SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) Shot Peening Coverage Determination

RATIONALE

The title has been expanded (include word “Determination” to indicate that this standard practice relates to a method of inspection, but does not govern the amount of coverage to be achieved. Section 3.2 is included to help quantify the mathematical nature of peening coverage. It is adapted from SAE J443 published in 1961. Section 4.5 Coverage Coupon is included to allow an alternative coverage rate determination method which may be useful in situations where the peening dent is very small and thus very hard to observe such as for high hardness parts or for parts peened at very low intensities.

1. SCOPE

This SAE Recommended Practice provides procedures for determining shot peening coverage.

Effectiveness of shot peening is directly dependent on coverage. Inadequate or excessive coverage may be detrimental to fatigue strength and life.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J442 Test Strip, Holder, and Gage for Shot Peening

SAE J443 Procedures for Using Standard Shot Peening Test Strip

3. COVERAGE

Coverage is defined as the percentage of a surface that has been indented at least once by the peening media. It is, however, very difficult to obtain accurate measurements of coverage above 98%. "Full coverage" is therefore defined as being at least 98% denting of the surface to be peened. Coverage above "full coverage", when required, is obtained by peening for multiples of the time required for "full coverage". The minimum peening time required to achieve full coverage can be determined by incrementing the peening time - until full coverage is obtained. Methods of assessing and predicting coverage are described here.

3.1 Variation in Coverage of Part Versus Test Strip (SAE J442)

Peening time to reach full coverage of parts may not be the same as the intensity/saturation times referenced in SAE J443 for Almen strips. That is because parts have different shapes and hardness characteristics from those of Almen strips. Soft part surfaces require less peening time than hard part surfaces to achieve full coverage – other factors being unchanged. That is because the size of each indent is larger for soft surfaces.

3.2 Relationship of Coverage to Exposure Time

There is a definite and quantitative relationship between coverage and exposure to the shot stream. This relationship may be expressed as follows:

$$C_n = 1 - (1 - C_1)^n \qquad \text{(Eq. 1)}$$

where:

C_1 = %coverage (decimal) after 1 cycle
C_n = % coverage (decimal) after n cycles
n = number of cycles

As this expression indicates, coverage approaches 100% as a limit. It is difficult to obtain accurate measurements of coverage above 98%. Since coverage approaches 100% as a limit, and since actual measurement can be made up to and including 98%, 98% is arbitrarily chosen to represent full coverage. Beyond this value, the coverage is expresses as a multiple of the exposure time required to produce 98% coverage. For example 1.5 coverage represents a condition in which the specimen has been exposed to the blast 1.5 times the exposure required to obtain 98% coverage. A chart plotted to a convenient exposure time scale is shown in Figure 1.

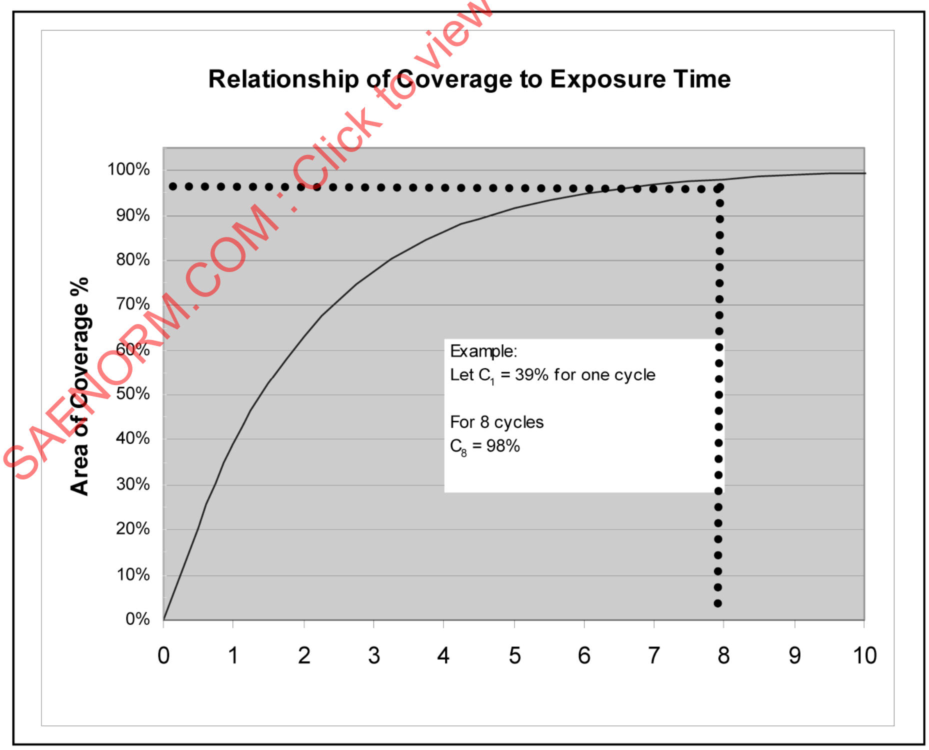

FIGURE 1 - FACTOR OF EXPOSURE TIME, T

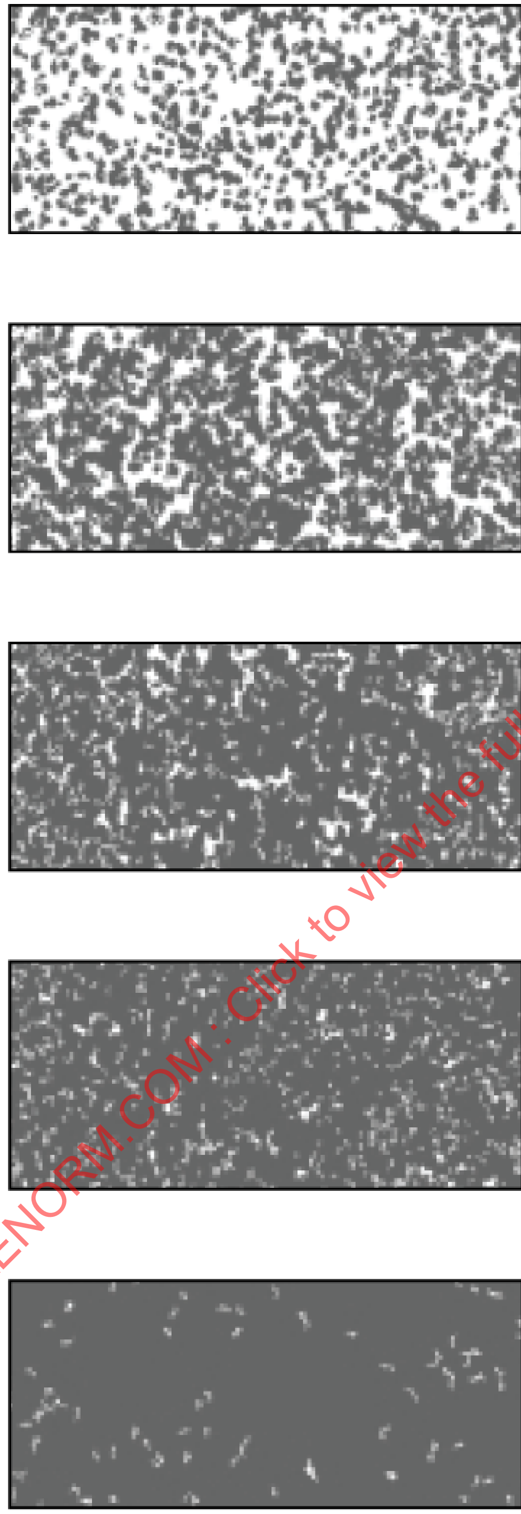

FIGURE 2 - EXAMPLE OF COVERAGE

3.3 Prediction of Passes Required to Achieve 98% Coverage (Full Coverage)

The coverage measured after one pass can be used to predict the number of passes required to achieve 'full coverage' (98%). This is based on the relationship given in 3·2. A graphical representation is given in Figure 3. As examples: if one pass gives 80% coverage then three passes should give at least full coverage, 60% in one pass would need five passes and 39% would need 8 passes.

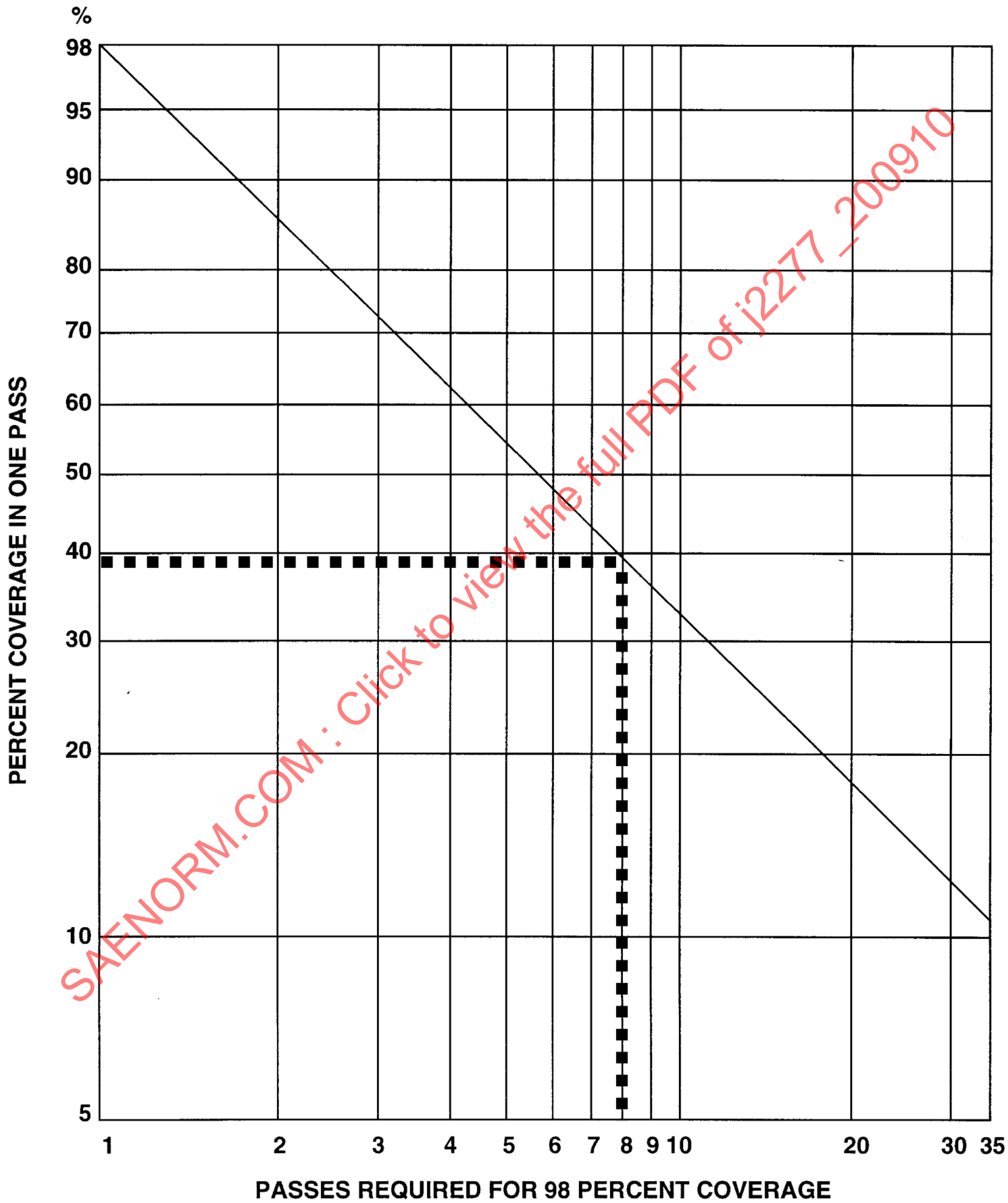

FIGURE 3 - NOMOGRAPH TO PREDICT COVERAGE AFTER EXPOSURE TO ONE PASS
Example: If the coverage for one pass is 39% it will then require 8 passes to achieve 98% (full coverage)