Differences Between Taber Abrasion Wheel Types (CS-10, CS-17, H-18)

Introduction

Taber abrasion testing evaluates material resistance to wear using different wheel types, such as CS-10, CS-17, and H-18, each varying in material, hardness, and abrasiveness. The choice of wheel depends on the material tested and the application. This document compares these wheels and their implications for testing.

Wheel Comparisons

1. CS-10 Wheel

- **Material**: Calibrase (resilient, rubber-based with abrasive particles).
- **Abrasiveness**: Mild to moderate.
- **Hardness**: Softer, more flexible compared to vitrified wheels.
- **Use Case**: Ideal for testing softer materials or coatings, such as paints, lacquers, plastics, textiles, or thin films.
- **Wear Mechanism**: Produces a rubbing or scuffing action, causing gradual surface wear or loss of gloss. Less aggressive, suitable for materials where subtle wear (e.g., scratching or haze) is the primary concern.
- **Example Application**: Testing decorative coatings on furniture or touchscreens, where surface appearance matters.
- **Typical Results**: Lower weight loss (e.g., 10–20 mg after 1,000 cycles) due to milder abrasion. Results in light scratches or haze.

2. CS-17 Wheel

- **Material**: Calibrase (resilient, rubber-based with coarser abrasive particles than CS-10).
- **Abrasiveness**: Moderate, more abrasive than CS-10 but less than H-18.
- **Hardness**: Similar to CS-10 but with increased abrasive intensity.

- **Use Case**: Suited for testing moderately durable coatings, plastics, or materials requiring a balance between mild and aggressive wear testing.
- **Wear Mechanism**: Produces moderate scratching and surface wear, more severe than CS-10 but less destructive than H-18. Used when CS-10 is too gentle but H-18 is too harsh.
- **Example Application**: Testing automotive interior plastics or mid-range protective coatings.
- **Typical Results**: Moderate weight loss (e.g., 20–50 mg after 1,000 cycles), with visible scratches deeper than CS-10 but less severe than H-18.

3. H-18 Wheel

- **Material**: Calibrade (vitrified, clay-based, harder and more rigid).
- **Abrasiveness**: High, very aggressive.
- **Hardness**: Harder and less resilient than CS-10 or CS-17.
- **Use Case**: Best for testing harder, durable materials, such as metals, ceramics, or heavy-duty coatings.
- **Wear Mechanism**: Causes intense abrasive wear, including scratching, gouging, or significant material removal. Simulates harsh real-world conditions.
- **Example Application**: Testing industrial components like tool coatings, flooring materials, or conveyor belts exposed to heavy wear.
- **Typical Results**: Higher weight loss (e.g., 50–100 mg after 1,000 cycles) due to aggressive material removal. Surface damage includes deep scratches or pitting.

Key Factors in Wheel Selection

- **Material Type**: Use CS-10 for delicate coatings, CS-17 for moderately durable materials, and H-18 for robust materials.
- **Test Objective**: CS-10 for surface appearance (e.g., gloss retention), CS-17 for balanced durability testing, H-18 for heavy wear resistance.
- **Industry Standards**: Standards like ASTM D4060 or ISO 7784-2 specify wheel types. CS-10 and CS-17 are common for coatings; H-18 for tougher materials.
- **Load**: Wheel abrasiveness interacts with applied load (e.g., 500g or 1,000g). H-18 with 1,000g is far more destructive than CS-10 or CS-17 with 500g.

Practical Implications

- **Comparability**: Results are only comparable with the same wheel, load, and cycle count. For example, 10 mg loss with CS-17 is not equivalent to 10 mg with H-18.
- **Real-World Simulation**: CS-10 mimics light wear (e.g., human touch), CS-17 simulates moderate wear (e.g., frequent handling), and H-18 replicates severe conditions (e.g., sand or mechanical contact).
- **Interpretation**: Low weight loss with H-18 indicates high durability, while low loss with CS-10 or CS-17 shows good resistance to mild or moderate wear, respectively.

Example Scenario

Testing two coatings for a smartphone screen:

- **CS-10 (500g, 1,000 cycles)**: Coating A: 8 mg loss, Coating B: 15 mg loss. Coating A resists light scratches better.
- **CS-17 (500g, 1,000 cycles)**: Coating A: 25 mg loss, Coating B: 20 mg loss. Coating B performs better under moderate wear.
- **H-18 (1,000g, 1,000 cycles)**: Coating A: 80 mg loss, Coating B: 60 mg loss. Coating B is better for harsh conditions.
- **Decision**: Choose Coating A for daily use (CS-10 priority) or Coating B for rugged environments (H-18 priority). CS-17 results help balance cost and performance for moderate wear.

Summary Table

Wheel	**Material**	**Abrasiveness**	**Best For**
CS-10	Resilient (rubber-based)	Mild	Soft coatings, plastics, textiles
CS-17	Resilient (rubber-based, coarser)	Moderate	Moderately durable coatings, plastics
H-18	Vitrified (clay-based)	High	Hard materials, heavy-duty coatings

Table 1: Summary of Taber abrasion wheel characteristics