Quality Considerations for Unique Item Identifiers
March 6, 2006

Data matrix quality checks are required for data content and accuracy and code profile or appearance. The data content can only be verified by de-coding the mark using a reader capable of this operation. The profile or appearance of the code can be inspected under magnification or by vision verification. When selecting to use vision verification, the manufacturer must be satisfied on the operational requirements of the verifier and the integrity of the checks that it is performing.

The quality standard for acceptance of machine-readable code marked directly on parts with Data Matrix symbology is normally specified by the product definition data. There may also be additional quality requirements in the contract provisions. In the case of Item Unique Identification (IUID), the DFARS Clause 252.211-7003 requires that the data elements of the Unique Item Identifier (UII) be placed on the item based on the criteria provided in the version of MIL-STD-130 cited in the contract schedule. The current version is MIL-STD-130M, Marking Practices for U.S. Military Property, dated 2 December 2005. The applicable requirements of MIL-STD-130M, which related quality conformance criteria for the Data Matrix symbology, are as follows:

5.2.7.2 Data Matrix Symbol. Minimum quality levels shall be as follows:
5.2.7.2.1 Dot peen, laser, laser ablation and electro-chemical etching markings. Marks that are acceptable per the requirements for printing on label material in 5.2.7.2.2 shall be acceptable or alternately **s**ee appropriate tables in SAE AS9132 for quality requirements.
5.2.7.2.2 Printing on label material. Unless otherwise specified in the contract or order, the symbol shall have a minimum print quality of grade 3.0 /05/660 measured with an aperture size of 0.005 inch (0.127 mm) with a light source wave length of 660 nm + 10 nm. As an exception, the ISO/IEC 15415 parameters Modulation (MOD), Symbol Contrast (SC), or both, may measure as low as 2.0, providing the overall ISO/IEC 15415 grade would be 3.0 if the MOD and SC grades are 3.0 or higher. (NOTE: this allows for lower contrast substrates, high density printing and over-laminates and other such limiting factors to the parameters MOD, SC, or both on otherwise well produced labels.) Quality (symbol verification) reports shall clearly show that the MOD, SC, or both, are the only parameters measured as low as 2.0, and clearly show that the overall grade would be at least 3.0 if MOD and SC were at least 3.0. The methodology for measuring the print quality shall be as specified in ISO/IEC 15415, where the overall grade is based on a single scan (not five scans).
5.2.7.2.3 Other marking methods. Quality acceptance criteria of 5.2.7.2.1 shall apply. If the quality acceptance criteria of 5.2.7.2.1 cannot be applied, quality acceptance levels shall be identified within the contract or order.
5.2.7.2.4 Obliteration of direct marked Data Matrix symbol. When a Data Matrix symbol mark is unacceptable (unreadable, in error, etc.) and cannot be removed or otherwise corrected without deleterious effect to the marked item, it shall be crossed out as shown in Figure 15 using two diagonal lines crossing each other through the center of the Data Matrix and two other lines (one vertical the other horizontal) through the two

interrupted frame lines (finder pattern) of the Data Matrix symbol. The marking method used shall be determined by the current design authority.

FIGURE 15. Obliteration of a Data Matrix symbol

With regard to dot peen, laser and electro-chemical etch markings (direct part markings) enterprises should have demonstrated process capabilities in place to produce direct part marks (DPM) of acceptable quality for the target applications. In general, DPM applications should strive for the maximum contrast, use the largest practical element size possible, select ECC 200, avoid quiet zone violations, and strive for the best mark consistency possible. To assure the best possible mark consistency, effective process controls should be in place to control print growth, axial non-uniformity, cell fill, angle of distortion, dot quality and dot center offset.

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