Verifying the Cleanliness of Steel after Solvent Cleaning

Answer

Dr. Nigel Whitehouse, Paint Research Association, Teddington, UK:

Dust, dirt, and similar particulate contamination left on the surface of steel after solvent cleaning can be seen in good light—with the unaided eye if the particulates are of reasonable size (50–100 micrometers [2-4 mils] in diameter or more) and with a hand lens (10X) if the particulates are small (less than 50 micrometers [2 mils]).

A test method that involves pressure-sensitive tape is used sometimes, however. It has been standardized in ISO 8502-3, Preparation of Steel Substrates Before Application of Paints and Related Products—Tests for the Assessment of Surface Cleanliness—Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method).

The standard provides pictorial ratings for the assessment of the average quantity of particulate contamination and descriptive classes for the assessment of the average size of the particles.

The method may be carried out as a simple pass/fail test against a previously agreed limit. It can also provide a permanent record of the particulate contamination on a surface.

The test is conducted as follows:

- The tape, with the dust adhering to it, is then removed and placed on a display board of a color in contrast to that of the particulate contaminants, and it is examined visually.
- The quantity of contamination adhering to the tape is estimated by comparison with the pictorial references in the standard. There are 5 pictorial references corresponding to dust quantity ratings 1 to 5.

On solvent-cleaned smooth steel (cold-rolled), the application of pressure-sensitive adhesive tape may leave adhesive residues on the steel in the test area if the level of particulate contamination is low. Therefore, the tape test should be used only when necessary, since it may remove one contaminant and introduce another.

ISO 8501, Preparation of Steel Substrates Before Application of Paints and Related Products—Visual Assessment of Surface Cleanliness, adopted the prime elements of SIS 05 59 00, adding a section on preparation of previously coated steel substrates. With the help of 28 photographs, it points out the relationship between cleanliness of a steel substrate and its appearance under normal vision.

The preparation grades in the standard are defined by describing the appearance of the surface before and after cleaning. In each case, it mentions that the surface “shall be free from visible oil, grease, and dirt as well as from all mill scale, rust, paint coatings, and foreign matters.”

Following is information concerning each of these categories.

- Visible oil, grease, and dirt: Only a few coatings can adhere to these contaminants, and so they must be removed by the different means known.
- Mill scale, rust, and previous coatings: The grade of preparation depends on the expected coating life.
Nowadays there are a number of methods to clean and blast clean a surface.

- **Previous coatings:** It is necessary to check whether they are still adherent and compatible with the new coating.
- **Foreign matter:** This is more difficult to address, because there are several types of foreign matter that can contaminate the surface and that will not necessarily disappear with cleaning (e.g., dust, welding residues, and water-soluble salts). Surface coatings are not compatible with these kinds of contaminants, and so they must be removed.

ISO 8502, Preparation of Steel Substrates Before Application of Paints and Related Products–Tests for the Assessment of Surface Cleanliness, describes various methods of evaluating the cleanliness of a surface, including the following:

- Part 1: Field Test for Soluble Iron Corrosion Products;
- Part 2: Laboratory Determination of Chloride on Cleaned Surfaces;
- Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method);
- Part 4: Guidance on the Estimation of the Probability of Condensation Prior to Paint Application;
- Part 5: Measurement of Chloride on Steel Surfaces Prepared for Painting (Ion Detection Tube Method);
- Part 6: Extraction of Soluble Contaminants for Analysis–The Bresle Method;
- Part 9: Field Method for the Conductometric Determination of Water-soluble Salts; and
- Part 10: Field Method for the Titrimetric Determination of Chloride.

Use of these standardized test methods can significantly improve the results of protective coating work, although not without some difficulties. These difficulties result from acceptability criteria that are not precisely described, required changes in work habits, and associated increases in costs that are not particularly well accepted in the market.

**Answer**

Jim Deardorff, Superior Coatings, Inc., Chillicothe, MO:

A black light (365 nanometer ultraviolet [uv] light) can be used to verify the removal of contaminants after SSPC-SP 1 solvent cleaning operations. Further information on this technique and other methods can be found in ISO 8502.
tions. This light can work in a number of ways.
  • Many shop contaminants are hydrocarbon-based (e.g., grease and oils) and will fluoresce under black light, thus highlighting areas that need to be cleaned again. Clean bare metal has no reaction (black) under uv light.
  • Some cleaning solvents will fluoresce under black light, again highlighting areas that were not completely cleaned.
  • I have also used a combination of a fluorescent dye and solvent applied to a metal surface to produce a uniform fluorescent response. Clean rags are then used to wipe the surface until the fluorescence is completely removed. I have found that it requires extra effort to remove the uv solvent from cracks, joints, and welds, which would probably be overlooked in normal SSPC-SP 1 cleaning operations.

Upcoming Questions in Problem Solving Forum

• September: On a recent bridge deck replacement contract, the aluminum-filled epoxy mastic applied to the top flanges of the existing beams (after the deck was removed) apparently reacted with the new concrete deck pour (i.e., the new concrete deck pour over the painted beams began to bubble). The temperature at the time of pour is not known but temperatures were high. Can the aluminum epoxy react with the wet concrete or is this reaction caused by other factors? Could the paint affect the bond between the concrete and the steel? Is painting the top flanges recommended? If not, why?

• October: What is the recommended coating system and procedure for repairing deteriorated systems consisting of an inorganic zinc primer, epoxy intermediate, and polyurethane topcoat? Does the repair system or procedure vary with the degree of coating degradation? If so, how?

• November: What is the best procedure for touching up rusted, untopcoated inorganic zinc-rich coatings?

• December: What is the best method to determine volume solids of coatings such as chemically curing epoxies and inorganic zinc-riches?

• January 1999: If aesthetic considerations (color, gloss retention) are not important, what is the advantage of applying a polyurethane topcoat over an inorganic zinc primer and epoxy intermediate?

Responses as well as new questions may be submitted to Karen Kapsanis, Editor, JPCL/PMC; fax: 412/431-5428.