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For Open Publication

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Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

Component & Tooling Identification Training

Presented by
Benjamin P. Sklenar
Military Account Executive



EWIS Tooling for 75 Years

Our mission is to be your trusted partner in tooling and technology for mission-critical electrical systems. DMC provides a full catalog of tooling to support EWIS including:

- Crimp Tools & Accessories (qualified to AS22520)
- Insertion/Removal Tools (qualified to AS81969 & AS5259)
- Connector Assembly Tools
- Tensile Test Equipment
- Safe-T-Cable®
- Twist-Strip®
- Lacelok®



EWIS Tooling for 75 Years

DMC also researches, designs, and develops tool kits to support specific platforms and wiring systems. Our comprehensive kits include all the items needed to strip, crimp, insert, remove, torque, and test. Kits also come with cross-reference charts for the connectors, contacts, and terminals which eliminates time-consuming research.



Introduction to Wire Stripping



Wire Prep



1. Determine the proper length of insulation to be removed. Wire must be visible in inspection hole. Less than 50% of overall wire diameter clearance between insulation and contact barrel.
2. Insert wire into exact center of correct slot for wire size to be stripped. Each slot is marked with wire size.
3. Close handles together as close as possible.
4. To prevent birdcaging, partially open handles allowing grips to open, then remove wire before allowing handles to fully open.
5. Release handles, allowing wire holder to return to open position.
6. Remove stripped wire.
7. After stripping, strands of wire should be twisted firmly together in the same direction as the normal lay of the wire.
8. Stripped wire with nicked or cut strands is not acceptable.



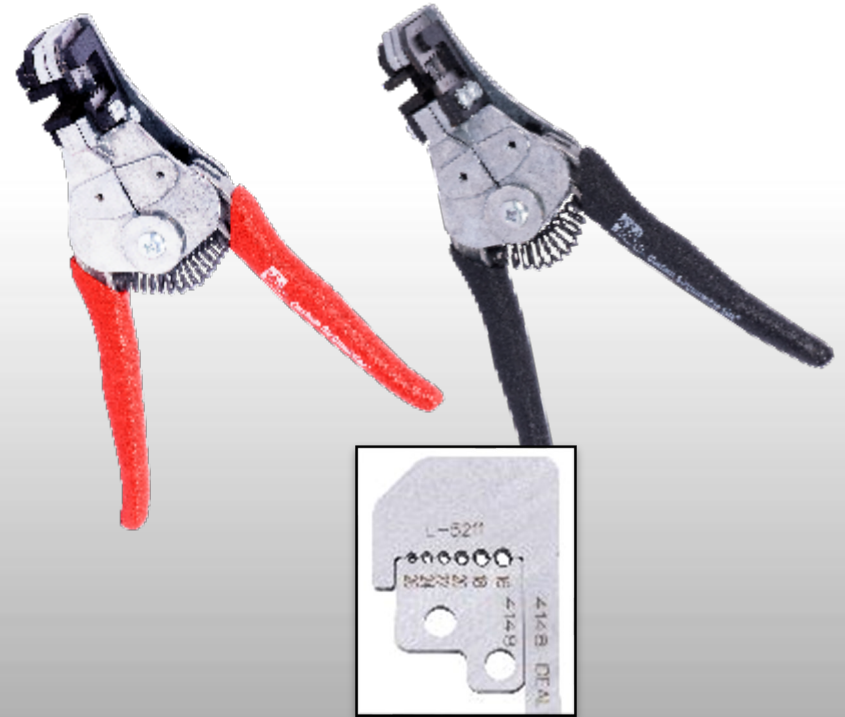
Wire Strippers

Stripmaster® wire strippers and knife-
type blades



Blue Handles

Custom Stripmaster® wire strippers and die-
type blades



Red Handles (10-14 AWG)
Black Handles (16-30 AWG)



Introduction to Contacts



Pin & Socket

Contact Styles are defined as Pin (male) and Socket (female).



Pin

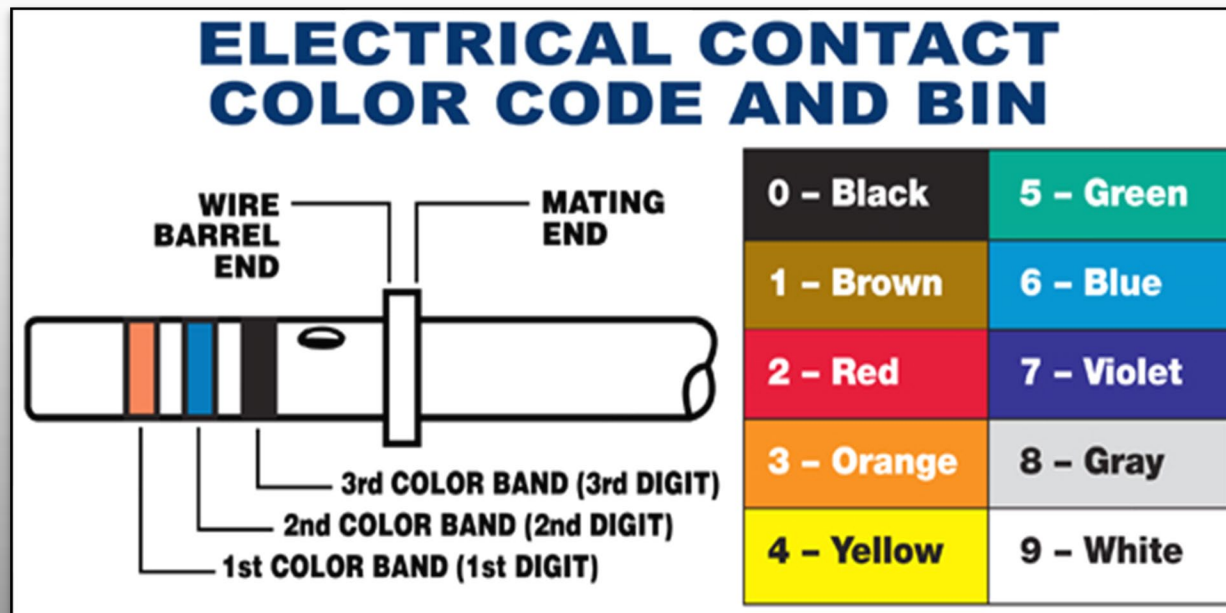


Socket

BIN Codes

M39029/XX-XXX

Color codes or **B**asic **I**dentification **N**umber (**BIN**) codes are used to identify contact part numbers



Contact Identification

- Contact Gages are used to identify the size of contacts in connectors
- Four contact gages are included with all DMC kits. This is especially useful where two or more contact sizes are present in a single connector.

- #22 Brown
- #20 Red
- #16 Blue
- #12 Yellow

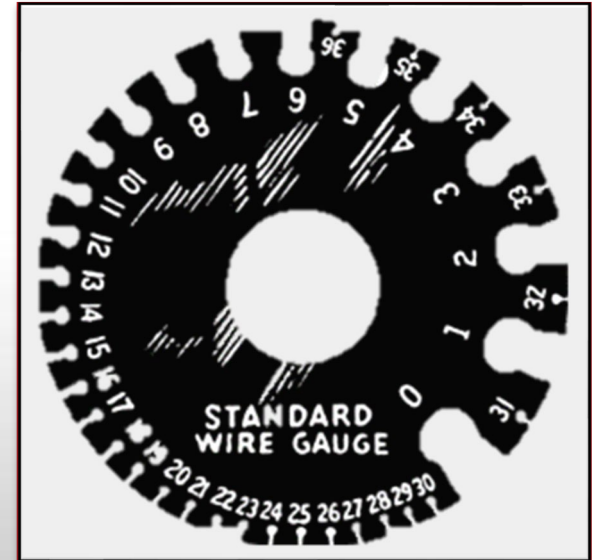


American Wire Gauge (AWG)

American Wire Gauge (AWG) is a US standard for wire conductor size.

The "gauge" is related to the diameter of the wire.

The higher the gauge number, the smaller the diameter and thinner the wire.



AWG WIRE SIZE CHART



Tool Selection



Step 1: Contact Identification



M39029/XX-XXX

Pin:

Orange-Blue-Orange

BIN 363

Socket:

Orange-Green-Brown

BIN 351

Step 2:

Use DMC Resources to Find Tooling



MIL-DTL-38999 SERIES 3

Tri-Start Coupling, Circular, Rear Release Contacts

CONNECTOR P/N	DESCRIPTION	CONNECTOR P/N	DESCRIPTION
D38999/20	WALL MOUNT FLANGE RECEPTACLE	D38999/30	LAYNARD RELEASE PLUG (SOCKET CONTACTS ONLY)
D38999/24	JAM NUT MOUNT RECEPTACLE	D38999/31	LAYNARD RELEASE PLUG (PIN CONTACTS ONLY)
D38999/26	STRAIGHT PLUG	D38999/34	JAM NUT RECEPTACLE (SOCKET CONTACTS ONLY)
D38999/29	LAYNARD RELEASE PLUG (PIN CONTACTS ONLY)	D38999/35	WALL MOUNT RECEPTACLE (SOCKET CONTACTS ONLY)

Using DMC's Catalog, search for the contact using the BIN code.

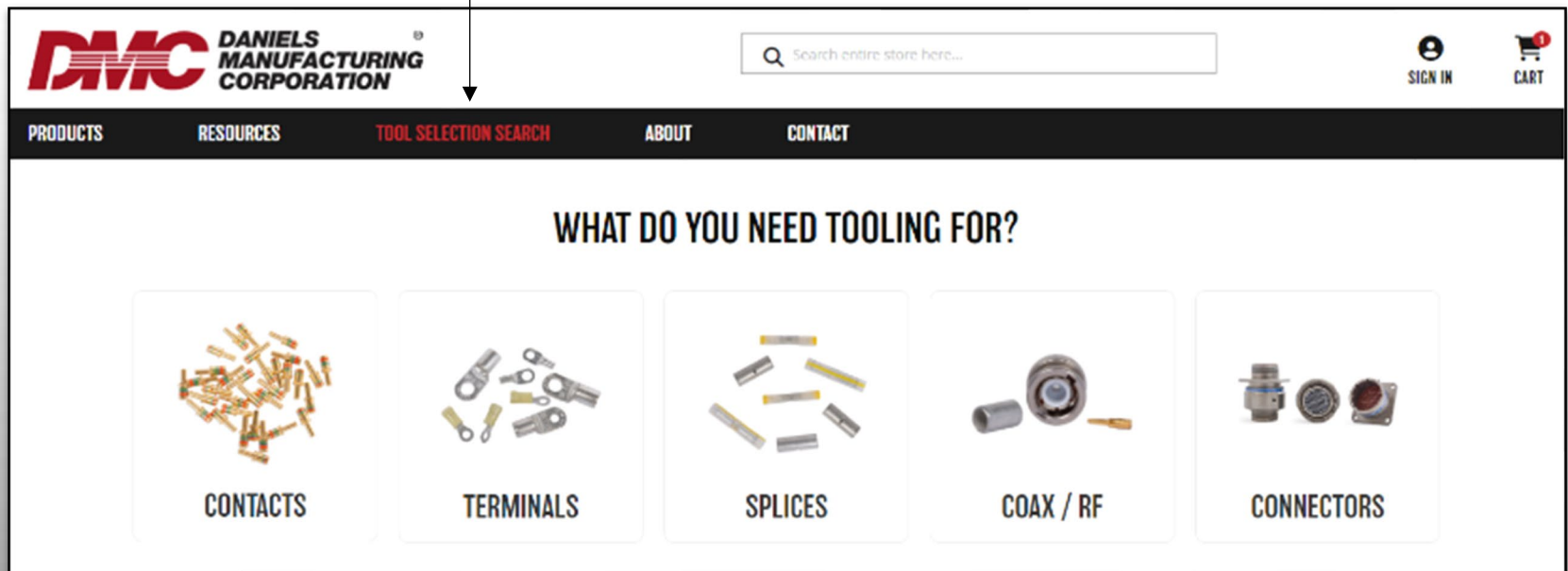
CONTACT P/N	BIN			PIN (P) OR SOCKET (S)	MATING END	WIRE BARREL	WIRE RANGE	CRIMP TOOL AND ACCESSORY				ASSEMBLY TOOLS								
								AF8	AFM8	MH860	1716P-1*	INSERTION	REMOVAL							
M39029/58-360	3-ORN	6-BLU	0-BLK	P	22	22D	22-28			K42	86-6	DAK95-22MB (ANGLED) OR DAK722-22D (STRAIGHT)	DRK95-22MB (ANGLED) OR DRK722-22D (STRAIGHT)							
M39029/56-348	3-ORN	4-YEL	8-GRA	S						K40	86-4									
M39029/118-644	6-BLU	4-YEL	4-YEL	P						K42	86-6									
M39029/118-650	6-BLU	5-GRN	0-BLK	P						K40	86-4									
M39029/117-632	6-BLU	3-ORN	2-RED	S																
M39029/117-638	6-BLU	3-ORN	8-GRA	S						K42	86-6									
M39029/58-361	3-ORN	6-BLU	1-BRN	P																
M39029/56-349	3-ORN	4-YEL	9-WHT	S										K40	86-4					
M39029/58-362	3-ORN	6-BLU	2-RED	P						22	22			22-26			K42	86-6	DAK95-22B (ANGLED) OR DAK722-22 (STRAIGHT)	DRK95-22B (ANGLED) OR DRK722-22 (STRAIGHT)
M39029/56-350	3-ORN	5-GRN	0-BLK	S													K40	86-4		
M39029/58-363	3-ORN	6-BLU	3-ORN	P	20	20	20-24			K43		DAK95-20B (ANGLED) OR DAK722-20 (STRAIGHT)	DRK95-20B (ANGLED) OR DRK722-20 (STRAIGHT)							
M39029/56-351	3-ORN	5-GRN	1-BRN	S																
M39029/118-646	6-BLU	4-YEL	6-BLU	P																
M39029/118-652	6-BLU	5-GRN	2-RED	P																
M39029/117-634	6-BLU	3-ORN	4-YEL	S																
M39029/117-640	6-BLU	4-YEL	0-BLK	S										86-7						



Step 2:

Use DMC Resources to Find Tooling

Alternatively, you can use the Tool Selection Search on dmctools.com



The screenshot shows the top navigation bar of the DMC website. The logo for Daniels Manufacturing Corporation is on the left, followed by a search bar with the placeholder text "Search entire store here...". On the right side of the navigation bar are links for "SIGN IN" and "CART". Below the navigation bar is a menu with the following items: "PRODUCTS", "RESOURCES", "TOOL SELECTION SEARCH" (highlighted in red), "ABOUT", and "CONTACT". The main content area features the heading "WHAT DO YOU NEED TOOLING FOR?" and five category tiles: "CONTACTS" (with an image of gold contacts), "TERMINALS" (with an image of various metal terminals), "SPLICES" (with an image of yellow and silver splices), "COAX / RF" (with an image of coaxial connectors), and "CONNECTORS" (with an image of various electrical connectors).



Step 2:

Use DMC Resources to Find Tooling

Select your component. In this case the component is a contact. Next, search for tooling by entering the BIN code or contact part number.

SEARCH BY CONTACT PART NUMBER

Base Specification Specification Sheet BIN Code

SEARCH

BIN Code

SEARCH

REFERENCE

BIN stands for Basic Identification Number which can be identified by the colored bands on the ends of the connectors. Referring to the diagram, the order starts from the very end of the wire barrel end and continues towards the mating end. In this example, the BIN number is 260. Refer to the table below for the color code reference.

0 BLACK	1 BROWN	2 RED	3 ORANGE	4 YELLOW
5 GREEN	6 BLUE	7 VIOLET	8 GRAY	9 WHITE



Step 2:

Use DMC Resources to Find Tooling


All tooling related to the component search will be presented along with general information relating to the component.

TOOLING FOR M39029/56-351


Mating End Sizes	Wire Barrel Size	Pin/Socket	Part No (Current)	Part No (Superseded)	Wire Range	Color Bin
20	20	S	M39029/56-351	MS27490-20	20-24	3 5 1

INNER/PRIMARY CRIMP TOOL


Military Approved




WA22P
Pneumatic Indent Crimp Tool




86-7
Positioner



AFM8
Adjustable Miniature 8 Indent



K43
Positioner



AF8
Adjustable Upper Range 8 Indent



Introduction to 4/8 Indent Tooling



AF8 (M22520/1-01)

- Crimp range **12 - 26 AWG**
- Cycle control ratchet
- Produces 8 indent crimp
- Crimp depth controlled by 8 position selector knob
- Go/No-Go performed with G125
- Utilizes turret and single position heads



AFM8 (M22520/2-01)

- Crimp range **20 - 32 AWG**
- Ratchet control cycling
- Produces 8 indent crimp
- Crimp depth controlled by 8 position selector knob
- Go/No-Go performed with G125
- Utilizes “K” positioners



Go/No-Go Gages



- It is important to periodically gage crimp tools by using an inspection/verification gage (Go/No-Go). This step ensures the tool has maintained the settings/tolerances it had when it was manufactured or calibrated.
- 4/8 indent crimp tools can easily be gaged by following the directions on the gage and tool instructions.

Go/No-Go Gages



- Set the tool to the specified setting (crimp depth selector) and first insert the “Go”, then the “No-Go” end of the gage into the indenters.
- The “Go” should pass freely between the four indenters, and the “No-Go” should not pass through the indenters.

IT IS IMPORTANT TO USE CAUTION NOT TO CRIMP THE GAGE OR FORCE A GAGE PIN THROUGH CLOSED INDENTERS.

Locators




- Turret heads can accommodate different size contacts (selected by color codes)
- Positioners are dedicated to a single contact size

Introduction to Crimping



Step 1:

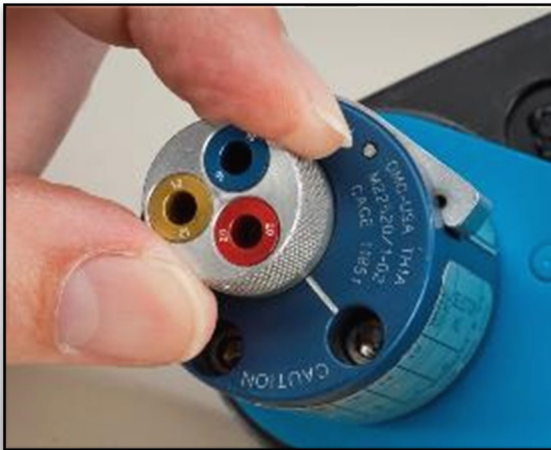
Once you have identified the appropriate tooling, use the data plate to find the correct settings for the tool.

M39029	COLOR CODE	24	22	20	18	16	14	12	WIRE SIZE
 /56-351; /57-357; /58-363 /106-615; /107-621; /117-634 /117-640; /118-646; /118-652 /121-665; /122-672	RED	1	2	3					SELECTOR No.
/56-352; /57-358; /58-364 /106-616; /107-622; /117-635 /117-641; /118-647; /118-653 /121-666; /122-673	BLUE			4	5	6			
/56-353; /57-359; /58-365 /106-617; /107-623; /117-636 /117-642; /118-648; /118-654 /121-667; /122-674	YELLOW						7	8	



Step 2:

Set the positioner color to red and push the turret knob in.



Next, set the selector setting knob to 3 by lifting and rotating.

Step 3:

Next, set the selector setting knob to 3 by lifting and rotating.



Note: The selector setting on the positioner you are using is always the one to use – ignore the AWG numbers listed on the selector knob. Revisions were made in AS22520/1 to remove AWG numbers on selector knobs.

Step 4:

Insert the wire into the contact prior to inserting the contact into the tool, or if it is preferable, insert the contact into the tool, then insert the stripped wire into the contact.



Step 5:



Close the tool until the movable handle fully bottoms, and the ratchet allows the handle to open.

Relax pressure and remove the crimped contact.

Step 6:

Inspect the contact



- The crimp location should be midway between the inspection hole and the end of wire barrel.
- Ensure there is wire in the inspection hole
- The gap between the insulation and contact barrel should be less than 50% of the overall wire diameter
- No wire strands should be located outside of the wire barrel
- Look for cracks in the plating material (magnification may be required.)

Introduction to Insertion/Removal Tools



Removal of Contacts

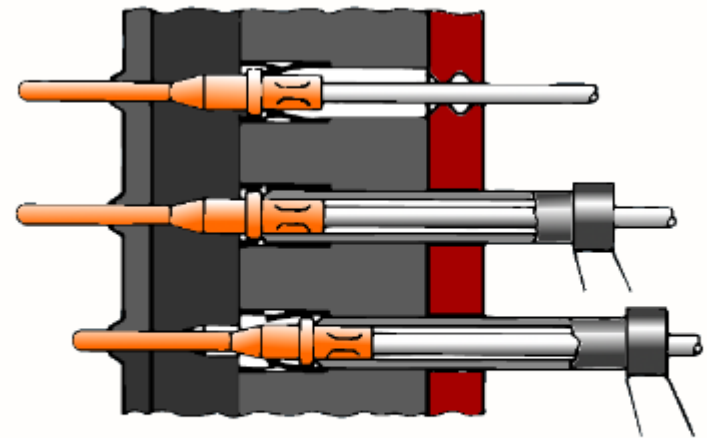
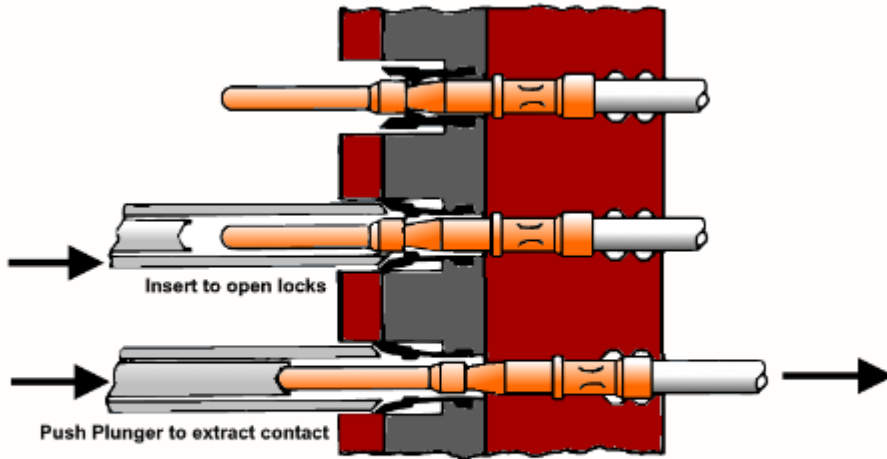


- Identification is key to this process. Begin by identifying the correct tool.
- Verify the correct contacts have been selected and use the predetermined tool to insert or remove the contacts from the connector.

Contact Release Systems used in Connectors

Typical Front Release Connector

Typical Rear Release Connector



Introduction to Connectors



Receptacles & Plugs

Receptacle

Receptacles have mating socket and often have mounting features such as a flange with holes.



Plug

Plugs have prolonged connecting pins.

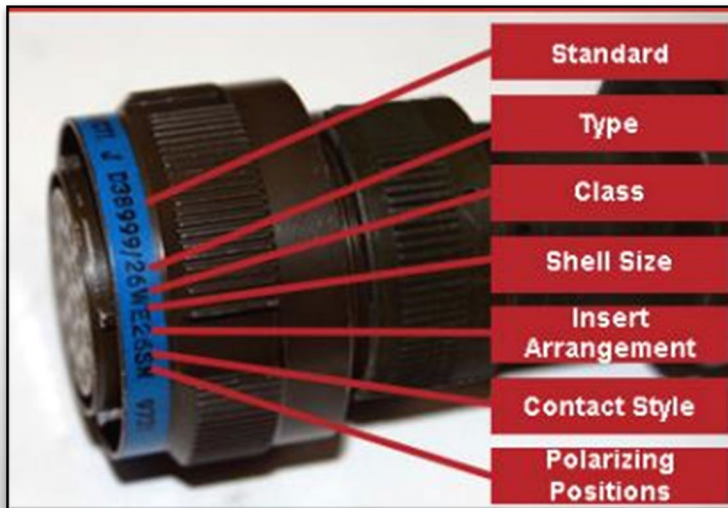
Front & Rear Release



- Blue bands on connectors generally indicate the connector has contacts that release from the rear of the connector (wire side).
- Connectors without color bands would likely indicate the connector contacts release from the front (mating side).

Connector Part Numbers

D38999/26-WE26SN



D38999/26 = MIL-DTL-38999 Series III

W = Class

- Material, plating, temperature range, and other design factors

E = Shell Size

- Diameter of connector

26 = Insert Arrangement

- Layout and size, type of contact

S = Contact Style

- Pin, socket, solder tail, etc.

N = Polarizing Positions

- Orientation of keys or insert rotation for proper mating

Introduction to Terminals, Splices and Stamped & Formed Contacts



Colors

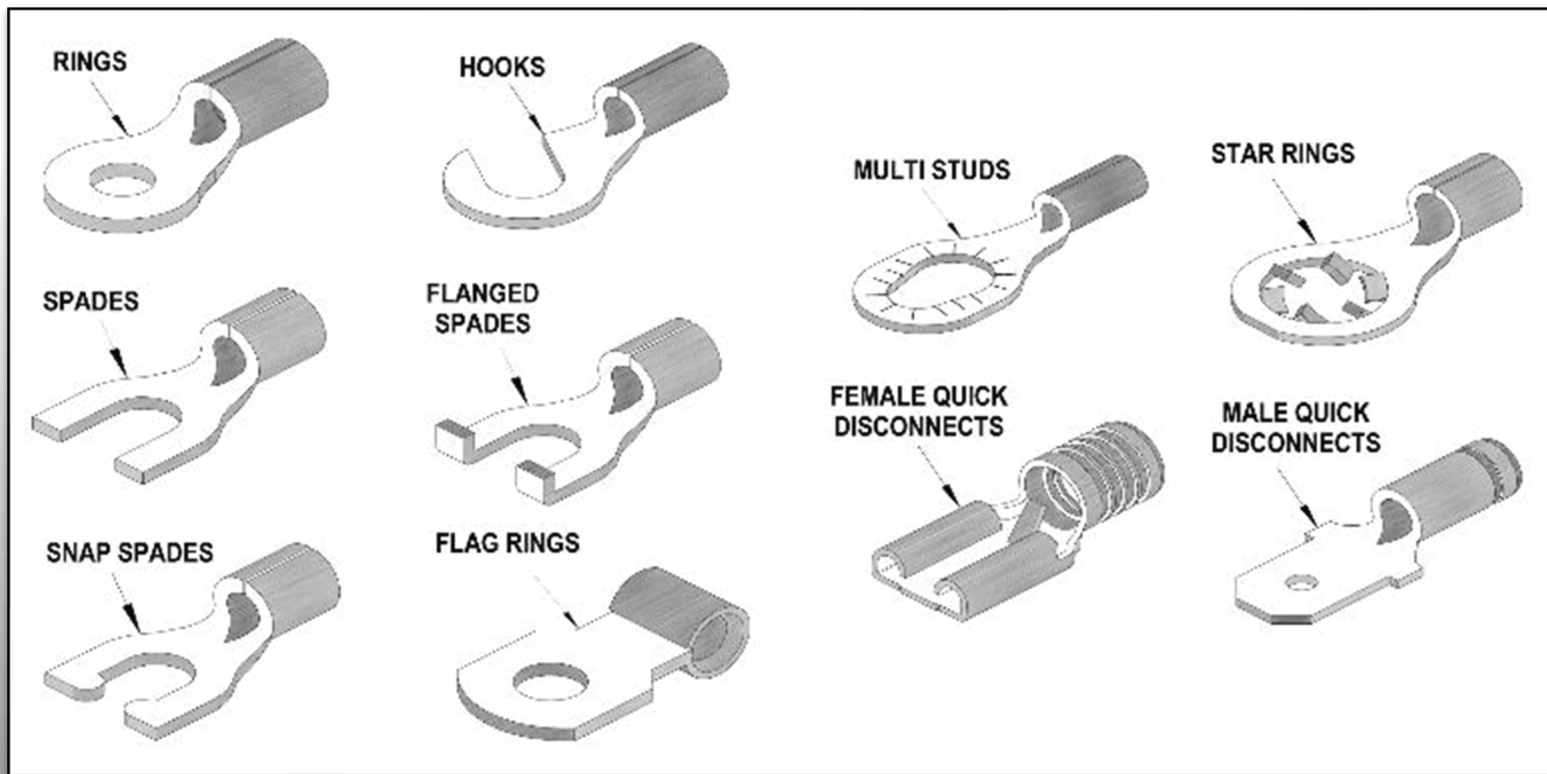
Color Code Wire Range (AWG)	
Yellow	24-26
Red	18-22
Blue	14-16
Yellow	10-12
Red	8
Blue	6
Yellow	4

- Color shades vary based on material and barrel styles
- PVC and Nylon take the color differently. In the 14-16 AWG range (blue) for example, the PVC barrels will be dark blue. The nylon barrels will be a lighter, translucent blue.
- When using the lighter blue terminals, the secondary sleeve will be crimped in addition to the wire barrel crimp.
- The color shade has no correlation to the quality of the insulation.



Tongue Styles

The “tongue” is the end of the terminal that attaches to other components (switch, stud, transformer, etc.).



Stamped and Formed Contacts

- Stamped and formed contacts are created from rolls of copper alloy that have been selected for their conductivity, strength, and temper.
- A series of complex progressive stamping dies form their specific geometry.
- Stamped and formed contacts can be purchased individually or on a reel.



Introduction to Form Crimp Tooling



HX4 (M22520/5-01)

HX4 series crimp tools have a system of interchangeable dies. Crimp dies are snapped into the tool frame and held in place by internal spring clips.



Insulated and uninsulated terminals are standardized under AS7928. The traditional tool for red, blue, and yellow (size 26-10 AWG wire) terminals is the AS22520/5-01 with AS22520/5-100 crimp dies.



Y Dies

Y Dies accommodate most coaxial and triaxial connectors and contacts conforming to MIL-DTL-39012, AS39029. Dies are also available to accommodate different types of ferrules, splices, and terminal lugs. Single, double, and triple cavity configurations are sold in various crimp patterns



Y622



Y501 (M22520/5-100)



Y443



Y Dies

The new and improved Y11 series dies were built to accommodate IPC requirements and feature an adjustable insulation crimp.



Y1115
(AS22520/5-106)



Y1116
(AS22520/5-107)



Y1117
(AS22520/5-108)



General Maintenance Tools



The preferred crimping tools for environmental splices are tools that have fixed crimp jaws such as the GMT232 (M22520/37-01) and GMT1090 (M22520/44-01).

Removable dies for the M22520/5 and M22520/10 tools are also available for crimping splices, but access to tight areas sometimes limits their use.



GMT232 (AS22520/37-01)



TOOL CAVITY	12-16		16-20		20-26	
	I.D.	O.D.	I.D.	O.D.	I.D.	O.D.
CRIMP SPLICER SIZE	.102	.153	.069	.106	.050	.080
	.097	.147	.064	.101	.045	.075

The GMT232 (AS22520/37-01) is designed to terminate wire splices conforming to MIL-S-81824 of the following sizes:

Splices are to be staggered in a wire bundle to avoid growth of the harness diameter.



Thank you!

We look forward to supporting your tooling and component needs.

Contact Us:
526 Thorpe Road,
Orlando, Florida 32824
www.dmctools.com
407-855-6161



DMC DANIELS
MANUFACTURING
CORPORATION



LaceLok[®]

The Smarter Option for Secondary Wire
Harness Support





About Us

- Established in 1949
- Veteran-owned small business
- Made in the USA
- Global reach as the preeminent mil-spec qualified tool manufacturer
- DMC® products have been used on virtually every Defense System, Aircraft Program, Land or Sea Going Transport System, Space Exploration Program



What is LaceLok®?

- LaceLok was designed to replace hand-tied lace and cable ties for secondary wire harness support
- Combines the ease of zip ties with the performance of string ties
- Developed by Ideal Industries in 2012
- Acquired and perfected by DMC in 2022
- Mil-Spec Qualified since Dec. 2022
- Listed in SAE AS50881H since Jan. 2023



Disadvantages of Traditional Methods

Hand-Tied Lace

- Applied inconsistently
- Loosen and slide over time
- Repetitive motion injuries
- Abrasion to operators
- Operator fatigue

Zip Ties

- Becomes brittle when exposed to extreme temperatures, chemicals & UV
- Often over tensioned
- Abrasive to wires and nearby components



Why LaceLok?

Safer & More Ergonomic

- Reduces repetitive motion and abrasion injuries
- Reduces operator fatigue

More Consistent

- Delivers consistent loop force that is controlled by the fastener, not the user
- Terminates consistently at 20 lbs (+/- 2 lbs) of applied tension

Superior Performance

- Rated for operation in extreme temperatures -65°C to 260°C
- Hydraulic fluid, lubricating oil, and fuel resistant
- Made of abrasion resistant meta-aramid fiber lace
- 40% lighter than large cable ties

Faster

- Installs up to 3x faster than most hand-tied lace
- Prevents rework



LaceLok Construction

Lacing Tape

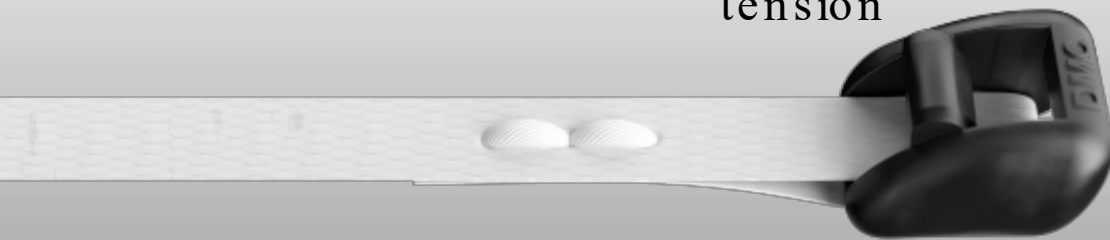
- Meta-Aramid fiber lace
- Meets A-A-52084 Lacing Spec

Fastener

- High-performance thermoplastic PEEK material
- Locking pin activates at 20 lbs (+/- 2 lbs) of tension

Thread

- Meets MIL-C-572
- Secures the fastener to the lace until it is activated



LaceLok Construction

LaceLok is available in various lengths and colors and is sold in quantities of 100.

- 6", 10", 18", and 24" lengths
- Natural, Natural w/Dark Tracer, Black, Blue, Brown, Grey, Green, Orange, Pink, Red, and Violet
- Common options are natural 10" (LF2-10NA1) and 18" (LF2-18NA1)



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CORPORATION

Installation

Step 1: Wrap LaceLok around the wire harness 1 to 3 times and feed the end of the lace through the fastener. Cinch tightly.

Step 2: Loop the end of the lace over the locking pin and back through the opening. Cinch tightly.

Step 3: Side-load the lace into the capstan and ensure that the fastener is nested in the tool.

Step 4: Squeeze the tool trigger 2 to 3 times to seamlessly tighten, lock, and cut the excess lace.



Mil-Spec Numbers

- AS50881H
- MIL-DTL-32554
- MIL-DTL-32555
- MIL-HDBK-522
- NAVAIR 01-1A-505-1
- TO 1-1A-14
- TM 1-1500-323-24-1



<https://www.youtube.com/watch?v=EI8rmpOVUy0&t=1s>

NSN now available for DLT-1100 – NSN: 5120-01-720-6605

CLF NSN creation is currently pending



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Thank You



DMC DANIELS
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CORPORATION



Safe-T-Cable[®]

The Ultimate Fastener Retention System



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Introduction



Safe-T-Cable® is a time-saving technology



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Introduction

- User-friendly alternative to lockwire
- Trusted for its reliability for over 30 years
- Commonly used in aircraft engines, and airframes
- Proven reliability in Space, Marine, and other harsh environments
- Continued acceptance for quality control and production enhancement



Benefits

- Reduced installation times
- Access to tight areas
- Quickly learned, repeatable
- Tool-dependent system
- Stronger than wire
- Quick visual inspection
- Improved FOD control



Materials

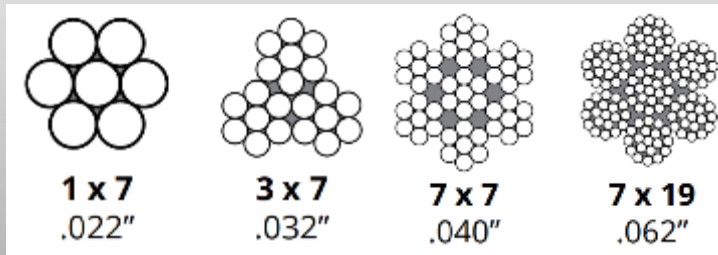
Safe-T-Cable is comprised of three components: the cable, the end fitting, and the ferrule. All three components are made of the same high-performance alloys typically used in aerospace fasteners.

- 321 Stainless Steel (AS3510) is the standard Safe-T-Cable material used for most engine and airframe applications.
- Inconel 600 (AS3509) is appropriate for high-temperature and/or non-magnetic applications.
- Inconel 625 (AS3655) is ideal for marine applications where superior corrosion-resistant properties are necessary.



Cable

- Available in four diameters
- Available in several lengths ranging from 9" – 24"
- Standard, self-looping jumper, flanged, and custom branded cables are available.



Ferrules



Individual ferrules are precisely manufactured to a size and hardness ensuring maximum tensile strength and their compatibility with the cable assemblies and tools being used.

- Conveniently stored in a disposable, spring-loaded cartridge
- Easily extracted from the cartridge minimizing the possibility of FOD
- Available in standard, elongated, or flanged configurations



Value Add Products

Custom-branded cable assemblies feature a logo or mark on the end fitting

- Most commonly used for warranty traceability, service location verification, and/or to identify tampering.



Value Add Products



Elongated ferrules are ideal for installations where the clearance between the fastener head and the surface to which the fastener is attached is limited.

- The radius end and longer shape allow for correct alignment between the tool nose and the fastener
- An excellent choice for low-profile fasteners or hard-to-reach areas



Value Add Products

Self-looping jumper cable assemblies provide the user with a means of anchoring a threaded fastener to almost any structure.

- Clear advantage over lockwire on turnbuckles, castellated fittings, and other applications where holes are not provided



Tooling

- The tool applies the tension, crimps, and cuts the excess cable off
- Adjustable and pre-set tension tools are available
- Manual, battery, and pneumatic power options
- Tools have replaceable noses that can be serviced by the user
- Multiple nose lengths are available to accommodate most applications
- Noses are interchangeable between tools for the same cable size



Tooling

Adjustable tension tools are the most popular Safe-T-Cable tools. The rotary tension mechanism on this tool can be adjusted to your precise cable tension requirements.

- Ball bearing slip clutch mechanism allow the user to tension the cable



SCTR323



DMC DANIELS
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Tooling

Pneumatic-powered tools are ideal for high-production environments.

- Lightweight
- Ergonomic design
- Available in adjustable tension and pre-set tension options
- Accommodate .022", .032", and .040" size cable



SCTPRM323



Tooling

Battery-powered tools make crimping cable easier and faster, while also improving operator ergonomics.

- Available in adjustable tension versions
- Cover all cable sizes (.022", .032", .040", and .062").
- New features allow the operator to track tool performance, users, and projects. Crimp data is viewable in real-time on the LED display, or can be downloaded via Bluetooth® to an app.



SCTE323C

SCTE625C



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CORPORATION

Verification Equipment

- The torque verification block and a push force tester are used to periodically check the tensioning mechanisms.
- This verification equipment is intended to apply the minimum pull-off loads while ensuring flex limits are met.

SCT-TB1 &
SCTD0001



SCTD013



Verification Equipment

- A motorized pull tester may also be used to capture and export data from tool indenter settings. The MPT-250C can record and perform pull-to-fail and force hold tests, providing accurate setting of the tools.



MPT-250C
& 15-3318



Verification Equipment

- Crimp depth may be adjusted by the user
- The Spanner tool is used to unlock the adjustment screw
- Operators can tighten/loosen the adjustment screw behind the tool nose



SCT32084



Standard & Classifications



National Aerospace Standards

- NASM33540 (MIL-STD-33540) “Safety Wiring, Safety Cabling, Cotter Pinning, General Practices”

SAE International

- AS567 Safety Cable, Safety Wire, Key Washers, and Cotter Pins for Production Systems, and Use
- AS3509 Cable, Safety, Kit, Nickel Alloy, UNS N06600
- AS3510 Cable, Safety, Kit, Corrosion and Heat Resistant Steel, UNS S32100
- AS3618 Cable, Safety, Ferrule, Elongated, Corrosion and Heat Resistant Steel, UNS S32100
- AS3619 Cable, Safety, Ferrule, Elongated, Nickel Alloy, UNS N06600
- AS3655 Cable, Safety, Kit, Corrosion Resistant Nickel Alloy, UNS N06625
- AS4536 Cable, Safety, Kit, Procurement Specification for Requirements and Use



U.S. Military Use

Safe-T-Cable is included in many technical manuals (TM) and technical orders (TO) used by the U.S. military and foreign military sales organizations to support aircraft, aerospace, and defense systems.

- TO-1-1A-8
- TO-1-1A-14
- TO-1-1A-15
- TM 1-1500-204-23-6
- TM 1-1500-323-24-1
- NAVAIR 01-1A-505-1
- NAVSEA MIL-STD-763
- ARMY MICOM, Drawing 13210868
- NA 01-1A-505-1
- NA 01-1A-8
- TO 00-25-255-1
- TM 1-1500-323-24-2



Commercial/OEM Use

- GE Aircraft Engines: 70-11-01-400-005 “Standard Practices Manual”
- Pratt & Whitney: PWA 316 “Safety Wire, Safe-T-Cable and Cotter-pin Installation”
- Rolls Royce: JES 138 “Locking Devices and Practices”
- Boeing: BAC 5018 “Installation of Safetying Devices”
- Airbus: AIPI 03-06-003 “Locking by Wire”
- NASA: CR4473 “Test Plan and Report”



Thank You!



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