XV	4 "

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In August of this year they made arrangements with Robinson to work jointly on the problem and to use Robinson's know-how in this system. The last we heard was November 14 stating that they had not had an opportunity to do much more work on this subject, but that Reed of the National Clay Sewer Pipe Association was getting ready to publish a report on hot melts and that they felt the results looked very encouraging.

Back to Robinson Clay Products for its 1955 picture. The 3rd of January Lloyd Shand wrote us a memo saying that they expected to use 15,000 pounds of plastisol per day by June of this year.

The last part of January Ken MacIsaac and Al Stockwell called at Robinson. They sent a research project to Joe Greenhoe and Joe sent us a run-down on work to date.

The Plastics Division, according to Joe, had made a recommendation in December of 1954. This was:

Opalon 410	100 parts
DIOP	100 "
Ranflex BN-1	60 "
Atomite	100 "
Dyphos	6 "
Iron oxide red	6 "

Robinson objected to the use of Atomite since they must use Potter Flint to withstand acid. They re-formulated this and sent it to Robinson Clay in January. The formulation then ran:

Opalon 410	100 parts
DOP	50 "
Solvaloid C	30 "
Potter Flint	100 "
Dyphos	6 "
Indian red 717	2 "

The pigment from Reichard Coulston. After mixing for 15 minutes in a pony mixer they added 50 parts of DOP and 50 parts of Solvaloid C and mixed for another 5 minutes.

This formulation had a Shore "A" of 56-58, one hour heat stability at 350°F. rated as good and suitable viscosity.

Potter Flint is a product of Pennsylvania Pulverizing Company of Lewistown, Pennsylvania. It sells for about \$15 a ton and is a finely ground grade that will pass 200 mesh screen.

On March 30 I called at Robinson Clay Products with Lloyd Shand. Al Stockwell was supposed to go, but was unable to accompany us. Mr. Anderson, their chemist, was out of town and Joe Millikin, his assistant, showed us through the plant. At this time they stated that they were looking for:

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1. 750 psi tensile strength
2. Shore Hardness of 50, which would be true both at 80°F. and 32°F.
3. No heat degradation or fuming at 375°F. This test is run to determine the fuming, carboning and discoloration of the product. It is checked every two minutes up until twelve minutes, every three minutes up to twenty-four minutes and over twenty-four minutes every six minutes as long as it will go.
4. 3,000 centipoise viscosity in one week.
5. Very good mold release from spun aluminum molds.
6. Excellent extraction resistance - they feel this can only be obtained by the use of Potter Flint.
7. They do not have a color or odor spec and can easily stand some color and some odor.
8. They prefer a lot of filler, but must have 100% total solids.
9. The price should be 25 cents a pound or less.

At that time they pointed out that their plant at Malvern, Ohio, was on a similar production basis and that they plan to set up a future plant at Pottstown, Pennsylvania, where they would have experimental work and a production line.

In June Ken MacIsaac sent me more recent specifications from Robinson. These call for a plastisol to be:

1. Color - tile red
2. Viscosity - 1,000 to 2,000 centipoises; viscosity after 30 days, not over 4,000 centipoises. The plastisol must be deaerated.

When cured at 300-400°F., depending upon supplier's recommendation, must have the following properties (ASTM tests were applicable):

Water absorption	- Not over 1%
Tensile strength	- Not less than 700 psi at 21 minutes cure at 400°F.
Percent elongation	- Not less than 100%
Tear resistance (Grescott Tear Test)	- Not less than 100%
Flammability	- Must be self-extinguishing

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| Filler | - Must be acid-proof; Potter Flint required. |
| Shore "A" Durometer | - 80°F. - not over 45 and less than 40
32°F. - not over 60 |
| Heat stability | - 2 in. diameter piece, 3/8 in. thick must be able to be heated for one hour without gassing or bloating. |

Dave Bechtold tells us on the first of December that they still buy from Weoster Finishes and Watson Standard and are running plants at Malvern, Ohio, and Pottstown, Pa. They expect to start at Magadore, Ohio, very shortly. Their consumption is roughly 8 drums of plastisol a day and because of friendship between Andersen of Robinson Clay Products and Joe Perrone of Weoster Finishes they do not feel ready to make their own until some time in 1956.

The last part of May, Al Reed of National Clay Sewer Pipe Manufacturers Association visited us and Elmer and I spent all day with him. We discussed plastisols and hot melts and we suggested these formulations:

1. Opalon 300	25
DOP	75
Dyphos	5
BS-207	1
Atomite	25
Antimony oxide	5
2. Opalon 300	25
DOP	5
Dyphos	5
BS-207	1
Atomite	25
Antimony oxide	5
Arcoel 5460	15
BOA	10
3. Opalon 300	25
DOP	55
BS-207	3
Atomite	12.5
Arcoel 5460	20
Flam-B-Gel B	5
Acronex C	2

Since Howard Bergen has been on the West Coast he unearthed a terrific amount of interest, both with Leven Chemical Company, Newhall, Calif., and Pacific Clay Products, Los Nietos, Calif., and also from the laboratory of the National Clay Pipe Manufacturers Association, which was located around Los Angeles.

The last specifications which we got from Pacific Clay Products listed:

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| Shore Hardness | - Not less than 45 at 80° nor more than 60 at 32° |
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Plastisol viscosity	- Not less than 1,000 centipoises initially nor more than 7,000 centipoises; the average viscosity should be approximately 3,000 and after 28 days aging should not be over 7,000.
Elongation	- At least 100%
Tensile strength	- Not less than 700 psi
Tear strength	- Greater than 100 pounds
Max. specific gravity	- 1.35 (this is really tough)
Filler	- Must be acid-proof

Other requirements:

1. There must be no change in physical properties after one hour at 400°F.
2. Water absorption - 1% or less

In addition, there should be no change in the finished material when it has been subjected to 10% Wesson oil, 10% detergent and 80% water at 130°F. There should not be more than 3% change in the properties after this solvent test.

For your information all the pipe on the West Coast is unglazed - this should promote adhesion.

We now have roughly ten accounts that could use this information and would be very happy to have it. Of course, all of them are working in the same industry and rather closely together and many sources might be duplication. If these primary accounts, that is the clay pipe people themselves, do not wish to work with it, we can easily market such information through selected compounders who would be happy to sell such formulations to the clay pipe people. You can see that this is a big problem with us and one which represents quite a bit of potential. I can think of no other problem at the current time which is spread out over such a wide number of accounts and which would probably do us more good with a small amount of information than any other instance.

We would certainly appreciate any information, both plastisol or hot melt, that you might be able to develop. As soon as we can get hold of it, we will instantly disseminate it to all our customers.

P. W. Spink

FMS/ls

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