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MEMORANDUM REPORT NO. M-319

DISCUSSION OF TEST METHODS EMPLOYED ON HOUSE PAINTS BY THE SHERWIN-WILLIAMS COMPANY, CHICAGO, ILLINOIS

On August 15, 1950, Dr. S. C. Horning and the writer visited the Paint Research Laboratory of the Sherwin-Williams Company in Chicago, Illinois. The primary purpose of the trip was to discuss testing methods of outside house paints with Dr. M. Van Loo, Director of Paint Research for the Sherwin-Williams Co., and his associates in the House Paint field -- Dr. W. K. Asbeck, R. E. Bruhn, J. Chapin, and O. Jagd.

Dr. M. Van Loo also volunteered information which is not directly concerned with testing procedures, but which may be useful to general House Paint research.

Discussion:

The following discussion includes the Sherwin-Williams exposure system, house test system, methods of testing for viscosity, brushing, color, drying, fineness, moisture failure, opacity, gloss, flashing, mildew, dirt collection, plus a reference to their concept of the critical pigment volume content of paints.

A. Exposure System

1. Sherwin Williams issues a "Letter of Instruction" for each exposure series. This is comparable to our "Exposure Memo" and includes:

(a) Purpose
(b) Method of Preparation of Panels
(c) Composition Data
(d) Where Exposed
(e) Remarks on Properties

2. Method of Preparing and Exposing Panels - S.-W.Co.

(a) Paint panels at farm wherever possible.

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(b) If panels must be painted in laboratory for any reason, expose to ultra-violet light (carbon-arc) for 2 hours between successive topcoats. (This presumably comes closer to actual outside painting conditions than the indoor painting method now used by our laboratory.)

(c) Allow 2 days for drying before recoating.

(d) S-W lays clapboards flat on bench for painting to get a uniform film thickness. At their test farm, panels are painted in a shed which is open to the weather on three sides (protected by cloth screening).

(e) Don't paint all panels in good weather, but minimize painting of panels in winter. This time is reserved for analysis of results and report writing.

3. Selection of Panels and Painting System

(a) S-W apparently uses extreme care in selecting panels for uniformity. Red cedar panels are now used almost exclusively as choice panels and Douglass Fir as second choice. In many cases, the grains at the cut edge of the wood are actually counted to insure uniformity.

(b) Panels are not painted on the back except for Miami exposures.

(c) All panels contain a "guide strip" (control) consisting of 1/3 of the length of 3' clapboard.

(d) In order to observe early indications of corrosion, white house paints are painted over a gray primer and colored tints are painted over a white primer.

(e) On the basis of a recommendation from the N. J. Zinc Company, Sherwin-Williams does not expose house paints on the 45° racks. These racks are used exclusively for exposing and storing panels for future repaint jobs.

4. Mounting Panels at Test Fences - S.-W. Co.

(a) 3 foot clapboards should not be mounted exactly vertical on the racks since this does not simulate actual conditions on a house.

(b) S-W drills a small hole on each end of the panel. The panels are then hung on small brads tacked to the studs on the fences. This method permits easy mounting and removal, and eliminates the danger of panels falling to the ground every time the outer cleats are removed from a section of the fence.

[A blueprint of the construction of the S-W test fence and a sample of their exposure rating cards is available from the writer for inspection.]

(c) S-W has exposure test fences at Chicago, Miami, Kansas, and Coffeyville, Indiana.

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(d) S-W rarely returns panels to the laboratory for inspection. Photographs are used in conferences in place of panels in most instances. Dr. Van Loo emphasized that significant differences may be lost if panels are periodically removed from the fence for even a few days elapsed time.

(e) Accelerated mildew conditions are obtained on house paints in New Orleans and Cuba.

(f) Panels are mounted on the fences in such a manner that the NV and SV panels are mirror images (directly opposite each other). This permits a quick analysis of the situation for inspection ratings.

(g) Exposure panels from series to series are numbered consecutively regardless of the type of paint being exposed.

(h) Panels are never reversed-lapped on the fences, since this does not conform to true clapboard house construction.

B. House Test System

If a paint looks good on the test fence, S-W tests it on houses. They furnish only the house paint free -- no trim paint or screen enamel. A man is assigned in each locality to check daily on the job as the painter is applying the paint.

S-W handles a maximum of 50 houses per year spread throughout the U.S. and Canada. Metropolitan areas are avoided; tests are confined to suburban areas. The Company subscribes to the Weather Service for daily reports. These reports are filed for future reference since they often help to settle house paint complaints.

As mentioned previously, S-W employ an expert photographer and depend on photographs a good deal in their house paint work both for test fence and field work.

S-W has abandoned the practice of having salesmen check their house tests at random since significant points are missed unless the house test is followed daily while the paint is being applied.

C. General Methods of Testing House Paints - S-W

1. Fineness - Outside house paints are ground almost exclusively on a 3 roll mill. Fineness is checked, both in the laboratory and plant, with a Hegman Grind Gauge. (1) Sherwin-Williams' Test Method #441 on the use of this gauge is available from the writer. S-W has not used the "spatula" method for testing fineness for over fifteen years. Briefly, the Hegman method consists of comparing the pattern of a drawdown with visual standards which are supplied with the gauge.

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2. Viscosity - All house paint consistency measurements are made with an efflux type viscosimeter. S-W believes this avoids unnecessary shaking and handling. Viscosity readings are recorded as, for example:

42 sec., + 1/4 cup, 1/8 cup, etc.

3. Brushing - Three master painters evaluate all of Sherwin-Williams' house paints. This evaluation is based on actual brushing tests. However, Dr. Van Loo claims that these painters can use the viscosity data supplied by the laboratory as an indication of ease of brushing. This is similar to our laboratory procedure of using stormer viscosity limits to keep in the good brushing range.

With the particular efflux viscosimeter now being used by S-W, they have set 30 sec. to 38 sec. as covering the good brushing range.

A paint is allowed to age at least 24 hours before brushing tests are made. A note of interest on brushing is that each of S-W's three master painters differ on his opinion of what factors constitute a good brushing house paint. Each painter used his own terms in rating brushouts which must then be interpreted by the chemist.

4. Drying - S-W has adopted a modified RCI drying recorder (2) for measuring the "set-to-touch" time. Dust-free and tack-free time are not measured. Hard or firm-dry time is rated by the thumb test. The following conditions are set for drying tests:

(a) Use plate glass plates for drawdowns.
(b) Run only in an air-conditioned room.
(c) Use a Decostenza blade for uniform drawdowns.

This instrument contains a blade which can be adjusted to give different film thicknesses. It is constructed in the shape of a horseshoe and has the added advantage of not requiring a suction plate for drawdowns due to the weight of the curved portion of the horseshoe which pushes ahead of the blade. It is supplied by a private manufacturer in Chicago.

5. Gloss - S-W uses visual methods for rating gloss on house paints. On enamels an 85° search unit is used for flats and a 60° unit for semi-gloss.

6. Opacity - Visual inspection is made on drawdowns made on glass plates. S-W does not make a general practice of running contrast ratios. However, they use the standard practice of plotting contrast ratio against spreading rate. They follow the procedure of stamping out a unit area after the drawdown has been made, whereas our Laboratory measures the area on each drawdown card individually.

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7. Color - Visual inspection is used for all shading operations. The Hunter Multipurpose Reflectometer, which gives a directional plot, is used for measuring color differences on dry films. S-W also recommends the Pittsburgh Color Eye but claims it is not too sensitive in the light color range.

8. Flashing - S-W has lots of trouble with flashing on their outside white house paint, but so far have not been able to connect this phenomenon with any particular property of a house paint.

9. Blistering - S-W apparently does very little exposure work on panels for blistering evaluation. At the test fence, a small section of the fence has recently been set aside for preliminary work on blistering. This consists merely of a double walled fence filled with saw-dust which is kept saturated with water.

10. Dirt Collection & Mildew - Both are rated visually although S-W recognizes the need for an instrumental method.

11. Chalk Running - S-W has recently recognized the desirability of providing means for detecting chalk running on the test fences. As a result, they are now experimenting with placing a row of red house bricks under a fairly large area of painted clapboards. They have not used black painted panels for this purpose in the past. They are also experimenting on one section of the fence with 18" eaves to check the effects on dirt collection and chalk running.

12. Flow - Flowouts are made on a 6" x 12" Anderson-Pritchard flow plate which is merely a steel panel provided with three concave dimples over which the paint is flowed.

D. Critical Pigment Volume Relationships

Dr. W. K. Asbeck discussed this subject with us in detail. The information has been published and can be found in the references listed at the end of this report.

In brief, Asbeck and Van Loo claim that the critical pigment volume concentration (CPVC) (3) is a fundamental physical transition point in a pigment-binder system at which the appearance and behavior of paint film changes considerably. CPVC is influenced by such factors as fundamental packing characteristics of the pigments, type of binder employed, types and amounts of special agents present, and fineness of grind of the system. A new cell was described in which the CPVC of a paint can be determined on a single sample in the wet state.

Gloss, rusting, and blistering were some of the properties of a paint which are changed by staying either below or above the CPVC.

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Sherwin-Williams is hoping that other paint laboratories will investigate this concept of CPVC and offer either criticism or support to the theory.

E. Inspection of Paint Research Laboratory and Exposure Test Farm

Dr. Van Loo and R. R. Bruhn concluded the visit by conducting us on a tour of the laboratory and the test fences. Both the laboratory and the test fences are relatively small in size compared to our laboratory and test far in Philadelphia and Wilmington, respectively.

Conclusions:

In general, the Sherwin-Williams Company is not any further advanced on instrumental testing methods than we are. The main points which were volunteered by S-W and which will be investigated under present objectives of Project P-1101 are as follows:

1. The use of the Hegman Grind Gauge for Fineness.

2. The use of the RCI Drying Recorder for measuring "set-to-touch" time.

3. The investigation of the CPVC of paints.

References:

(1) D. Doubleday, and A. Barkman, Official Digest 307, 598 - August (1950).

(2) Laiderman, D.D., and Bruhn, R.R., Paint, Oil & Chem. Rev. June 12, 1950

(3) Asbeck, K.W. & Van Loo M., Inc. Eng. Chem. 7, 1474 (1949).

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