

NOTE



All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of ± 0.13 [$\pm .005$] and angles have a tolerance of $\pm 2^\circ$. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This specification covers the requirements for the application of HD-20 Precision Formed Contacts. These contacts are available in three snap-in types: crimp, posted, and solder cup. The crimp snap-in contacts are available with or without an insulation support barrel for strain relief. The contacts accept a wire size range of 28 through 18 AWG and may be terminated to either stranded or solid wire.

After termination, these contacts are inserted into the cavities in the BACK of the connector housing and snap into place. Assembled connectors containing these contacts are available and designed to meet requirements of Military Specification MIL-C-24308.

When corresponding with TE Connectivity Personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

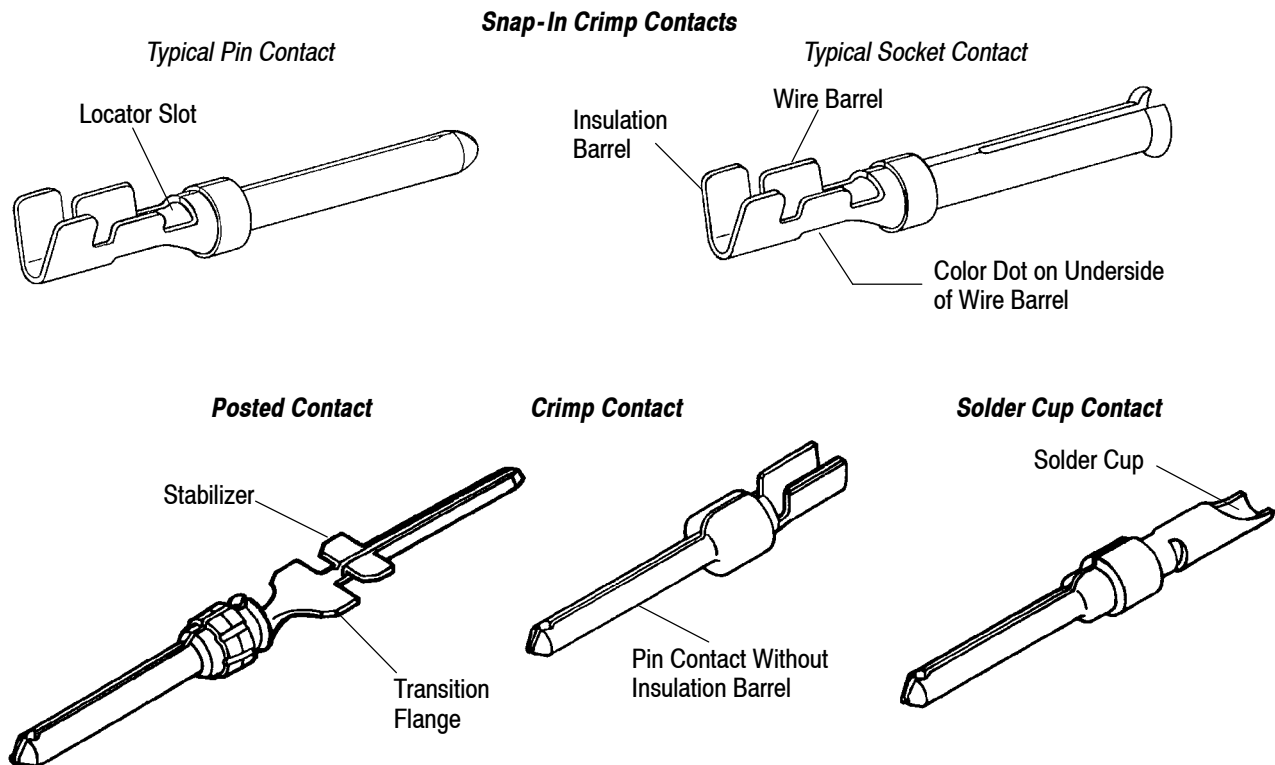


Figure 1

2. REFERENCE MATERIAL

2.1. Revision Summary

Revisions to this application specification include:

- Updated document to corporate requirements
- Corrected tensile strength for 18 AWG in table in Figure 3

2.2. Customer Assistance

Reference Product Base Part Number 66504 and Product Code 5899 are representative numbers of HD-20 Precision Formed Contacts. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a TE Representative or, after purchase, by calling Product Information at the number at the bottom of page 1.

2.3. Drawings

Customer Drawings for each product part number are available from the service network. The information contained in Customer Drawings takes priority if there is a conflict with this specification or with any technical documentation supplied by TE.

2.4. Manuals

Manual 402-40 is available from the service network. This manual provides information on various flux types and characteristics along with the commercial designation and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

2.5. Instructional Material

The following list includes available instruction sheets (408-series) that provide assembly procedures for product, operation, maintenance and repair of tooling, as well as setup and operation procedures of applicators; and customer manuals (409-series) that provides setup, operation, and maintenance of machines.

| <u>Document Number</u> | <u>Document Title</u> |
|------------------------|--|
| 408-3295 | Preparing Reel of Contacts for Application Tooling |
| 408-7424 | Checking Terminal Crimp Height Gaging Die Closure |
| 408-7799 | AMPLIMITE* Solder Pot Contacts (66569-3 and 66570-3) |
| 408-8040 | HD Quick-Change Applicators (Side-Feed Type) with Mechanical Feed System |
| 408-8547 | CERTI-CRIMP* II Straight Action Hand Tools |
| 408-9404 | Insertion/Extraction Tool 91285-1 and Replacement Tip Kits 543382-[] |
| 408-9816 | Handling of Reeled Products |
| 409-5128 | Basic AMP-O-LECTRIC* Model "K" Terminating Machine 565435-5 |
| 409-5842 | AMP-O-LECTRIC Model "G" Terminating Machine 354500-[] |
| 409-5852 | AMPOMATOR* CLS Model III-G Lead-Making Machine 122500-[] |
| 409-10012 | AMP-O-MATIC* Side-Feed Stripper-Crimper III Machine No. 1320895-[] |

3. REQUIREMENTS

3.1. Storage

A. Reeled Contacts

When using reeled contacts, store coil wound reels horizontally and traverse wound reels vertically.

B. Shelf Life

The contacts should remain in the shipping containers until ready for use to prevent deformation to the contacts and/or damage to the housings. The products should be used on a first in, first out basis to avoid storage contamination that could adversely affect signal transmissions.

C. Chemical Exposure

Do not store contacts near any chemicals listed below, as they may cause stress corrosion cracking in the components.

| | | | | | |
|----------|------------|----------|------------|----------|------------------|
| Alkalies | Ammonia | Citrates | Phosphates | Citrates | Sulfur Compounds |
| Amines | Carbonates | Nitrites | Sulfur | Nitrites | Tartrates |

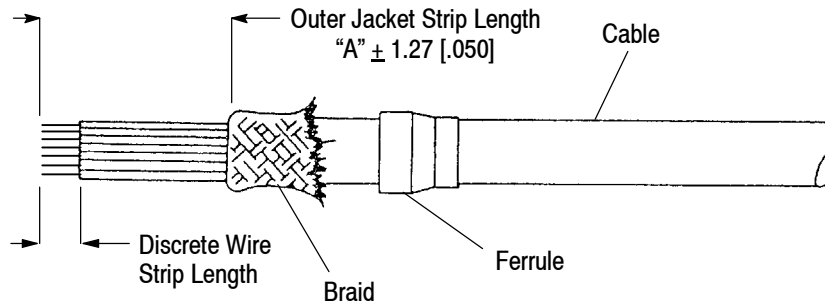
3.2. Wire Size and Preparation

The contacts will accept a wire size range of 28 to 18 AWG and may be terminated to either stranded or solid wire.

Figure 2 lists insulation stripping lengths as determined by the contact wire size range used. Also listed are acceptable wire insulation outside diameters for the contacts, and color codes used to easily identify loose-piece contacts.



DO NOT nick, scrape, or cut the wire conductor during the stripping operation.



| OUTER JACKET STRIP LENGTH | | | | | |
|---------------------------|--|--|---------------|--|--|
| CONTACT POSITIONS | | | "A" LENGTH | | |
| 9 | | | 33.02 [1.300] | | |
| 15 | | | | | |
| 25 | | | | | |
| 37 | | | 43.18 [1.700] | | |
| 50 | | | 40.64 [1.600] | | |

| DISCRETE WIRE | | | | | |
|---|--|------------------------------|----------------------------|----------------|-------------------|
| CONTACT WIRE SIZE RANGE (AWG) | COLOR CODE (ON WIRE BARREL OF LOOSE PIECE CONTACTS ONLY) | INSULATION DIAMETER ACCEPTED | STRIP LENGTH ± 0.25 [.010] | | |
| | | | MILLIMETERS | DECIMAL INCHES | FRACTIONAL INCHES |
| OPEN BARREL CONTACTS (With or Without Insulation Support) | | | | | |
| 32-28 | --- | 0.76-1.02 [.030-.040] | 2.39 | .094 | 3/32 |
| 28-24 | BLUE | 1.73 [.068] Max | 2.77 | .109 | 7/64 |
| | BLACK | 1.27-1.52 [.050-.060] | 2.39 | .094 | 3/32 |
| 26-22 | YELLOW | 0.76-1.02 [.030-.040] | | | |
| 24-20 | RED | 1.27 [.050] Max | 2.77 | .109 | 7/64 |
| | | 1.73 [.068] Max | 2.39 | .094 | 3/32 |
| 22-18 | GREEN | 1.27-1.52 [.050-.060] | 2.77 | .109 | 7/64 |
| 18 and Smaller | None | None Specified | 3.96 | .156 | 9/64 |

Figure 2

3.3. Crimped Contact Requirements

Contact shall be located in desired tooling and crimped according to the instructions packaged with that tooling. See Section 5, TOOLING of this document for details on tooling options and instructional materials.



Wire insulation shall NOT be cut or broken during the crimping operation, nor shall the insulation be crimped into the contact wire barrel. Reasonable care should be taken by tooling operators to provide undamaged wire terminations.

A. Contact Crimp Barrel Configurations

The contact wire barrel shall be crimped to an F-crimp configuration as shown in Section X-X of Figure 3. The insulation barrel (when present) shall be crimped to an O-crimp configuration. Refer to the table in Figure 3 for crimp dimensions.

B. Contact Crimp Features

Figure 3 shows a typical contact as it should appear after crimping. Although a pin contact with insulation barrel is shown, the requirements apply equally to socket contacts and to contacts not having an insulation barrel.

1. Crimp Location

For optimum crimp effectiveness, the crimp must be within the area shown and must meet the crimp requirements provided in Figure 3. Effective crimp length shall be no less than the dimension given in Figure 3 and is defined as that portion of the wire barrel, excluding bellmouth(s), fully formed by the crimping tool. Instructions for adjusting, repairing, and inspecting tools are packaged with the tools.

2. Conductor Extension

The conductor may extend beyond the wire barrel to the maximum shown.

3. Wire Barrel Seam

The wire barrel seam must be closed with no evidence of loose wire strands visible in the seam.

4. Conductor/Insulation

The conductor and insulation must both be visible in the area between the insulation barrel and the wire barrel.

5. Bellmouth

Front and rear bellmouths shall be formed and adhere to the dimensions given.

6. Cutoff Tab

The cutoff tab shall be cut to the dimensions shown.

7. Burrs

The cutoff burr shall not exceed the dimensions shown.

8. Flash

The wire barrel flash shall not exceed the dimensions shown in Section X-X.

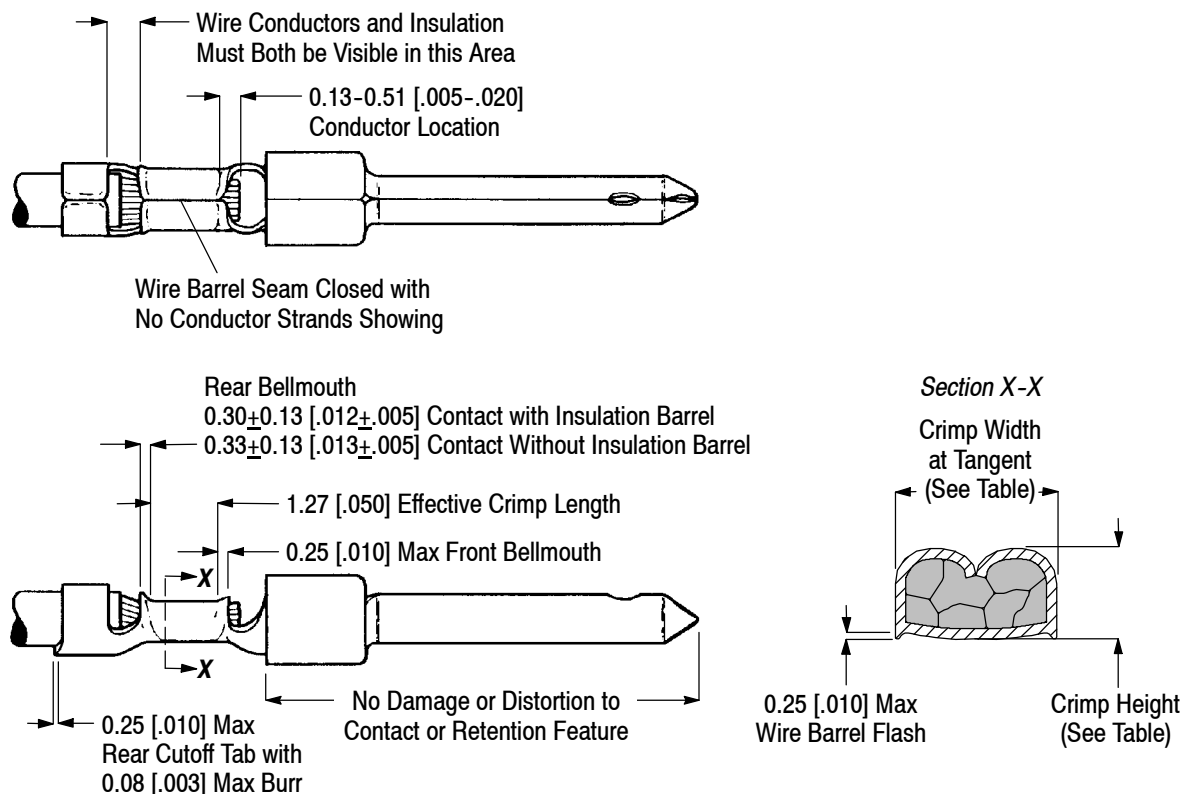


Figure 3 (cont'd)

HAND TOOL WIRE CRIMP DIMENSIONS

| WIRE SIZE RANGE (AWG) | WIRE INSUL DIA ACCEPTED | SIZE OF WIRE APPLIED | WIRE BARREL CRIMP | | INSULATION BARREL CRIMP | | |
|-----------------------|--------------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------------|-----------------------|
| | | | HEIGHT RANGE | WIDTH | WIDTH (Ref) | HEIGHT (Ref) | |
| 32-28 | 0.76-1.02 [.030-.040] | 32 | 0.58-0.46 [.023-.018] | 0.84 [.033] | 1.35-1.57 [.053-.062] | 0.64-1.93 [.025-.076] | |
| | | 30 | 0.61-0.46 [.024-.018] | | | | |
| | | 28 | 0.63-0.51 [.025-.020] | | | | |
| 28-24 | 1.73 [.068] Max | 28 | 0.47-0.57 [.0185-.0225] | 1.40 [.055] | --- | --- | |
| | | 26 | | | | | |
| | | 24 | | | | | |
| | 0.76-1.02 [.030-.040] | 1.27-1.52 [.050-.060] | 28 | 0.67-0.77 [.0265-.0305] | 1.07 [.042] | 1.40 [.055] | 1.27 [.050] |
| | | | 26 | | | | |
| | | | 24 | | | | |
| | | 28 | 1.40 [.055] | | | 0.76 [.030] | |
| | | 26 | | | | | |
| | | 24 | | | | | |
| 26-22 | 1.02-1.27 [.040-.050] | 26 | 0.71-0.81 [.028-.032] | 1.07 [.042] | 1.40 [.055] | 0.76 [.030] | |
| | | 24 | | | | | |
| | | 22 | | | | | 0.81-0.91 [.032-.036] |
| 24-20 | 1.73 [.068] Max | 24 | 0.70-0.80 [.0275-.0315] | 1.40 [.055] | --- | --- | |
| | | 22 | | | | | |
| | | 20 | | | | | |
| | 1.27-1.52 [.050-.060] | 24 | | | 1.40 [.055] | 1.27 [.050] | |
| | | 22 | | | | | |
| | | 20 | | | | | |
| 22-18 | 1.73 [.068] Max | 22 | 0.84-0.94 [.033-.037] | 1.57 [.062] | --- | --- | |
| | | 20 | | | | | |
| | | 18 | | | | | 1.07-1.17 [.042-.046] |

Figure 3 (cont'd)

AUTOMATIC MACHINE WIRE CRIMP DIMENSIONS

| WIRE SIZE RANGE (AWG) | WIRE INSUL DIA ACCEPTED | SIZE OF WIRE APPLIED | WIRE BARREL CRIMP | | | INSULATION BARREL CRIMP | |
|-----------------------|--------------------------|----------------------|-----------------------|-----------------------------|-------------|--------------------------|--------------------------|
| | | | HEIGHT RANGE | TENSILE STRENGTH N [LB] Min | WIDTH | WIDTH (Ref) | HEIGHT (Ref) |
| 32-28 | 0.76-1.02 [.030-.040] | 32 | 0.58-0.46 [.023-.018] | 8.01 [1.8] | 0.84 [.033] | 1.35-1.57 [.053-.062] | 0.64-1.93 [.025-.076] |
| | | 30 | 0.61-0.46 [.024-.018] | 10.01 [2.2] | | | |
| | | 28 | 0.63-0.51 [.025-.020] | 11.12 [2.8] | | | |
| 28-24 | 1.73 [.068] Max | 28 | 0.66-0.76 [.026-.030] | 12.01 [2.7] | 1.07 [.042] | --- | --- |
| | | 26 | 0.71-0.81 [.028-.032] | 20.02 [4.5] | | | |
| | | 24 | 0.76-0.86 [.030-.034] | 35.91 [8.0] | | | |
| | 1.27-1.52 [.050-.060] | 28 | 0.64-0.69 [.025-.027] | 12.01 [2.7] | | 1.35-1.57 [.053-.062] | 1.14-1.93 [.045-.076] |
| | | 26 | 0.71-0.76 [.028-.030] | 20.02 [4.5] | | | |
| | | 24 | 0.79-0.84 [.031-.033] | 35.91 [8.0] | | | |
| | 0.76-1.02 [.030-.040] | 28 | 0.64-0.69 [.025-.027] | 12.01 [2.7] | | 1.35-1.57 [.053-.062] | 0.64-1.93 [.025-.076] |
| | | 26 | 0.74-0.79 [.029-.031] | 20.02 [4.5] | | | |
| | | 24 | 0.79-0.84 [.031-.033] | 35.91 [8.0] | | | |
| 26-22 | 1.02-1.27 [.040-.050] | 26 | 0.71-0.81 [.028-.032] | 20.02 [4.5] | 1.07 [.042] | 1.35-1.57 [.053-.062] | 0.64-1.93 [.025-.076] |
| | | 24 | 0.76-0.86 [.030-.034] | 35.91 [8.0] | | | |
| | | 22 | 0.86-0.97 [.034-.038] | 53.38 [12.0] | | | |
| 24-20 | 1.73 [.068] Max | 24 | 0.76-0.86 [.030-.034] | 35.91 [8.0] | 1.40 [.055] | --- | --- |
| | | 22 | 0.76-0.86 [.030-.034] | 53.38 [12.0] | | | |
| | | 20 | 0.76-0.86 [.030-.034] | 88.96 [20.0] | | | |
| | 1.27-1.52 [.050-.060] | 24 | 0.76-0.86 [.030-.034] | 35.91 [8.0] | | 1.35-1.57 [.053-.062] | 1.14-1.93 [.045-.076] |
| | | 22 | 0.76-0.86 [.030-.034] | 53.38 [12.0] | | | |
| | | 20 | 0.76-0.86 [.030-.034] | 88.96 [20.0] | | | |
| 22-18 | 1.73 [.068] Max | 22 | 0.84-0.94 [.033-.037] | 53.38 [12.0] | 1.57 [.062] | --- | --- |
| | | 20 | 0.89-0.99 [.035-.039] | 88.96 [20.0] | | | |
| | | 18 | 1.07-1.17 [.042-.046] | 120.10 [27.0] | | | |

Figure 3 (end)

3.4. Crimped Contact Straightness

A. Twist or Roll

The crimped wire and insulation barrels must be aligned with the un-crimped portion of the contact to within the limit shown in Figure 4.

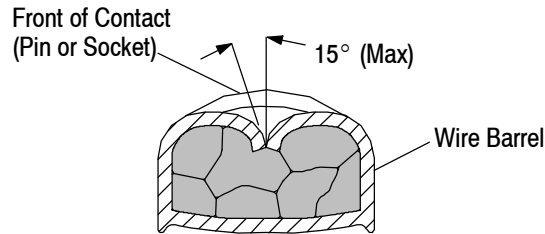
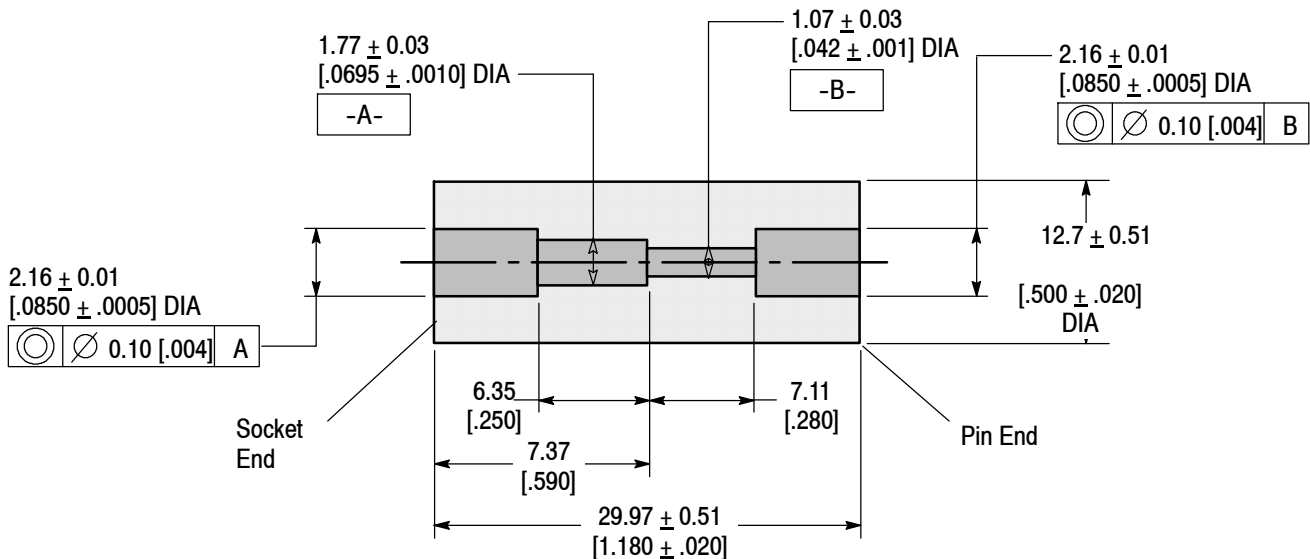


Figure 4

B. Straightness

Test questionable contacts using a straightness gage manufactured to the specifications of Figure 5. To be considered acceptable for use, a contact must fully enter the gage without binding.



NOTES: Material Tool Steel, AISI Type 01 or 02
 Hardness Rockwell B99 Maximum
 Finish Black Oxide

Figure 5

3.5. Solder Cup Contacts

Observe the guidelines and procedures described in Instruction Sheet 408-7799 when solder cup contacts are required. Solder, clean, and dry all wire leads to contacts according to the following:

A. Flux Selection

Wire lead and contact wire barrel interior shall be fluxed prior to soldering using a mildly active rosin. Flux must be compatible with manufacturing, safety, and health guidelines.

B. Cleaning

After cleaning, removal of fluxes, residues, and activators is mandatory. Cleaning procedures and solvents depend on the type of flux used. See Figure 6.



Consideration must be given to toxicity and other safety and health requirements as recommended in the Material Safety Data Sheet supplied by the solder cleaning solvent manufacturer.

| CLEANER | | TIME (Minutes) | TEMPERATURES (Maximum) | |
|-------------------|---------|-------------------|------------------------|------------|
| NAME | TYPE | | CELSIUS | FAHRENHEIT |
| Alpha 2110 | Aqueous | 1 | 132 | 270 |
| Bioact EC-7 | Solvent | 5 | 100 | 212 |
| Butyl Carbitol | Solvent | 1 | Room Ambient | |
| Isopropyl Alcohol | Solvent | 5 | 100 | 212 |
| Kester 5778 | Aqueous | 5 | 100 | 212 |
| Kester 5779 | Aqueous | 5 | 100 | 212 |
| Loncoterge 520 | Aqueous | 5 | 100 | 212 |
| Loncoterge 530 | Aqueous | 5 | 100 | 212 |
| Terpene Solvent | Solvent | 5 | 100 | 212 |

Figure 6

C. Drying

When drying cleaned assemblies, DO NOT exceed recommended temperature limitations. Excessive temperatures may cause degradation of the connector used as a stabilizer during the soldering process.

D. Soldering Guideline

Manual 402-40 is available upon request and can be used as a guide in soldering. This manual gives various flux types and characteristics, commercial designation, and flux removal procedures. A checklist is included in the manual to aid in obtaining information pertaining to soldering problems.

3.6. Posted Contacts

Pin and socket contacts having 0.64 mm [.025 in.] square technology posted aft ends are available to fit HD-20 connectors. Posts 3.18 mm [.125 in.], 4.78 mm [.188 in.], 10.80 mm [.425 in.], and 16.54 mm [.651 in.] in length are offered, allowing a variety of mating or grounding options. When inserting posted contacts into housings, be careful to hold the contact by the transition flange. See Figure 1.

3.7. Repair/Replace

Use Insertion/Extraction Tool 91285-1 (Instruction Sheet 408-9404) to remove individual contacts from housings for replacement or for relocation to another housing cavity. Damaged or worn contacts may be replaced provided there is sufficient slack, after restripping the wire, to insert the new contact.



DO NOT re-use damaged or worn contacts. Instead, replace them with new contacts and discard the old ones.

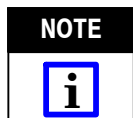
4. QUALIFICATION

No qualifications or approvals are required for HD-20 Precision Formed Contacts.

5. TOOLING

HD-20 Precision Formed Contacts can be terminated to wire using hand, semi-automatic, or automatic crimping tools. Recommended tooling, and instructional material, is provided in Figure 7.

All hand tools and applicators include integral dies. The automatic machines that hold applicators are also listed in the table along with related documentation.



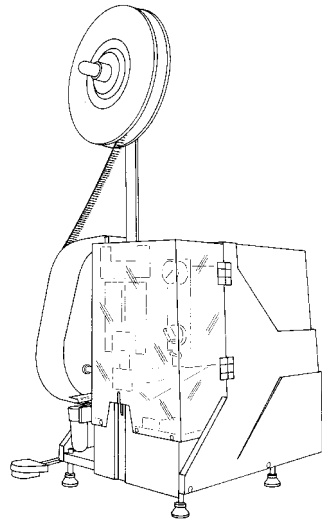
The Model "K" AMP-O-LECTRIC Terminating Machine 565435-5 has been superseded by the Model "G" Terminating Machine 354500-1 for new applications. For existing applications, the Model "K" is still recommended because of the large number of installed machines.

Alpha, Bioact, Butyl Carbitol, Kester, and Loncoterge are trademarks of their respective owners.

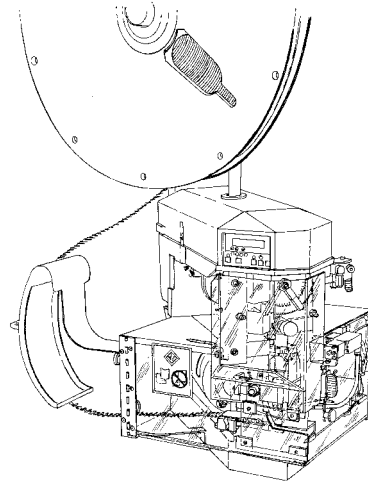
| WIRE SIZE RANGE (AWG) | WIRE INSULATION DIAMETER ACCEPTED | HAND TOOL (408-8547) | APPLICATOR [■] (408-8040) | AUTOMATIC MACHINE | MACHINE DOCUMENT |
|-----------------------|-----------------------------------|----------------------|------------------------------------|-------------------|------------------|
| 32-28 | 0.76-1.02 [.030-.040] | --- | 680659-2 | 354500-1 | 409-5842 |
| | | | | 565435-5 | 409-5128 |
| 28-24 | 1.73 [.068] Max | 91548-1 | 466506-2 | 565435-5 | 409-5128 |
| | | | 466903-1 | 1320895-1 | 409-10012 |
| | 1.27-1.52 [.050-.060] | 91549-1 | 466758-2 | 354500-1 | 409-5842 |
| | | | 466963-1 | 565435-5 | 409-5128 |
| | 0.76-1.02 [.030-.040] | 91503-1 or 91549-1 | 466423-1 | 1320895-1 | 409-10012 |
| | | | 466423-2 | 122500-2, -3 | 409-5852 |
| | | | | 356500-1, -2 | 409-5878 |
| | | | 466901-1 | 354500-1 | 409-5842 |
| 26-24 | 1.02-1.27 [.040-.050] | 91525-1 | 567036-1 | 122500-2, -3 | 409-5852 |
| | | | | 356500-1, -2 | 409-5878 |
| | | | | 662700-[] | 409-5884 |
| | | | | 1213400-1, -2 | 409-5878 |
| 22 | | | 567036-2 | 354500-1 | 409-5842 |
| | | | | 565435-5 | 409-5128 |
| 24-20 | 1.73 [.068] Max | 91548-1 | 466505-1 | 122500-2, -3 | 409-5852 |
| | | | 466505-2 | 356500-1, -2 | 409-5878 |
| | | | | 354500-1 | 409-5842 |
| | 1.27-1.52 [.050-.060] | 91503-1 | 466902-1 | 565435-5 | 409-5128 |
| | | | 466422-1 | 1320895-1 | 409-10012 |
| | | | 466422-2 | 122500-2, -3 | 409-5852 |
| 356500-1, -2 | 409-5878 | | | | |
| 22-20 | 1.73 [.068] Max | 91513-1 | 567033-1 or 567033-2 | 354500-1 | 409-5842 |
| | | | | 122500-2, -3 | 409-5852 |
| | | | | 356500-1, -2 | 409-5878 |
| | | | | 662700-[] | 409-5884 |
| | | | | 1213400-1, -2 | 409-5878 |
| 18 | | | | 354500-1 | 409-5842 |
| | | | | 565435-5 | 409-5128 |

■ In order to use the same applicator in the AMPOMATOR CLS IV Lead-Making Machine and the AMP-O-LECTRIC Terminating Machine, the feed cam and wire stripper must be changed. See the Customer Manuals supplied with these machines.

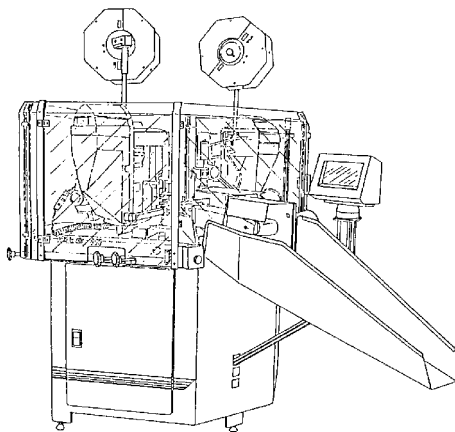
Figure 7 (cont'd)



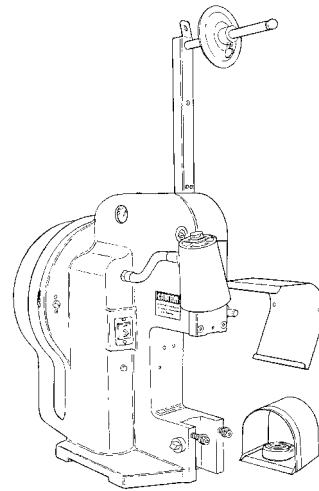
AMP-O-MATIC Side Feed Stripper-Crimper Model III Machine 1320895-[] (409-10012)



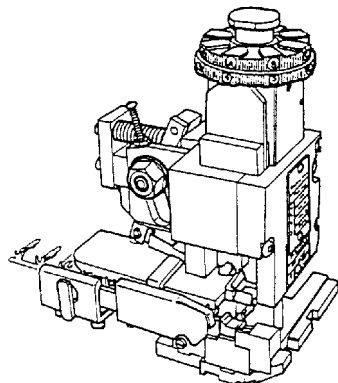
AMP-O-LECTRIC Model "G" Terminating Machine 354500-[] (409-5842)



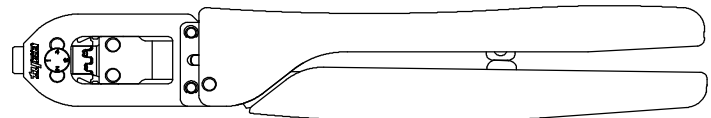
AMPOMATOR CLS IV+ Lead-Making Machine (409-5878)
AMPOMATOR CLS Model III-G Lead-Making Machine 122500-[] (409-5852)



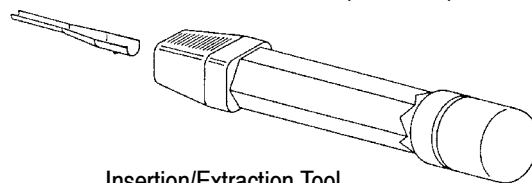
Basic AMP-O-LECTRIC Model "K" Terminating Machine 565435-5 (409-5128)



HD Quick Change Applicators (408-8040)



Typical Hand Tool (408-8547)



Insertion/Extraction Tool 91285-1 and Replacement Tip Kits 543382-[] (408-9404)

Figure 7 (end)

6. VISUAL AID

Figure 8 shows a typical application of HD-20 Precision Formed Contacts. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

NOTE: CRIMPED CONTACT WITH INSULATION BARREL SHOWN; SAME REQUIREMENTS ALSO APPLY TO CONTACTS WITHOUT INSULATION BARREL

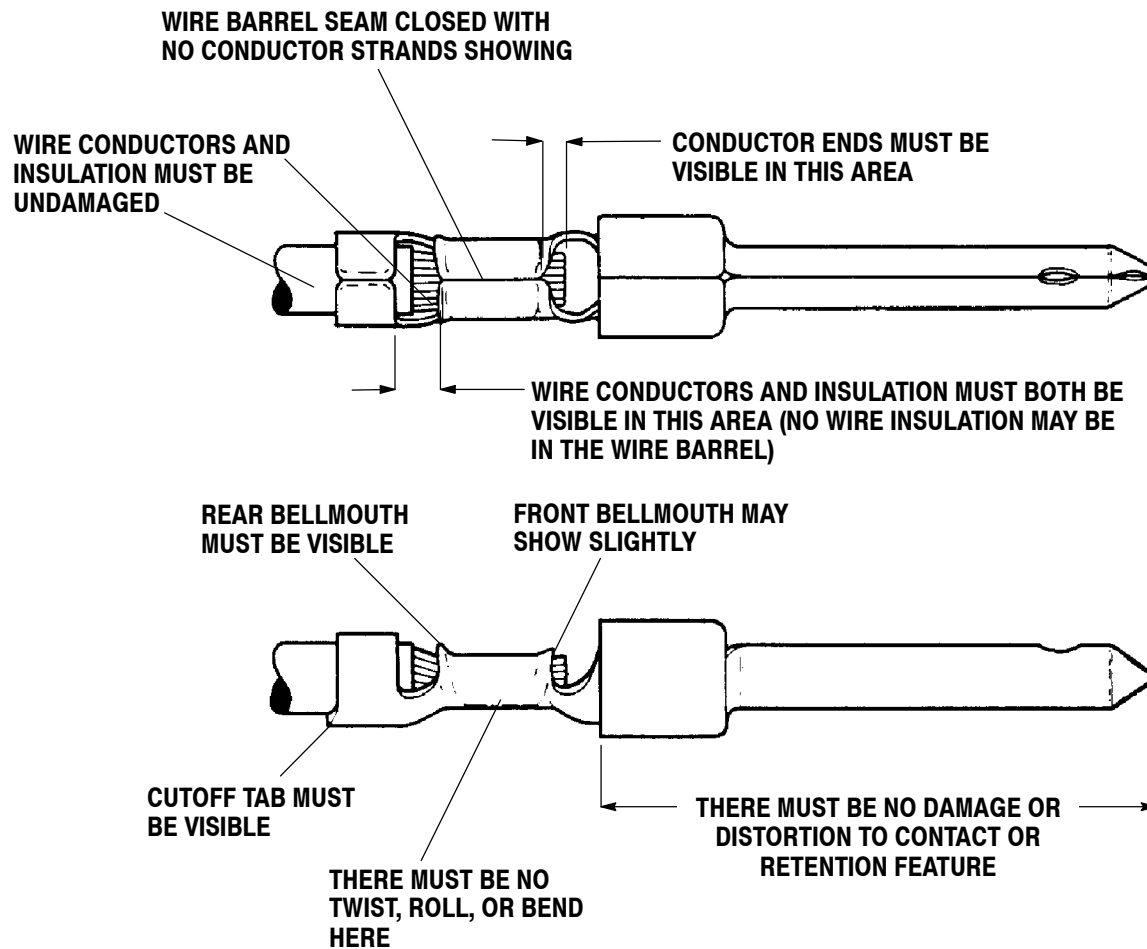


FIGURE 8. VISUAL AID