



# FINISHES QUALITY CONTROL STANDARDS AND TESTING PROCEDURES

At Herman Miller all materials undergo two forms of testing. Initial testing is done when a new product, process, or supplier is accepted. These tests lead to the development of quality standards, which our suppliers take responsibility for meeting. From that point on, materials are checked on a random basis to see that suppliers adhere to the quality standards. Quality is checked at suppliers, as materials are received in our facilities, and throughout production.

When our test equipment permits it, our test procedures conform to the methods established by the American Society for Testing and Materials (ASTM). If not, we try to approximate the same test condition with different equipment. Herman Miller strives to meet and exceed all industry standards pertaining to our products.

Note: In addition to visual checking, we also use computer-based color testing to reduce the subjectivity of visual checks.

If you have any questions about specific test results, please contact your Herman Miller dealer or sales representative.

## Coated Surfaces

Our coated surfaces are checked for the following kinds of qualities as materials come into Herman Miller facilities:

- They are checked for visual and tactile defects.
- Paint finishes are checked for color consistency using color tolerance sets. These sets enable checkers to see if the color on random samples of the material vary too much from standards established for color (hue), lightness and darkness (value), and purity (chroma).
- Paint finishes for metal are routinely examined for film thickness, surface preparation, primers, and overall appearance. They are also checked for pencil hardness, crosshatch adhesion, coating flexibility, and impact resistance.

## Testing Procedures

Herman Miller coated surfaces (paint finishes for metal) are tested for their ability to stand up to the kind of wear they are likely to get in actual use. We want to be sure the color layer will not crack or chip in ordinary use, that the substrate will not rust, and that there will be an acceptable UV resistance. We also test to make sure the coated surface won't crack if hard objects are dropped on it (from reasonable heights), that it won't lift up from the substrate, and that it won't scratch or mar.

Coated surfaces (paint finishes for metal) are divided into four groups based on their anticipated use in the field. The more wear a painted surface will be exposed to, the better it must perform under test conditions.

All Herman Miller paint finishes must pass the following tests:

**Salt-spray resistance** (*tests a finish's resistance to corrosion and lifting away of finish from the metal*):

A line is etched through the finish on a test plaque, which is placed in a salt spray chamber. The duration of the test varies according to the anticipated wear level of the paint finish. Results are expressed as an amount of lifting observed. Must not exceed maximum level of lifting.

**Water immersion** (*tests resistance of paint finish to blistering or lifting*):

Samples are placed in distilled water for 100 hours. Results are expressed as a rating based on degrees of blistering and lifting. No blistering or lifting allowed.

### ***Testing Procedures Continued***

#### ***Ultra-violet light exposure (tests paint finish's resistance to chalking or changes in color):***

Samples are placed in a chamber with high intensity ultra violet light from a carbon-arc for 160 hours. Results are expressed as degree of color change or chalking observed from three angles. There must be no color change observed at any angle.

#### ***Pencil hardness (tests paint resistance to scratching and gouging):***

Samples are gouged using lead pencils of different hardness. Results are expressed as hardest lead, which will not break through finish to substrate. Must meet minimum hardness requirements, which vary according to anticipated, wear levels.

#### ***Cross-hatch adhesion (tests adhesion of paint to metal):***

The finish is cut with a grid pattern (1/16" to 1/8" apart) that goes through the metal beneath. Tape is pressed on to the grid and then lifted away. The finish must remain attached to the metal. Results are expressed as a classification based on degree of flaking. Must be required class or better.

#### ***Coating flex (tests the adhesion and brittleness of the finish):***

A test plaque is bent around a cone-shaped mandril. Results are expressed as the distance from the point of the cone at which adhesion loss is observed. Must not exceed maximum distance requirement.

#### ***Abrasion resistance (tests paint finish for durability):***

An abrading wheel is run over the surface for a certain number of cycles. Results are expressed as the amount of the finish lost after each 100 cycles. The weight loss must not exceed the requirement, which varies according to wear level.

#### ***Scratch resistance (tests paint finish hardness):***

A fixture with a chisel point is dragged across the surface of the finish at a varying load. The finishes with lower wear levels must pass minimum load requirements with only slight marring. All finishes must not exceed the maximum scratch width (which varies according to wear level) at the specified load.

#### ***Adhesion test (evaluates hardness and adhesion of paint finish to substrate):***

A fixture with a chisel point is dragged across the surface of the finish at increasing loads. Results are expressed as a measure of the load at which the chisel point breaks through the finish's surface. Must pass minimum load requirements, which vary according to wear level.

#### ***Impact resistance (test finish for tendency to crack at the edges of a dent in the substrate):***

A blunt-end weight is dropped from a specific height, indenting the substrate. The height of the drop is increased until the paint finish cracks. Results are expressed, as the impact required to cause the paint finish to crack. Must meet minimum impact values, which vary according to the wear level.

## Laminates

Laminates are checked for the following qualities:

- Color consistency is checked by using color tolerance sets. These sets enable checkers to see if the color on random samples of the material vary too much from the standards established for color (hue), lightness and darkness (value), and purity (chroma).
- Laminates are checked for visual and tactile defects.

### *Testing Procedures*

Laminates are tested for their ability to stand up to the kind of wear they are likely to get in actual use. We want to be sure the color layer will not rub through in ordinary use, that the surface finish won't dull or stain, and that there will be an acceptable resistance to UV exposure. We also test to make sure the laminate won't crack if hard objects are dropped on it (from reasonable heights), that it won't lift up from the substrate, and that it can withstand hot and cold temperatures.

All Herman Miller laminates are given the following tests:

#### ***Resistance to boiling water*** (tests laminate's resistance to stains and gloss changes):

Boiling water is spilled out on the surface and then a test fixture, representing a cup, is placed on top of the spill for twenty minutes. Results are expressed as a degree of effect: unaffected, temporarily affected, superficially affected, or considerably affected. Laminate must be unaffected.

#### ***High-temperature resistance*** (tests laminate's resistance to staining, gloss change, and deformation):

A vessel is filled with wax, heated until the melted wax reached 356° F, and placed on the laminate's surface for twenty minutes. Results are expressed as a degree of effect: unaffected, temporarily affected, superficially affected, or considerably affected. Laminate must be unaffected.

#### ***Stain resistance*** (tests laminate's resistance to changes in gloss, color, or surface texture):

A sample of each of 18 staining agents is placed on the surface of the laminate and covered with a sheet of glass to prevent evaporation. The staining agents are washed off after an hour. Results are expressed as a degree of effect: unaffected, slightly affected, or considerably affected. Laminate must be unaffected or slightly affected, depending on the staining agent.

#### ***Abrasion resistance*** (tests laminate for hardness and thickness of color layer):

An abrading wheel is run over the surface for a certain number of cycles. Results are expressed as the total weight of the sample lost after each 100 cycles. The point at which the color wears through is also noted. Must meet minimum weight-loss requirements and minimum cycles to wear through.

#### ***Impact resistance*** (tests laminates resistance to cracking when hard objects are dropped on it):

A one-half pound steel ball is dropped on the laminate from increasing heights until the surface cracks. Results are expressed as a measure of the height at which the ball was dropped when it cracked the laminate. Laminates must withstand at least a 15" drop without cracking.

#### ***Scratch resistance*** (tests laminate's resistance to scratching):

A fixture with a chisel point is dragged across the surface of the finish at a certain load. Results are expressed as the width of the scratch produced, which indicates the depth to which the chisel point penetrated. Scratch must not exceed a specific width.

#### ***Adhesion*** (evaluates hardness and adhesion of laminate layers):

A fixture with a chisel point is dragged across the surface of the laminate at increasing loads. Results are expressed as a measure of the load at which the chisel point breaks through the laminate's surface. Must pass minimum load requirements.

## Veneers

Veneers are inspected by our vendors before they arrive at Herman Miller. Vendor masters have been established and are used throughout the manufacturing process.

### *Testing Procedures*

Veneers are tested for their ability to stand up to the kind of wear they are likely to get in actual use. Tests simulate conditions like spilling hot or cold drinks on the surface; pressing down hard with writing implements; and exposure to heat, light, and various stains, such as ink and colas.

Herman Miller veneer products are given the following tests:

#### *Hardness (tests resistance to pressure from writing instruments):*

A blunt-tipped stylus is put into a fixture and dragged across the surface at varying loads. The results are expressed as the load at which the surface is dented. Veneers must meet a minimum load requirement.

#### *Resistance to boiling water (tests resistance to gloss, color, texture, or loss of finish material):*

Boiling water is spilled out on the surface and then a test fixture, representing a cup, is placed on top of the spill. Results are expressed as a degree of effect: unaffected, slightly affected, or considerably affected. Veneer must be unaffected or slightly affected.

#### *Cold water resistance (tests resistance to changes in gloss, color, or texture, or loss of finish):*

A felt pad saturated with cold water is placed on the surface, then covered to prevent evaporation. Results are expressed as a degree of effect: unaffected, slightly affected, or considerably affected. Veneers must be unaffected or slightly affected.

#### *Stain resistance (tests resistance to seven staining agents, including ink and coffee):*

A sample of each of seven staining agents is placed on the surface and covered with a sheet of glass to prevent evaporation. The staining agents are washed off after an hour. The results are rated from highest (not affected) to lowest (any changes in gloss, color, or texture). Veneers must be unaffected.

#### *Ultra-violet light resistance (tests resistance to fading or chalking):*

The sample is placed in a chamber and subjected to high intensity UV light from a carbon arc. Results are expressed in pass/fail terms. The surface is examined from three angles for color and value changes. Only minimal change from its original condition is acceptable.

## Formcoat®

### *Testing Procedures*

Formcoat is tested for its ability to stand up to the kind of wear it is likely to get in actual use. The formcoat is tested to be sure the color layer will not rub through in ordinary use, that the surface finish won't dull or stain, and that there will be an acceptable resistance to UV exposure. The formcoat is also tested to make sure it won't crack if hard objects are dropped on it from reasonable heights, that it won't lift up from the substrate, and that it can withstand hot and cold temperatures.

## Wrapcoat

### *Testing Procedures*

Wrapcoat is tested for its ability to stand up to the kind of wear it is likely to get in actual use. The wrapcoat is tested to be sure the color layer will not rub through in ordinary use, that the surface finish won't dull or stain, and that there will be an acceptable resistance to UV exposure. The wrapcoat is also tested to make sure it won't crack if hard objects are dropped on it from reasonable heights, that it won't lift up from the substrate, and that it can withstand hot and cold temperatures.