Item Unique Identification (IUID) Marking

IUID Center Representative
NSWC Corona, IUID Center
3 May 2016

Housekeeping

- Please mute your telephone

- Please use the chat box for questions which are critical to the understanding of the presentation

- Please submit any question not requiring immediate attention to CRNA-IUID_gateway@navy.mil

- Questions will be answered as time permits

Marking Requirements

Marked on the Item*

ECC200 Data Matrix Symbol

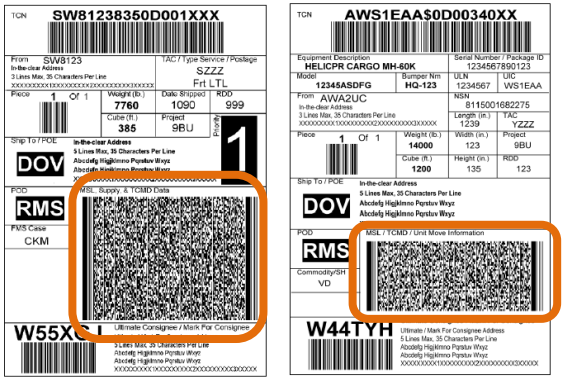
MIL-STD 130 *has technical details*

The Department of Defense's (DoD) IUID requirements dictate an item's mark:

1. Remains readable throughout the item's normal life cycle
2. Withstands all environmental conditions to which the item will be exposed under normal operating conditions
3. Provides no detrimental effects on the functional performance, reliability, or durability of the item

*there are provisions to mark on the package or on an attached tag for some items

Marked on the Packaging



NOTE: Not actual size. Recommended label size is 4 by 6 inches (10.2 by 15. 2 cm).

FIGURE 2A. Generic MSL. FIGURE 2B. Unit move MSL.

PDF417 within the MSL

PDF417 on the DD1348-1A

MIL-STD 129 *has technical details*

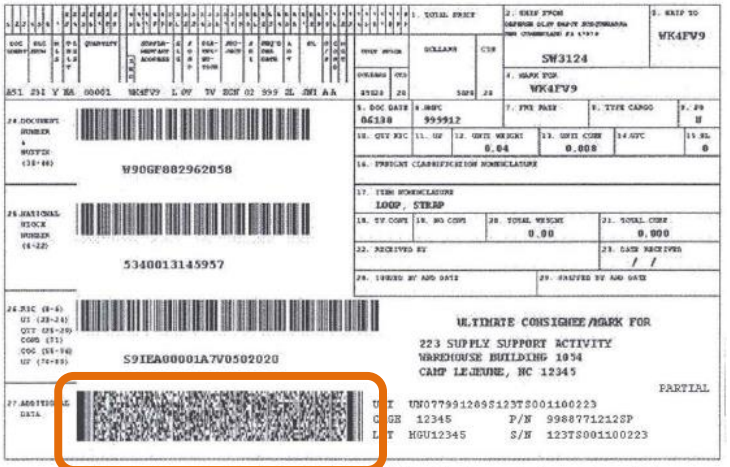
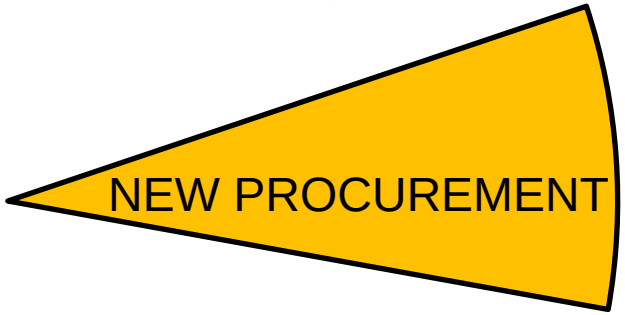


FIGURE 39. Sample of a DD Form 1348-1A, Issue Release/Receipt Document (IRRD).

Marking the DoD Inventory

DCMA

Vendor Marks Before DoD Accepts*



Contracts with DFARS 252.211-7003

* This is generally what happens. Exceptions do exist however.
DCMA = *Defense Contract Management Agency*
DFARS = *Defense Federal Acquisition Regulation Supplement*

New Acquisition

- DFARS 252.211-7003 in a contract makes IUID marking a contractual requirement
  - Items with CLIN cost ≥ $5,000 get marked
  - Other items which need to be marked shall be identified within an attachment to get marked

FYI: DFARS 252.211-7003 plans to be changed to align with DODI 8320.04

- The vendor determines how to generate the UII and what syntax and data qualifiers to use

New Acquisition Marking Costs

Will this cost a lot?

If you let it, then yes it will cost a lot.

Generally speaking, vendors are already marking your items with nomenclature, part numbers, serial numbers, etc.

These same methods are also good for IUID Data Matrix marking. In production, the cost of the additional IUID marking, should add almost no extra cost.

Marking Methods

- Labels (Stickers)
- Data Plates
- Dot Peen
- Laser Etch
- Chemical Etch
- Silk Screening
- Thermal Spray
- Ink Jet Printing
- Laser Ablation
- Laser “Annealing”
- Cast/Forged
- Laser Bonding
- Embroidery
- Photo Etch

NOT MEASUREMENT SENSITIVE

MIL-STD-130N
w/CHANGE 1
16 November 2012

SUPERSEDING
MIL-STD-130N
17 December 2007

DEPARTMENT OF DEFENSE
STANDARD PRACTICE
IDENTIFICATION MARKING OF
U.S. MILITARY PROPERTY

AMSC 9251 AREA SESS

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5.2.7.2. Data Matrix symbol quality. The following provide acceptance criteria for all marking procedures that can be used at the Supplier's choice:

a. ISO/IEC 15415
b. AIM DPM-1-2006
c. SAE AS9132

5. DETAILED REQUIREMENTS

5.1 General.

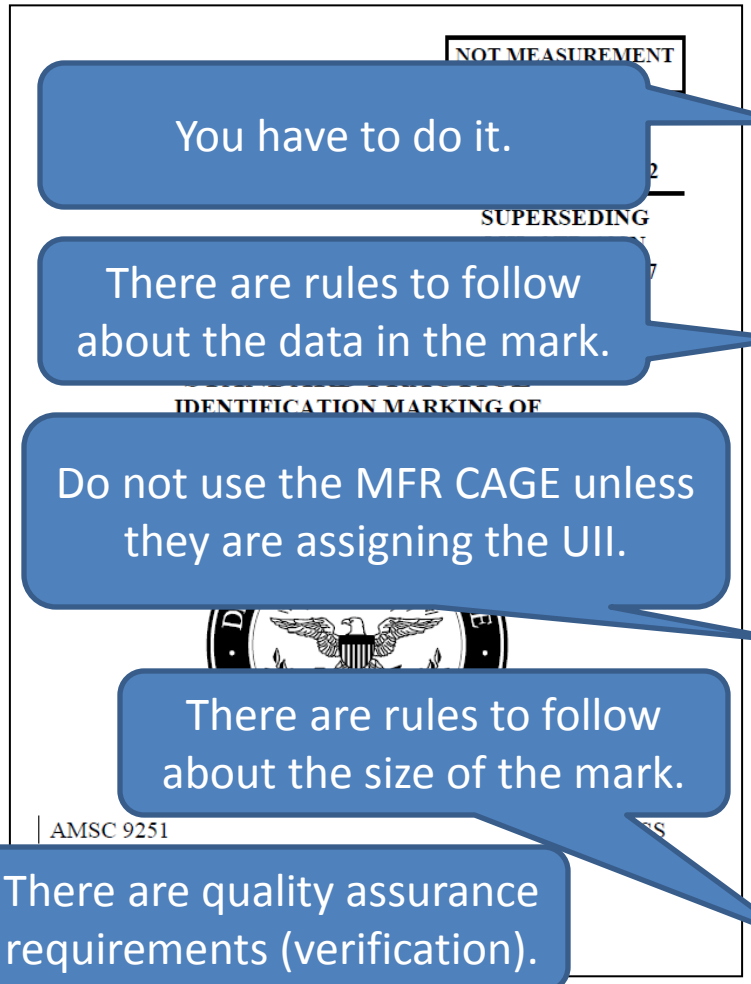
MRI marking per 5.2 shall be applied to all items subject to DFARS mandated IUID (see 3.32) criteria.

5.2 Machine-readable information (MRI) Marking

MRI (Data Matrix symbol) with HRI (translation or interpretation) shall be applied to items specifically designated for IUID…The Data Matrix symbol shall meet the requirements stated in 5.2.3.2 and 5.2.7.2.

5.2.1.5 Assignment of IUID to legacy items.
…the Enterprise Identifier (EID) of the organization ensuring the uniqueness must be the EID used to generate the UII versus any other EID represented in the prior marks.

5.2.3.2 Two-dimensional Symbol. The two-dimensional symbol shall be the Data Matrix ECC 200 in accordance with ISO/IEC 16022. Unless otherwise specified, the module size shall be no smaller than 0.0075 inch (0.19 mm) and no larger than 0.025 inch (0.635 mm). Square symbol sizes shall not exceed one inch (25.4 mm). The larger dimension of rectangular Data Matrix symbols, as permitted by ISO/IEC 16022, shall not exceed one inch.



You have to do it.

There are rules to follow about the data in the mark.

Do not use the MFR CAGE unless they are assigning the UII.

There are rules to follow about the size of the mark.

There are quality assurance requirements (verification).

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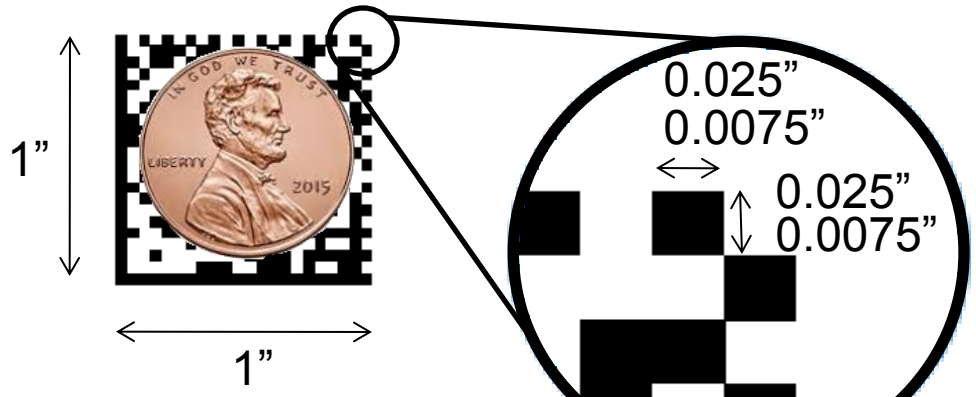
What's a Module? & How small are we talking?



The longest side of a symbol shall not exceed one inch.

The module size shall be no larger than 0.025 inch.

Smallest IUID compliant data matrix possible would be 0.011 in^2 (0.105" per side)

Per MIL-STD-130N

The module size shall be no smaller than 0.0075 inch.

40 x 40 data matrix using 0.025" modules ⟶ 1" matrix with a 170 character limit

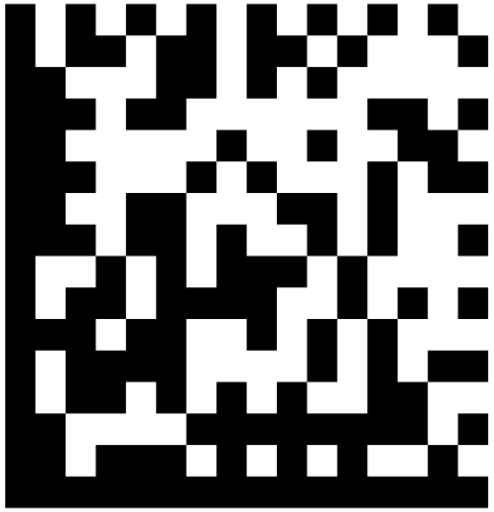
132 x 132 data matrix using 0.0075" modules ⟶ 0.99" matrix with a 1,954 character limit

Environmental Conditions

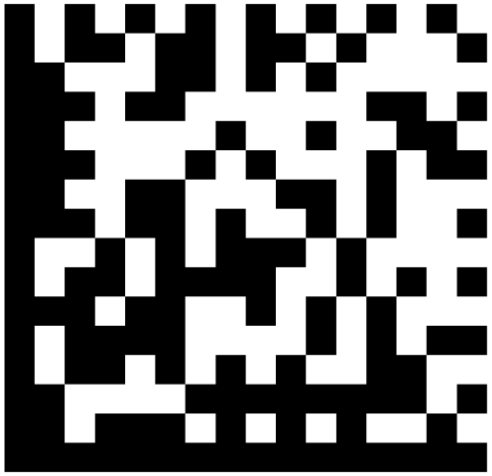
Mild Environments	Moderate Environments	Harsh Environments
General office conditions where there are moderate temperatures and minor exposure to non-abrasive cleaning chemicals. Examples include office furniture, calculators, computers, reproduction machines, and so forth.	Indoor or general outdoor use. Parts are exposed to some chemicals and abrasives, moderate cleaning and exposure to outdoor environments in temperate regions. Examples are in-plant fixed assets, embedded parts, internal air, sea or ground vehicle components (less engines), and so forth.	Harsh indoor/outdoor conditions; long-term exposure to salt air, caustics; extreme temperature variations; exposure to chemicals, including petroleum products; frequent cleaning and exposure to autoclaves, chemicals, or abrasives. Examples are external aircraft components, engine parts other than internal combustion engine components, refinery equipment, work-in-process manufacturing, and tools
Minimum suggested cell size 0.008-inch required for successful reading.	Minimum suggested cell size 0.010 inch (0.254 mm).	Minimum suggested cell size 0.020 inch (0.508 mm) or larger.
Minor damage can render a mark unreadable.	Error correction can reconstruct symbol.	Less error correction needed.
		

2D Data Matrix Barcodes

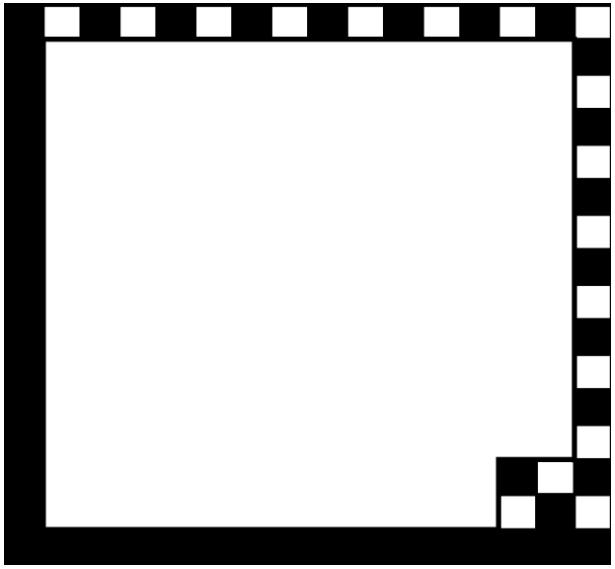
Hello World!



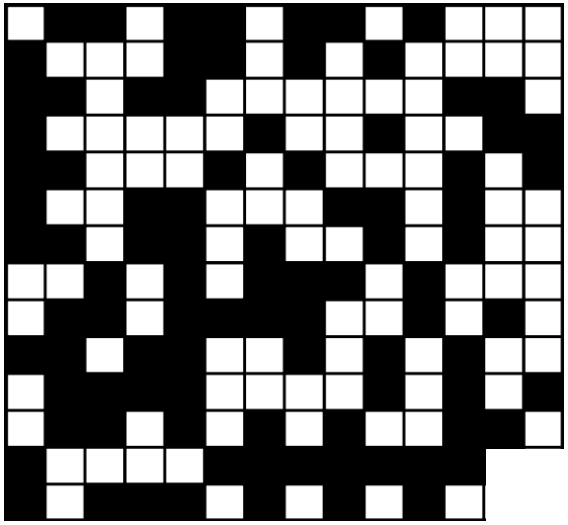
2D Data Matrix Barcodes



Fixed pattern



Information



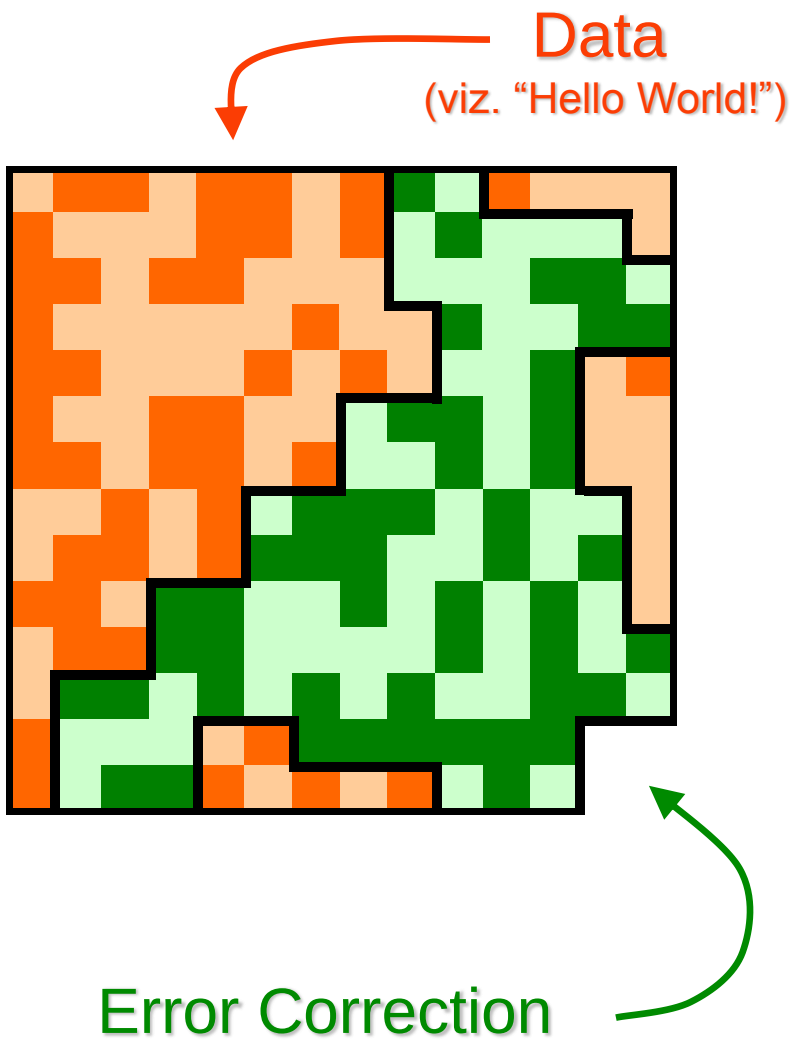
To read the barcode a scanner will overlay a grid on the image of the symbol and extract the fixed pattern and then the data.

2D Data Matrix Barcodes

The upper-left-hand corner actually contains most of the data. The lower-right-hand corner carries error correction.

The error correction allows damaged marks to be read and for all of the encoded data to be recovered.

In theory, about 50% of the mark can be damaged. In practice, about 30% of the mark can be damaged.



A Readable, Failing Mark

UNDER PRINT

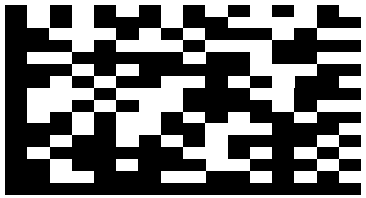
OVER PRINT

FIXED PATTERN DAMAGE

FIXED PATTERN DAMAGE

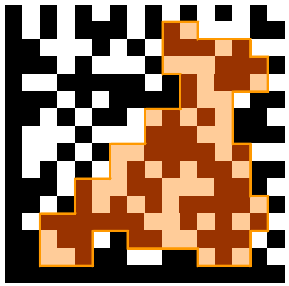
Verification

Verification grades (“A”–“F”) eight characteristics of the mark
Grades of “B” or higher are required to pass the mark

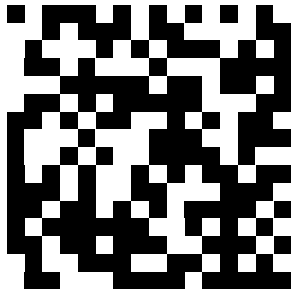


Axial
Non-uniformity

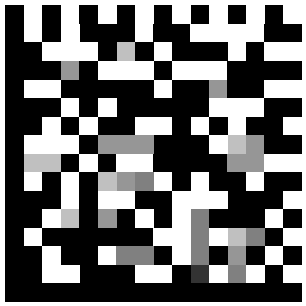
Grid
Non-uniformity



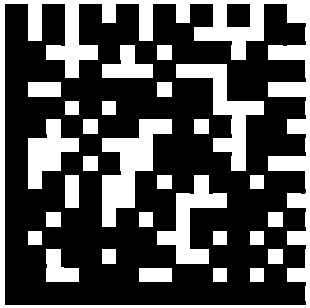
Unused
Error Correction



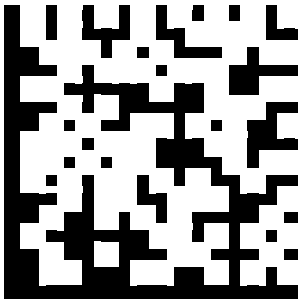
Fixed Pattern
Damage



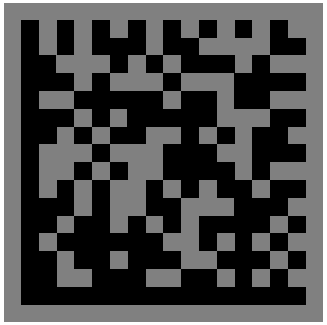
Modulation



Over-print



Under-print



Contrast

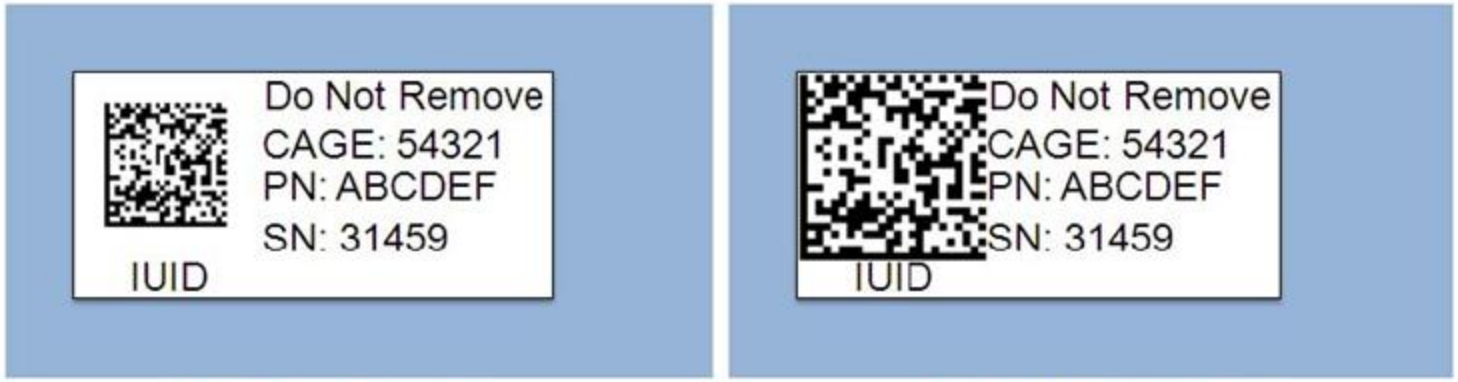
A Verification Sampling Plan

Lot Size	*Sample Size to Test*	*Max. Defects to Accept Lot*
1-25	*21*	*1*
26-50	*41*	*3*
51-100	*54*	*4*
101-150	*75*	*6*
151-200	*78*	*6*
201-300	*89*	*7*
301-500	*101*	*8*
501-600	*112*	*9*
601-800	*113*	*9*
801-1000	*114*	*9*
1000-5000	*125*	*10*

For example

If 100 labels were printed, 54 of them would be randomly verified. If more than 4 barcodes failed verification, the quality of the lot would be rejected and all 100 barcodes would be verified, discarding those that failed verification.

Quiet Zones are Important to Barcodes



Data Matrix With Sufficient Quiet Zone

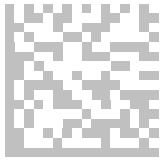
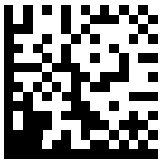
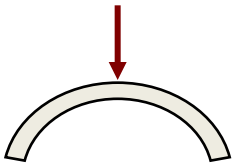
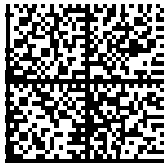
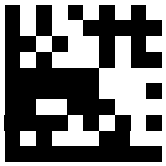
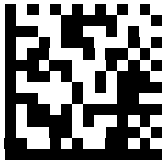
Data Matrix Without Sufficient Quiet Zone

- A clear space (quiet zone) must be left around the outside of the symbol in order for the scanner to successfully decode the data matrix.
- A minimum of one cell width of quiet zone must be left around the symbol.
- However, due to variations in surface finish, it is helpful to extend this area. If possible, allow an additional 10% of the longest symbol side.

Readability of the Mark

Expensive Readers

Cheap Readers

Hard to Read		Easy to Read
	Contrast	
	Shape	
	Cell Size	
	Reflectance	

Direct Part Marking

Typical intrusive marking methods include:

Abrasive blast

Direct laser marking using short wavelength lasers

Dot peening (stamp impression)

Electrochemical etching (electrolytic surface coloring or metal removal processes)

Engraving

Fabric embroidery

Laser shot peening

Milling

Cast

Dot Peen

Laser Etch

Intrusive Marks Require Engineering Analysis

Source: NAVAIR Material Engineering Report 460664MER1 of Oct 2010

Non-Recurring Engineering

SECNAVINST4440.34 of 22 December 2009 Section 5f:

Engineering change requests and drawing revisions shall not be required when affixing labels with IUID markings to legacy equipment if it does not impact form, fit or function and if the following conditions are met:

(1) The existing label is completely removed.

(a) The new label with IUID compliant data matrix is placed in the same location as the replaced label.

(b) The new label with IUID compliant data matrix has the same dimensions as the replaced label.

(c) The new label material and method of marking is the same as the replaced label or an improved and qualified media replacement. The IUID compliant data matrix must be permanent, per MIL-STD-130N of 17 Dec 07.

(d) The new label is affixed on the item in the same manner as the replaced label.

(e) The information on the replacement label may be resized or repositioned anywhere on the label to accommodate [the] IUID compliant data matrix.

(2) A replacement label is not required if sufficient space exists to place the IUID compliant data matrix or label to the right, left, up or down with respect to the existing label.

(3) A replacement label is not required if room exists on the current label to add an IUID compliant data matrix.

(4) When otherwise determined by the appropriate Technical Authority (TA) of the respective organization.

Non-Recurring Engineering

HQDA G4 memorandum of 28 June 2011 Section 5:

This memorandum authorizes the procurement and opportunistic marking of non-safety-critical items requiring IUID per references (b and c) that are currently marked with data plates or data labels per the following blanket rules: .

(a) Army Engineering Change Proposals (ECP) and drawing revisions shall not be required when affixing labels with IUID markings to non-safety critical legacy equipment.

(b) Marking must conform to the requirements of Mil-Std-130N or latest.

(c) Marks are to be placed where scans can be made without interference from other machine-readable marks on the equipment or data plate.

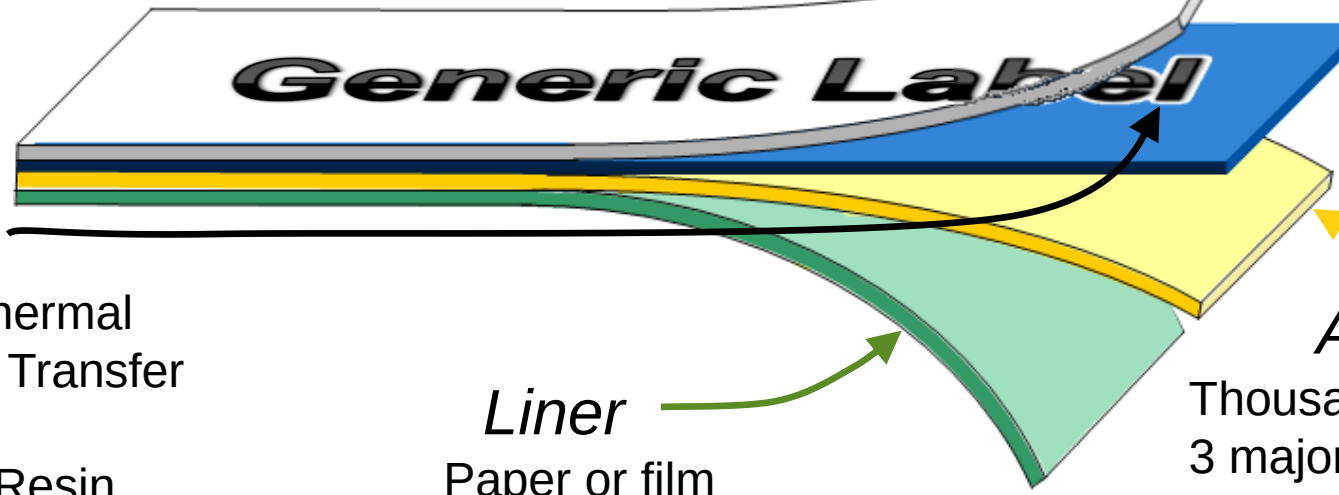
(d) If the existing label must be removed in order to be IUID compliant, all of the following apply:

(1) The new label with IUID compliant data matrix is placed in the same location, has the same dimensions, and is affixed in the same manner as the legacy label.

(2) The new label material and method of marking is the same as the previously applied label. The IUID compliant data matrix must meet permanency requirements of reference d.

(e) The same rules apply to marking, in accordance with (IAW) Reference d of uniquely identified legacy items which have had part, lot or batch number changes.

The World of Labels



Top Coat

Optional layer
Can help overcome:
UV, chemicals, abrasion problems

Face Stock

Paper
Polypropylene
Polyester
Polyolefin

"Ink"

Inkjet
Toner
Direct Thermal
Thermal Transfer
- Wax
- Wax/Resin
- Resin

Direct Laser

Liner

Paper or film
Moisture stability important to minimize edge curl
Comes with release coating

Adhesive

Thousands of choices!
3 major categories
- Rubber PSA*
- Acrylic PSA*
- Silicone PSA*

* PSA is short for Pressure Sensitive Adhesive

Adhesives

Rubber Adhesives

Adhesives made from natural or synthetic rubbers which are made tacky by mixing them with various compounds.

• High Initial Strength (Good Thumb Appeal)

• Economical

Performance Characteristics Include:

• Adequate for short term, non-critical applications

• Limited chemical, temperature and Ultra Violet light resistance

Acrylic Adhesives

A combination of acrylic monomers and other compounds.

• Permanent bonding applications

• Have a high initial bond and adhere well to most surfaces

• Lower initial adhesion than their rubber counterparts

Performance Characteristics Include:

• Excellent aging characteristics

• Outstanding chemical and ultra violet light resistance

• Higher temperature stability than rubber adhesives

• Good for long term, durable applications!

Silicone Adhesives

Polymers with an inorganic backbone and organic side groups

• Bond to silicone-coated and other LSE surfaces

• Widest temperature range

• High cost

Performance Characteristics Include:

• Suitable for long term, critical applications

• Higher temperature resistance, service range 30ºF to 500ºF

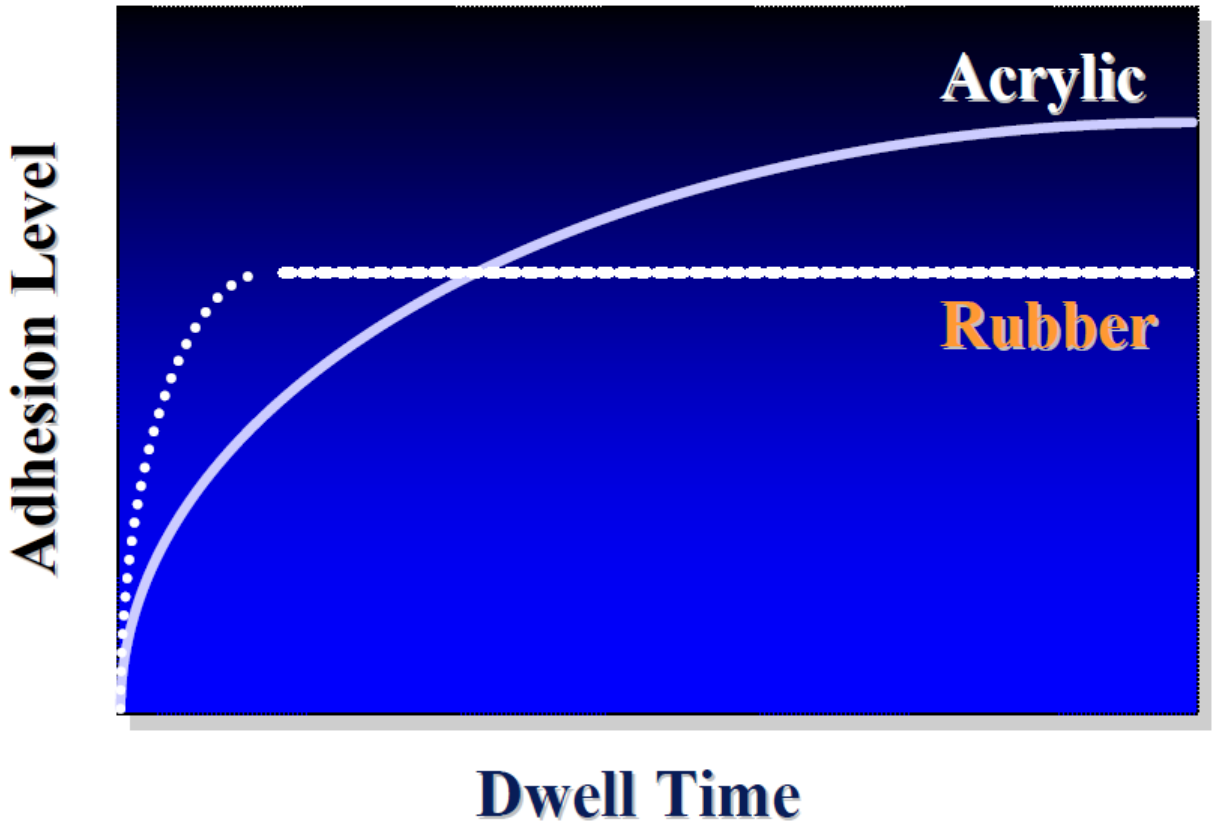
• Resistance to chemicals, moisture and UV

• Clean removability to some substrates

• Out-gassing can obscure electro-optics

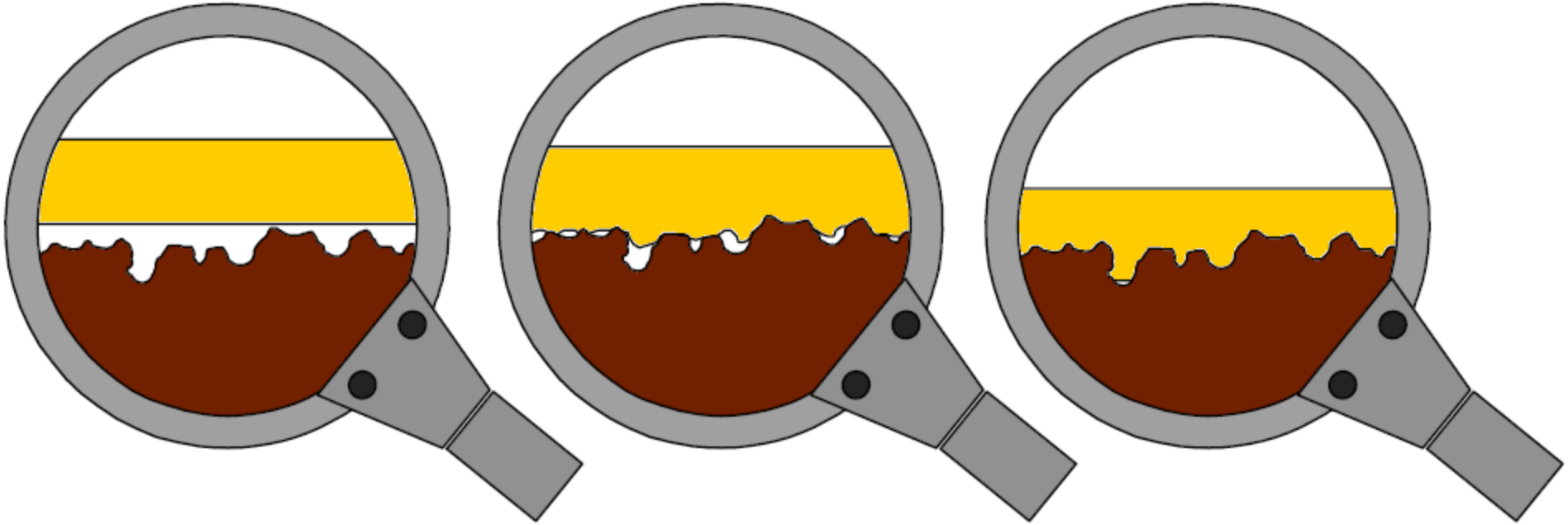
The Tortoise & the Hare

The bond strength of Acrylic adhesives builds over time...



Wet Out & Ultimate Strength

Dwell Time allows adhesive to "flow" into the Peaks & Valleys of the Substrate



Initial Adhesion
No Dwell Time

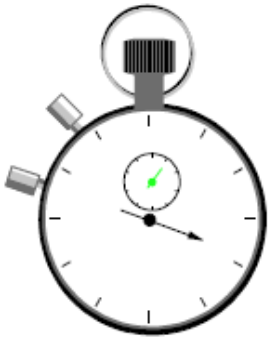
Ultimate Adhesion
72 hrs @ 25 °C

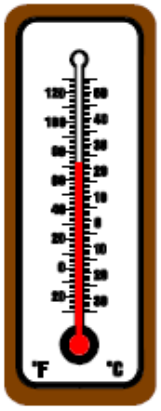
Common PSA Terminology

- **Adhesion** – Ability to stick or bond to a substrate.

- **Cohesion** – Internal strength of an adhesive to itself.
- **Substrate** – The surface or material to which you want your PSA to stick.
- **Surface Energy**
  - A measure of the molecular attraction of the facial contact of a material.
  - Property that will effect the ability the PSA to stick.
- **Wet out** – The ability of an adhesive to flow and/or reflow over a surface to maximize bond strength based on higher contact area.

Application Is Critical





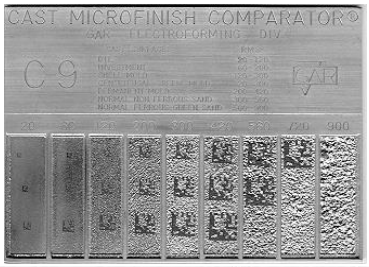
- **Time**
  - Allow at least 72 hours before testing the ultimate adhesion strength. This gives the adhesive time to *flow*, effectively covering your substrates.
- **Temperature**
  - Applying your adhesive at room temperature is always best. Slightly higher temperatures can actually improve adhesive flow, speeding up the the bonding process. At cold temperatures, select an adhesive made for application in cold temps.
- **Pressure**
  - Applying adequate pressure will accelerate the adhesive flow and eliminate trapped air. This will ensure higher adhesive coverage of the substrate.

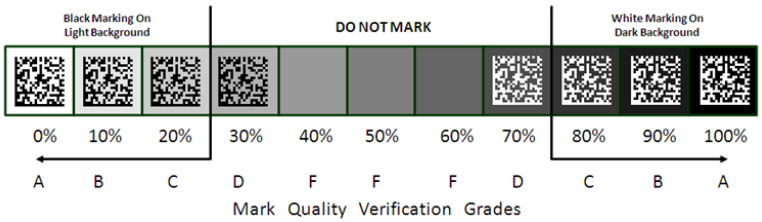
The Department of the Navy IUID Marking Manual

- The DON Marking Guide is available
- Brings together many established resources pertinent to marking IUID symbols on legacy items
  - Major Automatic Identification and Data Capture (AI/DC) manufacturers
  - Government and aerospace user groups under a collaborative agreement with National Aeronautics and Space Administration (NASA) and the United States Coast Guard (USCG)
  - DoD and DON Policies
  - ISO and MIL standards
- The body of the document is 7 pages long
- Its 17 appendices are 33 pages long

Average Roughness Level (millionths of an inch)	Minimum Cell Size (inches)
20 (0.000508 mm)	0.0075 (0.19 mm)*
60 (0.001524 mm)	0.0091 (0.23 mm)
120 (0.003048 mm)	0.0150 (0.38 mm)
200 (0.005080 mm)	0.0201 (0.51 mm)
300 (0.007620 mm)	0.0252 (0.64 mm)
420 (0.010668 mm)	0.0299 (0.76 mm)

* 0.0075 inches approaches the limits of many readers regardless of surface roughness.





Functional Placement Of The IUID Mark

Protected

In-Service Convenient

In-Storage Convenient

IUID Resources

OSD UID Policy Office Website http://www.acq.osd.mil/dpap/pdi/uid/index.html

Trusted site for policy (DoD Instructions, Directives, Publications, DFARS Clauses, Memorandums and Standards)

DoD Procurement Information Website

http://www.dodprocurementtoolbox.com/page/unique-id

Trusted site for implementation information (Marking, Registering Items, Contracting, etc.)

MIL-STD 129 (current version is R as of Feb 2014)

Marking standards and requirements for shipping and storage

MIL-STD 130 (current version is N, Change 1 as of Nov 2012)

Marking standards and requirements for items

DoD Guide to Uniquely Identifying Items (currently v3.0 as of Dec 2014)

Business rules, additional guidance for implementation

IUID Helpdesk iuid.helpdesk@dla.mil

QUESTIONS
&
ANSWERS