F. Lithopone

June 8, 1953

Mr. C. Ludlow
Cia. Sherwin-Williams, S.A.
Apartado Postal 35 -Bis
Mexico City 1, D.F., Mexico

Dear Sir:

The ASTM specification TT-L-426 is entirely too broad for lithopone for use in paints in general. This was true for interior paints in use 10 to 15 years ago, and is still true in interior paints in use today. In the past, most vehicles for interior paints contained oleoresinous varnishes with possibly some synthetic resins. Today the emphasis is on synthetic vehicles with possibly some oleoresinous types. Either type requires for general usage a lithopone of controlled reactivity to prevent excessive body and afterbody in the paint.

Zinc oxide (more appropriately called acetic soluble zinc) in lithopone is one of the contributing factors to excessive body and afterbody in paints. With many types of vehicles, a zinc oxide content in the lithopone of over 0.3% is highly undesirable, and in some cases actually intolerable. This is the reason why the specification of Sherwin-Williams' lithopones and competitive lithopones used in the United States are limited in general to a maximum of 0.3% zinc oxide even though the ASTM specification permits up to 1%. Very few, if any, paint manufacturers could tolerate a lithopone with as much as 1% zinc oxide content. Manufacturers of lithopone have, therefore, kept the zinc oxide content much lower, as for instance, 0.3% maximum. The Sherwin-Williams' specification for regular lithopone in September, 1940 limited the zinc oxide content to 0.5% maximum. Because of trouble from reactivity the permitted zinc oxide content was lowered to a maximum of 0.3% before 1946. (See card dated December 30, 1946 for regular lithopone.

For many usages a special so-called non-reactive or low reactive lithopone is required. In these cases the zinc oxide content may be set as low as 0.1 to 0.15% maximum.

What has been said above about zinc oxide content in lithopone for use in oleoresinous vehicles or synthetic vehicles applies even more forcefully when used in emulsion or latex types of paints. When an oil or varnish paint afterbodies, short of gelation, the paint can usually with some effort, though expensive, be reclaimed with certain modifications. In the case of emulsion paints or latex paints, where the zinc oxide reacts with the protein or other components of the system, the

emulsion may break. Salvage is difficult or impossible. Sometimes the paint may not break for 6 months to a year or more. Sometimes during this period the condition for breaking the emulsion develops but the emulsion may not break until the paint is being applied. The break shows up as rolls or strings which develop during brushing, or the break may be delayed until the brush is washed. In the latter case the bristles become very sticky and it is impossible to wash the paint out of the brush without resorting to harsh chemicals.

For certain usages a lithopone may show low zinc oxide content and still be unsatisfactory. This is particularly true in flat wall paints that carry highly polymerized oils or high-acid varnishes that are stabilized or peptized by the acid. Some lithopones have a rather high adsorptive power for fatty acids. This is believed to be a physical phenomenon rather than chemical. The method used to control this is by the use of what we know as "pigment capacity" factor (PC Factor). This is determined by the amount of linseed fatty acids absorbed by a given amount of the pigment. As previously indicated, a lithopone may have low zinc oxide content and still have high reactivity because of what may be called an activated surface permitting relatively high absorption of fatty acids as indicated by the PC Factor. The PC Factor is controlled by the method of processing during manufacture as well as by the type of raw materials used. When the fatty acids are adsorbed, the vehicle may become unstable to the point of gelation. It should be mentioned that low PC Factor doesn't insure satisfactory performance, especially when soluble salts are present.

Other factors in lithopone that affect the stability of the emulsion and latex paints are pH, specific resistance and soluble salts.

The pH must be controlled in relatively narrow limits. The Sherwin-Williams specification for lithopone for use in emulsion and latex paints limits the pH to 7.3 to 8.6 (See Raw Material Characterization Card for 67-C-2, dated July 1, 1952). This control is important to avoid the use of undesirable neutralizing agents.

The specific resistance is indicative of the soluble salt content of the lithopone. Soluble salts in general are very undesirable in that many types cause the emulsion to break. This may be a slow or delayed action that is not apparent until stored six months or a year, or even until application. The minimum specific resistance for the water-setting lithopones for use in emulsion or latex paints is 3500 ohms. For regular paints that are not specially treated, the minimum is considerably higher than this, as for instance: 7000 to 10000 ohms.

Again, the lithopone may have high specific resistance or relatively low soluble salts and still be unsatisfactory or undesirable for use in emulsion or latex paints. Certain types of soluble salts are extremely undesirable and must not be present in more than traces. Such salts are soluble calcium and soluble chloride. Soluble sulfates are also undesirable.

A lithopone may be too fine causing flocculation in emulsion or latex paints, or it may be too coarse, causing granulation in the film. This coarseness may be reflected also in the texture, producing poor grinding qualities. Note that the Mexican lithopone has poor texture. The Sherwin-Williams' specification is 0.15% maximum on a 325 mesh, but again this does not tell the whole story, as the residue on a 325 mesh screen may be normal and satisfactory and the lithopone be undesirable because it is composed of too many fines. These fines are quite often called "colloidal fines". These excessive fine particles may agglomerate and produce a rough or unsightly film surface.

The zinc sulfide content of Sherwin-Williams' lithopones for use in latex and emulsion paints like Super Kem-Tone is a minimum of 28%. The ASTM specification permits a minimum of 26%. Lithopone is preferably produced by a double decomposition of ZnS and $ZnSO_4$ which may be written in the simplified form as

$$ZnS + ZnSO_4 \rightarrow BaSO_4 + ZnS$$

This reaction gives a theoretical zinc sulfide content of 29.4% and a barium sulfate content of 70.6. It is felt that a minimum of 28% zinc sulfide represents a good practical operating minimum, particularly since the hiding power is affected by the zinc sulfide content.

Color, of course, is very important also.

A recent 5-kilo sample of lithopone from Mexico, obtained through Mr. L. A. Mason, showed the following properties in comparison to the lithopone 2185 dry or 67-C-2 lithopone approved for use in Kem-Tone and Super Kem Tone, as well as other emulsion and latex paints.

A previous sample of lithopone from Mexico (See letter of March 13, 1953 to D. A. Ender, Jr.) showed high chloride, poor texture and high pH but appeared reasonably satisfactory otherwise. Evidently the Mexican lithopone is not uniform if the two samples are typical. The Coffeyville laboratory obtains the following comparative results on the 5-kilo sample and a typical SW lithopone:

	Mexicom Sample	S.W. Standard
Color	Creamy Brown - Brown Transparency - Poor Color	Standard
Zinc Oxide	0.628% (High)	0.30% Maximum
Residue (325 Mesh)	1.09% (Very High)	0.20% "
Tinting Strength	102	100 Minimum
Specific Resistance	2585 (Too low)	3500 Min. for resin, latex paints
Calcium	Considerable	Trace
Paint Consistency	Low Oil	
Livering	Std.	Std.
pH	8.7	8.7
PG	3.4	3.6
Water Absorption	22.5	20.0
Water Soluble Salts	High	Low
Texture (Paint)	Poor	Normal
Color (Paint)	Fair - Passable	Std.
Settling	More than Std. (Not too bad)	
Light Resistance	3	2 Std.

The characteristics, as of sample of Mexicom lithopone obtained from the Pasadena Department, are as follows in comparison to Pasmalith M-320 (the lithopone preferred for Kem-Tone and Super Kem-Tone) and to the regular SW lithopone of medium oil absorption.

	Mexicom	Pasmalith M-320	[illegible]
Code		[illegible]	[illegible]
Color	V. Gray	Std.	Std.
F.S.	97	100	99
Oil Absorption	17.3	15.6	14.5
Water Absorption	22.0	20.0	18.8
Sp. Res.	3,600[1]	5,100	9,000
pH	9.1	7.5	9.0
Fineness[2]	3 5/8	4 3/4	5

[1] Definite test for chlorides, Cl^-
[2] Hegman gauge rdg of paste in oil after 100 rev. of Hoover Muller.

Note the poor texture (3 5/8) and the high chloride in the Mexicom sample.

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The physical and chemical tests used to determine the suitability of lithopone for use in SW paints, as well as for sales, are as follows:

Test	Method	Test	Method
Color	[illegible]	Water Absorption	[illegible]
Tinting Strength	[illegible]	Zinc Oxide	[illegible]
pH	[illegible]	PC Factor	[illegible]
Specific Resistance and Soluble Calcium	[illegible]	Moisture	[illegible]
		Zinc Sulfide	[illegible]
Residue, 325	[illegible]		
A Factor	[illegible]		

The above tests are supplemented by long term performance tests.

Duplicate copies of the procedures describing the above methods are not readily available, but copies can be made or obtained if necessary.

There is very little published data on the characteristics or specification of lithopone. Specific details are practically completely controlled by the manufacturer or the consumer. The above characteristics are a matter of record at our Coffeyville Plant, and are covered to a large extent by the Raw Material Characteristic Card (or Specification).

The specifications covering the regular lithopones and one special lithopone of the water-wetting types(W-320) are given below:

Brand Name	[illegible]	[illegible]	[illegible]	[illegible]
SW No.	[illegible]	[illegible]	[illegible]	[illegible]
	(Formerly 2105)			
Color	Equal to Std.	Equal to Std.	Equal to Std.	Equal to Std.
Tinting Strength	[illegible]	[illegible]	[illegible]	[illegible]
A Factor	—	15-19	19-25	26-31
PC Factor	—	2.5-3.5	4.0-6.0	5.5-7.5
pH	7.3-8.6	8-9	8-9	8-9
Specific Resistance, Min.	[illegible]	(1)	(1)	(1)
Soluble Salts	Equal to Std.	Equal to Std.	Equal to Std.	Equal to Std.
Soluble Calcium	Trace	Trace	Trace	Trace
Light Resistance	Equal to Std.	Equal to Std.	Equal to Std.	Equal to Std.
Water Absorption	15-20	—	—	—
Residue, 325 Sieve, % Max.	0.15	0.15	0.15	0.15
Moisture, % Max.	0.30	0.30	0.30	0.30
ZnO, % Max.	0.30	0.30	0.30	0.30
ZnS, % Min.	28	28	28	28

(1) For use in latex and emulsion paints the minimum would be 7000 ohms.

You will note from the above table that quite a few characteristics have been set on the basis of a standard.

We hope that the above information will give you the necessary data for your purpose as outlined in your letter of May 22, 1953. If you need additional information, we shall be glad to try to get it.

Yours very truly,

THE SHERWIN-WILLIAMS CO.

C. E. Adams, Chief
Mineral Products Laboratory

CEA:ff

cc: SDS,Jr. DAK,Jr. JHH RAS JVH