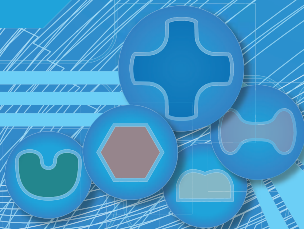




ASTRO TOOL CORP.
CONNECTOR ASSEMBLY TOOLING



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Meeting Your Connector Tool Needs

For many years, Astro Tool has been the leading name in connector service and assembly tooling. Astro has products, not only for military and aerospace programs, but also for other high tech fields such as computers, fiber optics and the medical industry.

At Astro, we know that quality, timely delivery and competitive pricing are what our customers demand and deserve. When your job requires crimping tools, insertion and removal tools or connector service kits, please remember that Astro has the tools of your trade. Our greatest asset is always our people, and everyone at Astro is dedicated to just one goal: customer satisfaction.

We are continually updating and adding to our product lines to meet the demanding complexities of today's market. Our engineering department is outfitted with the latest in computer design systems to aid the design of new connector service systems. Our manufacturing facilities use state-of-the-art computer numeric control machining centers that enable us to precisely produce sophisticated tooling while holding ever-tightening tolerances. Astro is ready for the future.

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OUR TOOLS AND SERVICES

- Astro Crimp Tool Products
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- Pneumatic Crimp Tools
- MIL-Spec Tool Kits
- Custom Tool Kits
- Free Cross Reference Services

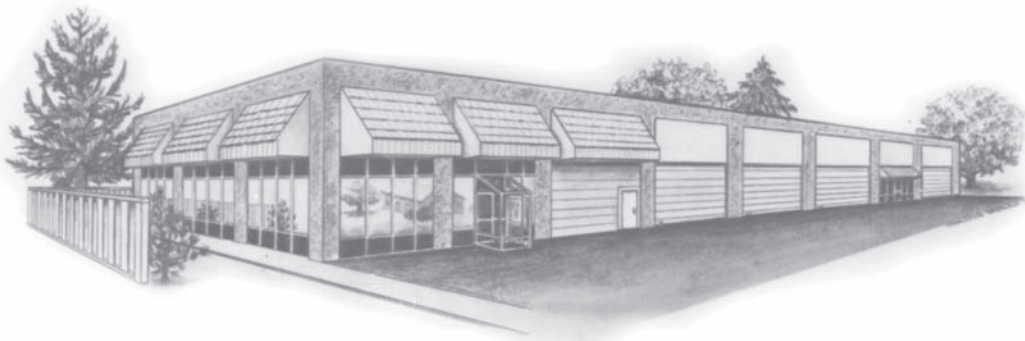
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NOTICE

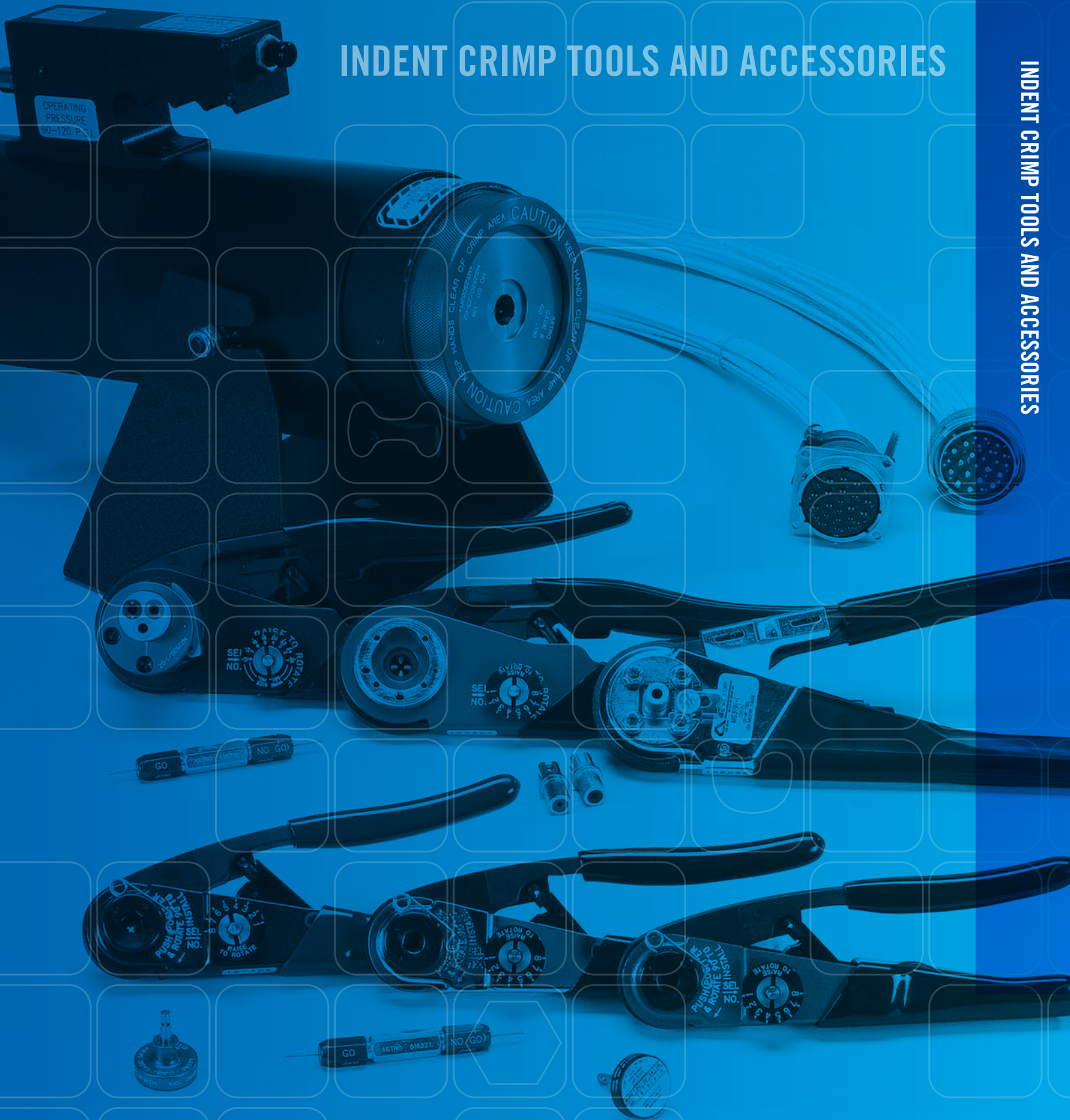
The tooling suggested herein may or may not cover a user's specific contract or manufacturing requirements. It is the user's responsibility to carry out sufficient testing to verify the suitability of the Astro product selected for the specific requirements of each particular application.

All Astro products are made in the USA.



INDENT CRIMP TOOLS AND ACCESSORIES

INDENT CRIMP TOOLS AND ACCESSORIES



Crimping Pin and Socket Contacts

CRIMPING

Crimping may be defined as the art of joining a conductor to a pin or socket contact by controlled compression and displacement of metal. It has been used for many years.

In a good crimp joint, there is a mutual metal flow causing symmetrical distortion of wire strands and contact material. The mil cross-sectional area is but slightly reduced and all voids are practically eliminated. Such a joint is similar to a cold weld. Mechanical strength and good electrical continuity are established. Because of the new environments to which electrical connectors are subjected, there has been a drastic change in thinking relative to the use of precision crimp joints in preference to solder.

CRIMPING CONFIGURATIONS

There are many different types of crimps employed today. These range from the terminal fold-over tab type of crimp to the single indent crimp, the dual indenter crimp, the three indenter crimp, hex crimps, and, finally, the MIL standard four indenter crimp. The four indenter crimp (Fig. 1) provides the most uniform displacement of wire and contact material. The wire strands and the contact material are formed together in a solid mass with little or no reduction of the mil area of the wire strands. A minimum of voids exists and very little extrusion of the wire strands takes place.

The four indenter crimp principle has been used to produce a variety of impressions, the most common being the “bathtub” and “octadent” (also called double indent) (Fig. 2) The octadent configuration has been chosen by the Military for use in the M22520/1 and /2 tools.

CRIMPING CHARACTERISTICS

Connectors utilizing crimping contacts usually permit the removal of these contacts several times so that modification, circuit changes, or replacement of contacts may be made with little difficulty and with the same quality assurance as in production line assembly. Crimping may be accomplished either with hand tools, power tools, or automated power tools. Repeatability of the crimp operation is characteristic provided precision crimping tools are employed. These tools must be capable of being gaged to insure that proper crimp depths are maintained. Inspection holes in each contact permit quality control personnel to view the wire strand ends thereby assuring that the conductor is properly positioned in the crimp barrel.

MIL-DTL-22520

This specification covers all the requirements for crimping tools used on removable type contacts in electrical connectors.

CRIMP DEPTH DETERMINATION

Having resolved an indenter design, the determination of crimp depth range must be established for each application. There are many factors which contribute to the selection of the proper indenter setting. These are primarily related to contact material and dimensions as well as wire type and size.

The proper crimp depth for a given contact is the one that yields the best mechanical and electrical joint. To determine this setting, many contacts of the same type are crimped though a range of indenter settings from too loose to too tight. The crimped contacts are then subjected to tensile and voltage drop tests.

WIRE PREPARATION

Proper wire preparation also plays an important part in making a good crimp joint. There are two popular methods of wire stripping — mechanical and thermal. During the mechanical stripping process, extreme care must be taken to avoid nicking or removing wire strands, otherwise a loss of tensile strength will result. Conversely, if the insulation is not completely removed, erratic values may be obtained. Heat stripping eliminates the danger of nicking strands. However, depending on the type of insulation being stripped, too much heat can cause actual charring of the insulation or decompose the insulation with the evolution of corrosive gases which react with the conductor platings. There is also a possibility of local annealing of the conductor. Too little heat can deposit an insulation film which can act as a lubricant. Any of these conditions can affect tensile results. Wire preparation is, therefore, another area that requires control if proper tensiles are to be achieved with a wire-contact combination.

Before making a tensile test it is also important that the stripped length of the wire be checked to ensure that the wire extends all the way into the contact wire barrel. During the tensile test it is necessary for the uncrimped end of the wire to be held in such a way that the pull force is evenly distributed to all the strands.

TENSILE TESTING

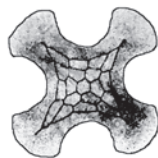
Tensile testing is a controlled pull test on the crimp joint to determine its mechanical strength. It is a destructive test which usually results in wire breakage in the crimped barrel, the wire pulling out of the crimped barrel, or wire breakage outside of the crimped area. The method and device used to conduct this test have a direct bearing on the results obtained. Per specification, the testing device pulls at the rate of one inch per minute. During the tensile test, the wire is elongating. The breakage or separation point, therefore, is associated with not only the pull force but also the rate of increase of this force.

Tensile curves are plotted for each contact and wire combination. They will usually differ, depending on the type of wire, plating, size of wire, and variations in contact design and material. A desirable tensile range must be determined for each of these combinations.

MILLIVOLT DROP

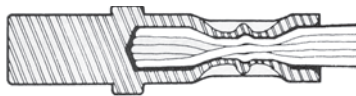
Millivolt drop tests are performed across the crimp joint to determine the electrical characteristics. The test current is passed through the contacts and voltage drop is measured from a point on the shoulder of the contact to a point on the wire. Voltage drop values under the maximum allowable indicate a good electrical joint.

FIG 1



4-Indenter Crimp
Cross-section
Across Axis

FIG 2



Octadent Crimp —
Horizontal Cross-section



VISUAL INSPECTION

Each contact is inspected under a microscope to make certain the indenture does not crack or tear the base metal, or cause excessive distortion of the contact.

CONTROLLING CRIMP DEPTH

From the tensile curves, a known crimp depth range is established. It is imperative, therefore, that the crimp tool settings be within the established tolerance.

To insure full closure of the tool handles and positive bottoming, it is necessary that tools be cycle controlled. This is accomplished by the use of a precision ratchet device which releases the handles at the positive bottoming position within specification tolerances. This release point and positive bottoming are applicable to all contact sizes.

MEASURING CRIMP DEPTH (GAGING)

Too loose a crimp setting will result in wire pullout and high millivolt drop (high resistance). Too tight a setting will nick the wire strands causing low tensiles and wire breakage within the contact.

Positive bottoming tools can readily be gaged by selecting gage pins dimensioned to the end limits of the known crimp range of a given contact.

AXIAL DEFORMATION

During the crimping process considerable force is applied and material displacement takes place, which may result in axial deformation of the contact. The following factors contribute to axial deformation of contacts:

1. Contact material and contact hardness.
2. Crimp barrel wall thickness.
3. Concentricity of conductor hole to O.D. of crimp barrel.
4. If an insulation support is included on the contact, the concentricity of this support (I.D. and O.D.) with respect to the other diameters in the contact.
5. Crimp depth - the deeper the crimp the greater the possibility of contact bending.
6. Conductor characteristics - conductor hardness, number of strands, size of wire, bunching of strands, the lay of the conductors, plating or the use of solid conductor.
7. The condition of the indenters - indenters which are not uniformly dimensioned or aligned or which have extreme variation in surface condition can cause contact bending.
8. The condition of the crimping tool - a worn crimping tool can contribute to contact bending.
9. Method of contact location and support - improperly supporting or positioning the contact in the tool can result in contact bending.
10. Method of measuring axial deformation - we have found that this is one of the least understood items relating to the crimp tool specification.

MIL-DTL-22520 is specific in defining and evaluating the axial deformation of contacts. This paragraph allows the following deformation:

FIG. 3

Contact Size	Contact Deformation
20 & smaller	.011 TIR
16	.012 TIR
12	.012 TIR

The TIR allowed includes a maximum of .005 TIR assignable to the contact during its manufacture. (TIR is an abbreviation for Total Indicator Reading and is a measure of the total deviation from a true center line when the item being measured is rotated through 360 °.)

COMPRESSION FORCES

Crimping compression forces are directly related to: A. Indenter Configuration; B. The Amount of Leverage in a Crimping Tool; C. Crimp Depth Required for Satisfactory Results; D. Contact Hardness and Contact-Conductor Combinations.

A. Indenter Configuration

MS drawings are specific as to indenter configuration of the Class I crimping tool. It is possible to change the shape of the indenters to reduce frontal area and thus reduce crimping forces. If the reduction of compression forces was the only factor involved, a knife blade edge on an indenter, or a conical tip shape would be the most desirable configuration. But this would result in cracked contacts, damage to plating, high wire embrittlement because of the concentrated stress of a small crimp area, and would also result in marginal tensile values.

B. The Amount of Leverage in a Crimping Tool

Leverage or linkage systems could be devised to minimize the amount of crimp compression forces. Archimedes' old adage could apply here wherein he says, "Give me a place to stand and to rest my lever on and I can move the Earth." From a practical viewpoint, however, the geometry of Class I tools under MIL-T-22520 are specific in tool length and width.

C. Crimp Depth Required for Satisfactory Results

Another way to reduce compression forces is to vary crimp depth. MS drawings are specific in designating crimp depths. It is understandable that the less the indenters indent the lower the compression forces involved. On the other hand, if the tool does not indent as deeply as specified, the possibility exists that sub-marginal or marginal tensile values will result.

D. Contact Hardness and Contact-Conductor Combinations

Contact material is definitely a factor contributing to high compression forces. Some contacts are made of hard material; some contacts have thick walls and some contacts are required to cover a range of conductors, all of which could involve high crimping forces. It is felt that an analysis of these conditions and an attempt to make them compatible with the crimping tool could facilitate the reduction of compression forces.

As can be seen from this brief review of crimping, many factors influence the effectiveness of a crimped joint. However, a good crimping tool compensates for many of these factors by providing proper crimp depths, resulting in termination having high tensile strength, low millivolt drop, and minimum contact deformation. With the use of a well-engineered tool, crimping becomes one of the most reliable methods of wire termination.

A glossary of connector terms is available at www.astrotool.com.



Standard Step Adjustable Crimp Tool 615708 (M22520/1-01)



- 8 indent crimp
- Dial selectable
- Uses turret and single position heads
- Cycle controlled ratchet

MS #.	ASTRO TOOL #	USAGE/DESCRIPTION	NSN.
M22520/3-1	615716	Gage For /1-01 /2-01	5220-00-165-7604
M22520/1-01	615708	Tool Frame	5120-00-165-3912
M22520/1-02	615709	Turret	5120-00-016-6382
M22520/1-03	615710	Turret	5120-00-016-6554
M22520/1-04	615711	Turret	5120-00-016-7582
M22520/1-05	615712	Universal Positioner	5120-00-165-3911
M22520/1-06	615713	Positioner	5120-00-016-7647
M22520/1-07	615714	Positioner	5120-00-016-7651
M22520/1-08	615715	Turret	5120-00-016-7654
M22520/1-09	615821	Positioner	5120-00-132-5039
M22520/1-10	615822	Positioner	5120-00-132-5095
M22520/1-11	616406	Positioner	5120-01-127-5231
M22520/1-12	616407	Turret	5120-01-036-9220
M22520/1-13	616408	Turret	5120-01-036-9221
M22520/1-14	616409	Turret	5120-01-036-9222
M22520/1-15	616410	Positioner	5120-01-036-9223
M22520/1-16	620172	Positioner	5120-01-075-8138
M22520/1-17	620537	Positioner	

The **Astro 615708** is qualified to MIL-DTL-22520/1. This dial selectable 8-step tool has extensive applications within the wire barrel sizes 12-22 and wire sizes 12-26 AWG. This tool produces an eight indent crimp configuration which provides maximum tensile strength for both MS and proprietary contacts when used with wire of various compositions.

The beauty of this tool is in the ease of its use. The operator simply has to attach the appropriate turret head, or universal positioner, to the tool and then set the selector to the desired step for the wire being used. The ratchet is designed to ensure a complete cycle of the tool. A complete and accurate crimp is obtained each and every time, with no partial crimps.

The **615708** tool is designed to be used with a turret head, a positioner or a universal head. These heads are easily attached with the use of built in hex socket screws. A data plate is permanently attached to each head. The data plate lists the contacts, for which the head was designed, along with selector settings that correspond to the wire being used.

Astro recommends that all of its tools be gaged periodically, to assure accurate calibration. A gage 615716 (M22520/3-1) is available for this purpose. See page 9.

The **615708** tool is 9¼ inches long and weighs approximately 20 ounces.

The **615708** is available in a pneumatic version, P/N APC708, on page 23.

An adjustable positioner is available, P/N 615712 and 615712-1.

A wide variety of Turret Heads and Positioners are available, in addition to those listed. Please contact factory for additional information.

Turret and Positioner Selection Charts for MIL-C-39029/AS39029 Contacts on page 9.



Miniature Step Adjustable Crimp Tool 615717 (M22520/2-01)



- 8 indent crimp
- Dial selectable
- Uses bayonet positioners
- Cycle controlled ratchet

The MIL-DTL-22520/2 qualified **Astro 615717** miniature 8-step adjustable hand crimping tool's 8-indent crimp configuration provides excellent results on contacts sizes 20-28 and wire sizes 20-32 AWG.

A wide variety of MS and proprietary contacts and wire compositions can be crimped by simply attaching a positioner in the bayonet-type socket and adjusting the selector to one of the eight preselected settings. The tool is equipped with a positive ratchet that requires the completion of the crimp cycle to ensure the integrity of each crimp.

Astro offers a wide variety of positioners to accommodate various mil-spec and proprietary contacts. Each positioner has a data plate which provides the correct crimp depth setting for the contact and wire combination. Astro also offers two adjustable positioners (615179 & 615179-1) that allow you to adjust the crimp location according to your specific needs. Custom positioners are available upon request.

Astro recommends the periodic gaging of all its tools. A gage (615716, M22520/3-1) is available for this purpose.

The **615717** is 7½ inches long and weighs 11 ounces.

The **615717** is available in a pneumatic version, P/N 621100, on page 26.

For ultra precise crimps on miniature and subminiature contacts with very thin wire barrel dimensions, Astro offers the 620613. This tool is built from the same tool frame as the 615717 (M22520/2-01) and utilizes the same positioners.

A wide variety of Positioners are available, in addition to those listed. Please contact factory for additional information.

MS #.	ASTRO TOOL #.	DESCRIPTION	NSN
M22520/2-01	615717	Tool Frame	5120-00-165-3910
M22520/2-02	615718	Positioner	5120-00-165-3913
M22520/2-03	615719	Positioner	5120-00-016-7657
M22520/2-04	615720	Positioner	5120-00-017-3640
M22520/2-05	615721	Positioner	5120-00-017-3742
M22520/2-06	615722	Positioner	5120-00-017-3809
M22520/2-07	615723	Positioner	5120-00-017-3827
M22520/2-08	615724	Positioner	5120-00-017-3921
M22520/2-09	615725	Positioner	5120-00-017-3927
M22520/2-10	615726	Positioner	5120-00-017-3932
M22520/2-11	615727	Positioner	5120-00-017-3934
M22520/2-12	615729	Positioner	5120-00-017-3935
M22520/2-13	616031	Positioner	5120-00-132-6939
M22520/2-14	616032	Positioner	5120-00-132-6962
M22520/2-15	616033	Positioner	5120-00-132-6978
M22520/2-16	616034	Positioner	5120-00-132-7868
M22520/2-17	616035	Positioner	5120-00-132-7893
M22520/2-18	616036	Positioner	5120-00-132-7894
M22520/2-19	616037	Positioner	5120-00-132-7872
M22520/2-20	616038	Positioner	5120-00-132-9004
M22520/2-21	616039	Positioner	5120-00-133-0029
M22520/2-22	615448	Positioner	5120-01-106-3737
M22520/2-23	616191	Positioner	5120-01-117-3905
M22520/2-24	616260	Positioner	5120-00-348-7531
M22520/2-25	616411	Positioner	5120-00-132-6932
M22520/2-26	616412	Positioner	5120-00-133-3263
M22520/2-27	616413	Positioner	
M22520/2-28	616414	Positioner	5120-00-124-3678
M22520/2-29	616415	Positioner	5120-00-124-3682
M22520/2-30	616416	Positioner	5120-01-117-3905
M22520/2-31	616417	Positioner	
M22520/2-32	620261	Positioner	
M22520/2-33	615257	Positioner	
M22520/2-34	620499	Positioner	
M22520/2-35	620517	Positioner	
M22520/2-36	616429	Positioner	

Positioner Selection Charts for MIL-C-39029/AS39029 Contacts on page 9.



Intermediate Step Adjustable Tool 616336 (M22520/7-01)



- 8 indent crimp
- Dial selectable
- Cycle controlled ratchet
- Lightweight and easy to use
- Uses bayonet positioners

The **Astro 616336** is qualified to MIL-DTL-22520/7.

This tool is an 8-Step Selectable with varying applications within the wire barrel sizes 16-22 and wire sizes 16-28 AWG.

The **616336** produces an 8 indent crimp configuration, which provides excellent results on MS and proprietary contacts and wire of various compositions.

The **616336** tool is designed to be used with a positioner that features easy attachment with a bayonet socket mount. A data plate is permanently attached to each positioner. This data plate provides the correct selector setting to be used for each contact and wire combinations. This helps to eliminate error in choosing the proper crimp depth.

Astro recommends that all of its tools be gaged periodically to assure accurate calibration. A gage 616337 (M22520/3-3) is available for this purpose. See page 9.

The **616336** tool is 7¼ inches long and weighs approximately 11 ounces.

The **616336** is available in a pneumatic version, P/N 621101, on page 26.

An adjustable positioner is available P/N 642020.

A wide variety of Positioners are available, in addition to those listed. Please contact factory for additional information.

MS #.	ASTRO TOOL #	USAGE/DESCRIPTION	NSN.
M22520/7-01	616336	Tool Frame	5120-00-133-1747
M22520/7-02	616327	Positioner	5120-00-133-1769
M22520/7-03	616328	Positioner	5120-00-133-1770
M22520/7-04	616329	Positioner	5120-00-133-1772
M22520/7-05	616330	Positioner	5120-00-133-1778
M22520/7-06	616331	Positioner	5120-00-133-1781
M22520/7-07	616332	Positioner	5120-00-133-1782
M22520/7-08	616333	Positioner	5120-00-133-1785
M22520/7-09	616334	Positioner	5120-00-133-1790
M22520/7-10	616335	Positioner	5120-00-133-1792
M22520/7-11	620083	Positioner	5120-01-122-1201
M22520/7-12	620084	Positioner	5120-01-112-2925
M22520/7-13	620085	Positioner	5120-01-110-4472
M22520/3-3	616337	Gage	5220-00-338-0378

Positioner Selection Charts for MIL-C-39029/AS39029 Contacts on page 9.



Turret and Positioner Selection Charts for MIL-C-39029 / AS39029 Contacts

For M22520/1-01, M22520/2-01, M22520/7-01 Crimp Tools

PRODUCT LISTINGS

Contacts for Connector Family: MIL-C-5015 (MS 3450 Series/rear-release Type) and MIL-C-83723 Series II

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/30-16S-16	217	MS3163-16S-16 M83723-30T17	M22520/1-02	615709	SKT	16S	16	A/B
M39029/29-16-16	212	MS3162-16-16 M83723-29T16	M22520/1-02	615709	PIN	16	16	A/B
M39029/30-16-16	218	MS3163-16-16 M83723-30T16	M22520/1-02	615709	SKT	16	16	A/B
M39029/29-12-12	213	MS3162-12-12 M83723-29T12	M22520/1-02	615709	PIN	12	12	A/B
M39029/30-12-12	219	MS3163-12-12 M83723-30T12	M22520/1-02	615709	SKT	12	12	A/B

Contacts for Connector Families: MIL-C-26482 Series II, MIL-C-81703 Series III, MIL-C-83723 Series III, MIL-C-83733

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/4-20-20	110	M83723-33B20	M22520/2-02 M22520/1-02	615718 615709	PIN	20	20	A/B
M39029/5-20-20	115	M83723-34B20	M22520/2-02 M22520/1-02	615718 615709	SKT	20	20	A/B
M39029/4-16-16	111	M83723-33B16	M22520/1-02	615709	PIN	16	16	A/B
M39029/5-16-16	116	M83723-34B16	M22520/1-02	615709	SKT	16	16	A/B
M39029/4-16-20	112	-	M22520/1-02	615709	PIN	16	20	A/B
M39029/5-16-20	117	-	M22520/1-02	615709	SKT	16	20	A/B
M39029/4-12-12	113	M83723-34B12	M22520/1-02	615709	PIN	12	12	A/B
M39029/5-12-12	118	-	M22520/1-02	615709	SKT	12	16	A/B
M39029/4-12-16	111	-	M22520/1-02	615709	PIN	12	16	A/B
M39029/5-12-16	119	M83723-34B16	M22520/1-02	615709	SKT	12	16	A/B

Contacts for Connector Family: MIL-C-26500

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/31-241	241	MS24254-20P	M22520/2-02 M22520/1-02	615718 615709	PIN	20	20	A/B
M39029/32-260	260	MS24255-20S	M22520/2-02 M22520/1-02	615718 615709	SKT	20	20	A/B
M39029/31-229	229	MS24253-16P	M22520/1-02	615709	PIN	16	16	A/B
M39029/32-248	248	MS24255-16S	M22520/1-02	615709	SKT	16	16	A/B
M39029/31-235	235	MS24254-12P	M22520/1-02	615709	PIN	12	12	A/B
M39029/32-254	254	MS24255-12S	M22520/1-02	615709	SKT	12	12	A/B



Turret and Positioner Selection Charts for MIL-C-39029 / AS39029 Contacts

For M22520/1-01, M22520/2-01, M22520/7-01 Crimp Tools

Contacts for Connector Family: MIL-C-24308

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/64-369	369	M24308/11-1	M22520/2-08	615724	PIN	20	20	A/A
M39029/63-368	368	M24308/10-1	M22520/2-08	615724	SKT	20	20	A/A

Contacts for Connector Family: MIL-C-5015 (MS3400 Series/Front-Release Type)

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/44-288	288	MS90453-16-16	M22520/1-02	615709	PIN	16	16	A/B
M39029/45-295	295	MS90454-16-16	M22520/1-02	615709	SKT	16	16	A/B
M39029/44-287	287	MS90453-16-22	M22520/1-02	615709	PIN	16	22	A/B
M39029/45-294	294	MS90454-16-22	M22520/1-02	615709	SKT	16	22	A/B
M39029/44-290	290	MS90453-12-12	M22520/1-02	615709	PIN	12	12	A/B
M39029/45-297	297	MS90454-12-12	M22520/1-02	615709	SKT	12	12	A/B
M39029/44-289	289	MS90453-12-16	M22520/1-02	615709	PIN	12	16	A/B
M39029/45-296	296	MS90454-12-16	M22520/1-02	615709	SKT	12	16	A/B

Contacts for Connector Family: MIL-C-38999 Series I, III, IV

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/56-348	348	MS27655-22D MS27490-22D	M22520/2-07	615723	SKT	22	22D	A/B
M39029/56-349	349	MS27490-22M	M22520/2-07	615723	SKT	22	22M	A/B
M39029/56-350	350	MS27490-22	M22520/2-07	615723	SKT	22	22	A/B
M39029/56-351	351	MS27655-20 MS27490-20	M22520/2-10 M22520/1-04	615726 615711	SKT	20	20	A/B
M39029/56-352	352	MS27655-16 MS27490-16	M22520/1-04	615711	SKT	16	16	A/B
M39029/56-353	353	MS27655-12 MS27490-12	M22520/1-04	615711	SKT	12	12	A/B

Contacts for Connector Family: MIL-C-26482 Series I

Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/31-240	240	MS3192A20-20A	M22520/2-02 M22520/1-02	615718 615709	PIN	20	20	A/A
M39029/32-259	259	MS3193A20-20A	M22520/2-02 M22520/1-02	615718 615709	SKT	20	20	A/A
M39029/31-228	228	MS3192-16-16A	M22520/1-02	615709	PIN	16	16	A/A
M39029/32-247	247	MS3193-16-16A	M22520/1-02	615709	SKT	16	16	A/A
M39029/31-234	234	MS3192-12-12A	M22520/1-02	615709	PIN	12	12	A/A
M39029/32-253	253	MS3193-12-12A	M22520/1-02	615709	SKT	12	12	A/A



Turret and Positioner Selection Charts for MIL-C-39029 / AS39029 Contacts

For M22520/1-01, M22520/2-01, M22520/7-01 Crimp Tools

PRODUCT LISTINGS

Contacts for Connector Family: MIL-C-28840								
Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/83-450	450	M39029/83-20-22	M22520/34-02	620636	PIN	20	22	A/B
M39029/83-451	451	M39029/83-20-28	M22520/34-02	620636	PIN	20	28	A/B
M39029/84-452	452	M39029/84-20-22	M22520/34-02	620636	SKT	20	22	A/B
M39029/84-453	453	M39029/84-20-28	M22520/34-02	620636	SKT	20	28	A/B

Contacts for Connector Families: MIL-C-38999 Series I, II, III, IV, MIL-C-83733, MIL-C-24308, and MIL-C-55302/68/69/71/72/75								
Military Part #	BIN Code	Supersedes Military Part #	Positioner/ Turret Part #	Astro Tool #	Style	Mating End Size	Wire Barrel Size	Type/ Class
M39029/58-360	360	MS27494-22D MS27493-22D M24308/13-1	M22520/2-09	615725	PIN	22	22D	A/B
M39029/57-354	354	MS27492-22D MS27491-22D M24308/12-1	M22520/2-06	615722	SKT	22	22D	A/B
M39029/58-361	361	MS27494-22M MS27493-22M	M22520/2-09	615725	PIN	22	22M	A/B
M39029/57-355	355	MS27492-22M MS27491-22M	M22520/2-06	615722	SKT	22	22M	A/B
M39029/58-362	362	MS27494-22 MS27493-22	M22520/2-09	615725	PIN	22	22	A/B
M39029/57-356	356	MS27492-22 MS27491-22	M22520/2-06	615722	SKT	22	22	A/B
M39029/58-363	363	MS27494-20 MS27493-20	M22520/2-10 M22520/1-04	615726 615711	PIN	20	20	A/B
M39029/57-357	357	MS27492-20 MS27491-20	M22520/2-10 M22520/1-04	615726 615711	SKT	20	20	A/B
M39029/58-364	364	MS27494-16 MS27493-16	M22520/1-04	615711	PIN	16	16	A/B
M39029/57-358	358	MS27492-16 MS27491-16	M22520/1-04	615711	SKT	16	16	A/B
M39029/58-365	365	MS27494-12 MS27493-12	M22520/1-04	615711	PIN	12	12	A/B
M39029/57-359	359	MS27492-12 MS27491-12	M22520/1-04	615711	SKT	12	12	A/B

BIN (Basic identification number) code color bands, reading in sequence from wire barrel end of the contact. Each digit of the BIN code shall be designated on the contact by a color band in accordance with the following:

0-Black 2-Red 4-Yellow 6-Blue 8-Gray

1-Brown 3-Orange 5-Green 7-Violet 9-White

For contacts not listed above, please consult factory for proper tooling.



Heavy Duty Pneumatic Crimp Tool AMT23B (M22520/23-01)



- 8 indent crimp configuration
- Designed with safety in mind
- Meets all MIL-DTL-22520/23 requirements
- No extra booster required for large contacts
- Interchangeable dies and locators

The **AMT23B** takes all the work out of crimping those large contacts. Using interchangeable dies and locators, this tool crimps contact sizes 8 through 0000. The steady, uniform crimp force, provided by the air logic function delay, crimps even the largest of these contacts without cracking them. Unlike similar tools, **Astro's AMT23B** crimps its full range without using a booster adapter.

The **AMT23B** is designed with operator safety in mind. The air logic function delay allows adequate time to remove fingers from the crimp area before crimping begins.

This tool is easily portable and weighs less than 19 pounds. It operates on 80-120 P.S.I. and requires a regulated, filtered and lubricated air supply for optimal function. Astro offers the 11413 air regulator for this purpose. The tool comes with a ½ inch diameter air coupler for convenient quick disconnect.

NOTE: ASTRO WILL CUSTOM DESIGN DIES AND LOCATORS FOR YOUR SPECIAL REQUIREMENTS. WE ALSO OFFER A WIDE RANGE OF GAGES FOR USE WITH THIS TOOL. PLEASE CONSULT THE FACTORY FOR FURTHER DETAILS.

CHANGING DIES AND LOCATORS



1. Unscrew Retainer Ring.



2. Pull off Indenter Die Assembly by hand.



3. Pull out the Locator by hand.

AMT23B (M22520/23-01) Die & Locator Selection Chart

M22520/23-01 INTERCHANGEABLE DIES AND LOCATORS		
MIL #	DESCRIPTION	ASTRO #
M22520/23-01	Crimp Tool	AMT23B
M22520/23-02	Die Assy. #8	AMT23002DA
M22520/23-03	Die Assy. #6	AMT23003DA
M22520/23-04	Die Assy. #4	AMT23004DA
M22520/23-05	Die Assy. #1/0	AMT23005DA
M22520/23-06	Die Assy. #2/0	AMT23006DA
M22520/23-07	Die Assy. #4/0	AMT23007DA
M22520/23-09	Locator #8	AMT23009L
M22520/23-10	Locator #6	AMT23010L
M22520/23-11	Locator #4	AMT23011L
M22520/23-12	Locator #4,4N,4G	AMT23012L
M22520/23-13	Locator #1/0	AMT23013L
M22520/23-14	Locator #1/0,1/0N	AMT23014L
M22520/23-15	Locator #2/0,2/0N	AMT23015L
M22520/23-16	Locator #4/0,4/0N	AMT23016L

DIE ASSEMBLY GAGING LIMITS			
Part #	Contact Size	Die Gaging Limits	
		GO	NO GO
AMT23002DA	8	.130	.136
AMT23003DA	6	.171	.178
AMT23004DA	4	.195	.202
AMT23005DA	0	.325	.332
AMT23006DA	00	.351	.358
AMT23007DA	0000	.425	.432

GAGES	
GAGE #	DIE ASSEMBLY
AMTG2302	AMT23002DA
AMTG2303	AMT23003DA
AMTG2304	AMT23004DA
AMTG2305	AMT23005DA
AMTG2306	AMT23006DA
AMTG2307	AMT23007DA

CONTACT LOCATORS			
Part #	Contact Size	MS Contact #	
AMT23009L	8	M39029/29-8-8	M39029/29-214
		M39029/30-8-8	M39029/30-220
		MS90453-8-8	M39029/44-291
		MS90454-8-8	M39029/45-298
AMT23010L	6	MS90559-11	M39029/48-317
	6N	MS90559-12	M39029/48-318
	6G	MS90559-14	M39029/48-319
	6	MS90560-7	M39029/49-329
	6G	MS90560-8	M39029/49-330
AMT23011L	4	M39029/29-4-4	M39029/29-215
		M39029/30-4-4	M39029/30-221
		MS90453-4-4	M39029/44-292
		MS90454-4-4	M39029/45-299
AMT23012L	4	MS90559-8	M39029/48-320
	4N	MS90559-9	M39029/48-321
	4G	MS90559-13	M39029/48-322
	4	MS90560-5	M39029/49-331
	4G	MS90560-9	M39029/49-332
AMT23013L	1/0	M39029/29-0-0	M39029/29-216
		M39029/30-0-0	M39029/30-222
		MS90453-0-0	M39029/44-293
AMT23014L	1/0	MS90559-5	M39029/48-323
	1/0N	MS90559-6	M39029/48-324
	1/0	MS90560-3	M39029/49-333
AMT23015L	2/0	MS90559-3	M39029/48-325
	2/0N	MS90559-4	M39029/48-326
	2/0	MS90560-2	M39029/49-334
AMT23016L	4/0	MS90559-1	M39029/48-327
	4/0N	MS90559-2	M39029/48-328
	4/0	MS90560-1	M39029/49-335

Miniature Adjustable Crimp Tool 612596 (MS3198-1)

- 8 indent crimp
- Dial selectable
- Uses bayonet-style positioners
- Cycle controlled

The **Astro 612596** meets performance requirements for MS3198-1 and M22520/34-01. This lightweight compact tool uses MS3198, M22520/34, M22520/2 and proprietary bayonet-style positioners to crimp most pin and socket contacts smaller than size 20 to wires size 20 AWG and smaller.

The **612596** is step-adjustable to eight preselected crimp depths. The correct crimp depth is determined by using the data plate located on each positioner. This tool utilizes the same positive ratchet found on other Astro crimpers, which requires the completion of a crimp cycle before the handles will return to their open position. This feature ensures the integrity of every crimp.

Astro recommends the periodic gaging of all its crimping tools. For this purpose Astro offers the M22520/3-1 (615716) gage with the tool in the number 8 selector position. For use on M22520/34-01 applications Astro recommends using the M22520/35 (621064) gage with the crimp depth selector set on the number 6 setting.



For contacts not listed, please consult factory for proper tooling.

Contacts for Connector Families: MIL-C-26482 Series II, MIL-C-81703 Series III, MIL-C-83723 Series III, MIL-C-83733

Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/Turret Part #	Astro Positioner #
M39029/4-110	110	M83723-33B20 M39029/4-20-20	PIN	20	20		
M39029/5-115	115	M83723-34B20 M39029/5-20-20	SKT	20	20	M22520/2-02	615718
M39029/9-132 THRU M39029/9-136	132 THRU 136	M39029/9-20-20C1 THRU M39029/9-20-20C5	PIN	20	20	MS3198-1P MS3198-1PA	612759 613382
M39029/10-138 THRU M39029/10-142	138 THRU 142	M39029/9-20-20C1 THRU M39029/10-20-20C5	SKT	20	20		

Contacts for Connector Family: MIL-C-28840

Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/Turret Part #	Astro Positioner #
M39029/83-450	450	M39029/83-20-22	PIN	20	22	M22520/34-02	620636
M39029/83-451	451	M39029/83-20-28	PIN	20	28	M22520/34-02	620636
M39029/84-452	452	M39029/84-20-22	SKT	20	22	M22520/34-02	620636
M39029/84-453	453	M39029/84-20-28	SKT	20	28	M22520/34-02	620636

Contacts for Connector Family: MIL-C-21097

Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/Turret Part #	Astro Positioner #
M39029/9-01	--	----	SKT	20	20	MS3196-4P	613023



612596 (MS3198-1) Positioner Selection Charts

Contacts for Connector Families: MIL-C-38999 Series I, II, III, IV, MIL-C-83733, MIL-C-24308 & MIL-C-55302/68/69/71/72/75							
Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/ Turret Part #	Astro Positioner #
M39029/58-360	360	MS27494-22D MS27493-22D M24308/13-1	PIN	22	22D	M22520/2-09	615725
M39029/58-361	361	MS27494-22M MS27493-22M	PIN	22	22M	MS3196-8P	613642
M39029/58-362	362	MS27494-22 MS27493-22	PIN	22	22		
M39029/57-354	354	MS27492-22D MS27491-22D M24308/12-1	SKT	22	22D	M22520/2-06	615722
M39029/57-355	355	MS27492-22M MS27491-22M	SKT	22	22M	MS3196-6P	613640
M39029/58-363	363	MS27494-20 MS27493-20	PIN	20	20	M22520/2-10 MS3196-9P	615726 613643
M39029/57-357	357	MS27492-20 MS27491-20	SKT	20	20	M22520/2-10 MS3196-9P	615726 613643

Contacts for Connector Family: MIL-C-38999 Series I, III, IV							
Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/ Turret Part #	Astro Positioner #
M39029/56-349	349	MS27490-22M	SKT	22	22M	M22520/2-07	615723
M39029/56-350	350	MS27490-22	SKT	22	22	MS3198-7P	613641
M39029/56-351	351	MS27655-30 MS27490-20	SKT	20	20	M22520/2-10 MS3196-9P	615726 613643

Contacts for Connector Family: MIL-C-81511 Series I & II							
Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/ Turret Part #	Astro Positioner #
M39029/46-303	303	MS90460 A23-22	PIN	23	22	MS3196-2PA MS3196-2P	613381 612760
M39029/46-304	304	MS90460 B23-22	SKT	23	22		
M39029/47-313	313	MS90461 A23-22	PIN	23	22		
M39029/47-314	314	MS90461 B23-22	SKT	23	22		

Contacts for Connector Family: MIL-C-26500							
Military Part #	BIN Code	Supersedes Military Part #	Style: Pin or Socket	Mating End Size	Wire Barrel Size	Positioner/ Turret Part #	Astro Positioner #
M39029/31-241	241	MS24254-20P	PIN	20	20	M22520/2-02 MS3196-1P, MS3196-1PA	615718 612759, 613382
M39029/32-260	260	MS24255-20S	SKT	20	20	M22520/2-02 MS3198-1P, MS3198-1PA	615718 612759, 613382

BIN (Basic identification number) code color bands, reading in sequence from wire barrel end of the contact. Each digit of the BIN code shall be designated on the contact by a color band in accordance with the following:

0-Black 2-Red 4-Yellow 6-Blue 8-Gray
1-Brown 3-Orange 5-Green 7-Violet 9-White

Standard Self-Adjusting Crimp Tool MS3191



- 4 or 8 indent
- Cycle controlled ratchet
- No dial adjustment required

Description	MS Designation	Astro Cat. #
Frame Assembly	MS3191-A	11210
Crimp Tool	MS3191-1	10692
Crimp Tool	MS3191-2	11234
Positioner	MS3191-20A	11062
Positioner	MS3191-16A	2520-3
Positioner	MS3191-12A	2520-4
Positioner	MS3191-20B	10854-1
Positioner	MS3191-16B	10854-2

The **MS3191** series of tools still continue to set a standard of excellence for crimping tools. This series of crimping tools is one of the easiest to use. Simply selecting the proper positioner determines the crimp depth, crimp location and point of ratchet release.

The four or eight indent crimp provides a uniform displacement of wire and contact material, on contact sizes 12-20 and wire sizes 12-26 AWG.

As with all Astro pin and socket crimp tools, the **MS3191** series tools can be ordered with a variety of indenter configurations, including octadent (tool part number: 612600).

A large selection of positioners is available for this tool. If we do not have a positioner to meet your special needs, Astro will custom design and

manufacture positioners for you. Various tool-positioner combination packages are available. Extra positioners are conveniently stored in the tool handle. (See chart for details.)

A gage kit (part number ATK 6000 [MS3196-2]) is available for the recommended periodic gaging.

This tool weighs approximately 20 ounces and is 9½ inches long.

The following MS contacts can be crimped with the MS3191-A frame assembly when used with the positioners specified:

For Locators in addition to those listed please consult factory.

Crimp Tool Assembly Part No .	Consists of	
	Crimp Tool Frame	Positioners
MS3191-1 (10692)	MS3191-A (11210)	MS3191-20A MS3191-16A MS3191-12A
MS3191-2 (11234)	MS3191-A (11210)	MS3191-20B MS3191-16B

Astro Locator Part # .	Locator MS Designation
11062	MS3191-20A
2520-3	MS3191-16A
2520-4	MS3191-12A
10854-1	MS3191-20B
10854-2	MS3191-16B
3538-3	MS3191-20C
11045-1	MS3191-22D
11045-2	MS3191-16D



8-Step Adjustable Crimp Tool EUS309



- 8 indent crimp
- Dial selectable
- Cycle controlled ratchet
- Lightweight and easy to use
- Uses bayonet positioners

Gaging Information (Dimension in Inches)

Selector Setting #	Go Size .0001	No Go Size .0001
1	.0360	.0410
2	.0450	.0500
3	.0520	.0570
4	.0610	.0660
5	.0690	.0740
6	.0760	.0810
7	.0860	.0950
8	.1000	.1100

The **ASTRO EUS309** is used to crimp powered D sub contacts but is not limited to this function.

It is an 8 step adjustable crimp tool, cycled controlled and capable of crimping wire barrel sizes 12-20. Its crimp range is slightly larger than that of the 615708 (M22520/1-01) and utilizes the same basic components.

It has a distinctive red look and is the same size and weight as the 615708 (9¼ inches long, approximately 20 ounces).

Various turrets and single head positioners are available upon consulting the factory.

Astro recommends periodic gaging with a P/N EUS309-G.

Mil Spec Crimp Tool Selection Charts

VENDOR (CAGE) CONNECTOR SERIES AND TYPE	BASIC CONNECTOR PART #	CONTACT PART #	PIN OR SKT	COLOR BANDS			BIN CODE	CONTACT SIZE		WIRE RANGE OR CABLE	CONTACT GAGE	CRIMP TOOL	ACCESSORY	INSTALLATION TOOL	REMOVAL TOOL	REMOVAL TOOL (UNWIRED CONTACTS)
				1st	2nd	3rd		MATING END	WIRE BARREL							
MIL-C-5015 MS 3400" SERIES CIRCULAR THREADED COUPLING FRONT RELEASE CONTACTS	MS3400 ()	M39029/44-287	P	RED	GRA	VIO	287	16	22	22-26	AT 0016	615708 --OR 616336	615709 (BLUE)	ATML 1701	ATML 1901B	ATML 1901B
		M39029/45-294	S	RED	WHI	YEL	294									
	MS3401 ()	M39029/44-288	P	RED	GRA	GRA	288	16	16	16-20			616328			
		M39029/45-295	S	RED	WHI	GRN	295									
	MS3402 ()	M39029/44-289	P	RED	GRA	WHI	289	12	16	16-20	AT 0012	615708	615709 (YELLOW)	ATML 1702	ATML 1902B	ATML 1902B
		M39029/45-296	S	RED	WHI	BLU	296									
	MS3404 ()	M39029/44-290	P	RED	WHI	BLK	290	12	12	12-14						
		M39029/45-297	S	RED	WHI	VIO	297									
	MS3406 ()	M39029/44-291	P	RED	WHI	BRN	291	8	8	8-10	--	AMT23B	AMT23002DA AMT23009L	--	ATML 1903B	ATML 1903B
		M39029/45-298	S	RED	WHI	GRA	298									
	MS3408 ()	M39029/44-292	P	RED	WHI	RED	292	4	4	4-6			AMT23004DA AMT23011L	--	ATML 1904B	ATML 1904B
		M39029/45-299	S	RED	WHI	WHI	299									
	MS3409 ()	M39029/44-293	P	RED	WHI	ORN	293	0	0	0-2			AMT23005DA AMT23013L	--	ATML 1905B	ATML 1905B
		M39029/45-300	S	ORN	BLK	BLK	300									
MIL-C-5015 MS3450" SERIES CIRCULAR THREADED COUPLING REAR RELEASE CONTACTS	MS3450 ()	M39029/30-217	S	RED	BRN	VIO	217	16S	16	16-20	AT 0016	615708	615709 (BLUE)	ATML 08207B OR ATR 1105 OR M81969/14-03	ATML 08208B OR ATR 2112 OR M81969/14-03	M81969/30 HANDLE WITH ATML 3006
		M39029/29-212	P	RED	BRN	RED	212	16	16			OR 616336				
	MS3451 ()	M39029/30-218	S	RED	BRN	GRA	218									
		M39029/29-213	P	RED	BRN	ORN	213	12	12	12-14	AT 0012	615708	615709 (YELLOW)	ATR 1153 OR M81969/14-04 OR ATML 08209B	ATR 2160 OR M81969/14-04 OR ATML 08210B	M81969/30 HANDLE WITH ATML 3007
	MS3452 ()	M39029/30-219	S	RED	BRN	WHI	219									
		M39029/29-214	P	RED	BRN	YEL	214	8	8	8-10	--	AMT23B	AMT23002DA AMT23009L	--	ATML 1501 OR M81969/29-02	--
	MS3454 ()	M39029/30-220	S	RED	RED	BLK	220									
		M39029/29-215	P	RED	BRN	GRN	215	4	4	4-6			AMT23004DA AMT23011L	--	ATML 1502 M81969/29-03	--
	MS3456 ()	M39029/30-221	S	RED	RED	BRN	221									
		M39029/29-216	P	RED	BRN	BLU	216	0	0	0-2			AMT23005DA AMT23013L	--	ATML 1503 OR M81969/29-04	
	MS3459 ()	M39029/30-222	S	RED	RED	RED	222									

BIN (Basic identification number) code color bands, reading in sequence from wire barrel end of the contact. Each digit of the BIN code shall be designated on the contact by a color band in accordance with the following:

0-Black 2-Red 4-Yellow 6-Blue 8-Gray
1-Brown 3-Orange 5-Green 7-Violet 9-White



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Mil Spec Crimp Tool Selection Charts

VENDOR (CAGE) CONNECTOR SERIES AND TYPE	BASIC CONNECTOR PART #	CONTACT PART #	PIN OR SKT	COLOR BANDS			BIN CODE	CONTACT SIZE		WIRE RANGE OR CABLE	CONTACT GAGE	CRIMP TOOL	ACCESSORY	INSTALLATION TOOL	REMOVAL TOOL	REMOVAL TOOL (UNWIRED CONTACTS)
				1st	2nd	3rd		MATING END	WIRE BARREL							
MILITARY SPECS MIL-C-38999 CIRCULAR REAR RELEASE CONTACTS SERIES I SCOOP- PROOF BAYONET COUPLING SERIES II LOW SILHOUETTE BAYONET COUPLING	SERIES I MS27466 () MS27467 () MS27468 () MS27496 ()	M39029/58-360	P	ORN	BLU	BLK	360	22	22D	22-28	AT 0022	615717 or 616336	615725 or 616332	ATML 0801B OR M81969/14-01 (GREEN)	ATML 0802B OR M81969/14-01 (WHITE)	ATK 2005 WITH (BLACK) ATK2005-22D-1
			LS	ORN	YEL	GRA	348					615717 or 616336	615723 or 616330			
			SS	ORN	GRN	YEL	354					615717 or 616336	615722 or 616331			
			P	ORN	BLU	BRN	361	22	22M	24-28		615717 or 616336	615725 or 616332			
	MS27653 () MS27654 () MS27656 () MS27661 ()	M39029/56-349	LS	ORN	YEL	WHI	349					615717 or 616336	615723 or 616330			
			SS	ORN	GRN	GRN	355					615717 or 616336	615722 or 616331			
			P	ORN	BLU	RED	362	22	22	22-26		615717 or 616336	615725 or 616332			ATK 2005 WITH (BROWN) ATK 2005-22-1
			LS	ORN	GRN	BLK	350					615717 or 616336	615723 or 616330			
	SERIES II MS27472 () MS27473 () MS27474 () MS27479 ()	M39029/57-356	SS	ORN	GRN	BLU	356					615717 or 616336	615722 or 616331			
			P	ORN	BLU	ORN	363	20	20	20-24	AT 0020	615708 or 615717 or 616336	615711 (RED) or 615726 or 616333	ATML 0805B OR M81969/14-10 (RED)	ATML 0806B OR M81969/14-10 (ORANGE)	ATK 2005 WITH (RED) ATK 2005-20-1
			LS	ORN	GRN	BRN	351									
			SS	ORN	GRN	VIO	357									
	SERIES III D38999/20 () D38999/24 () D38999/26 () D38999/29 () D38999/30 ()	M39029/58-364	P	ORN	BLU	YEL	364	16	16	16-20	AT 0016	615708 or 616336	615711 (BLUE) or 616329	ATML 0807BB OR M81969/14-03 (BLUE)	ATML080B OR M81969/14-03 (WHITE)	ATK 2005 WITH (BLUE) ATK 2005-16-1
			LS	ORN	GRN	RED	352									
			SS	ORN	GRN	GRA	358									
	SERIES IV D38999/40 () D38999/42 () D38999/44 () D38999/46 () D38999/47 () D38999/49 ()	M39029/58-365	P	ORN	BLU	GRN	365	12	12	12-14	AT 0012	615708	615711 (YELLOW)	ATML 0809B OR M81969/14-04 (YELLOW)	ATML 0810B OR M81969/14-04 (WHITE)	ATK 2005 WITH (YELLOW) ATK 2005-12-1
			LS	ORN	GRN	ORN	353									
			SS	ORN	GRN	WHI	359									

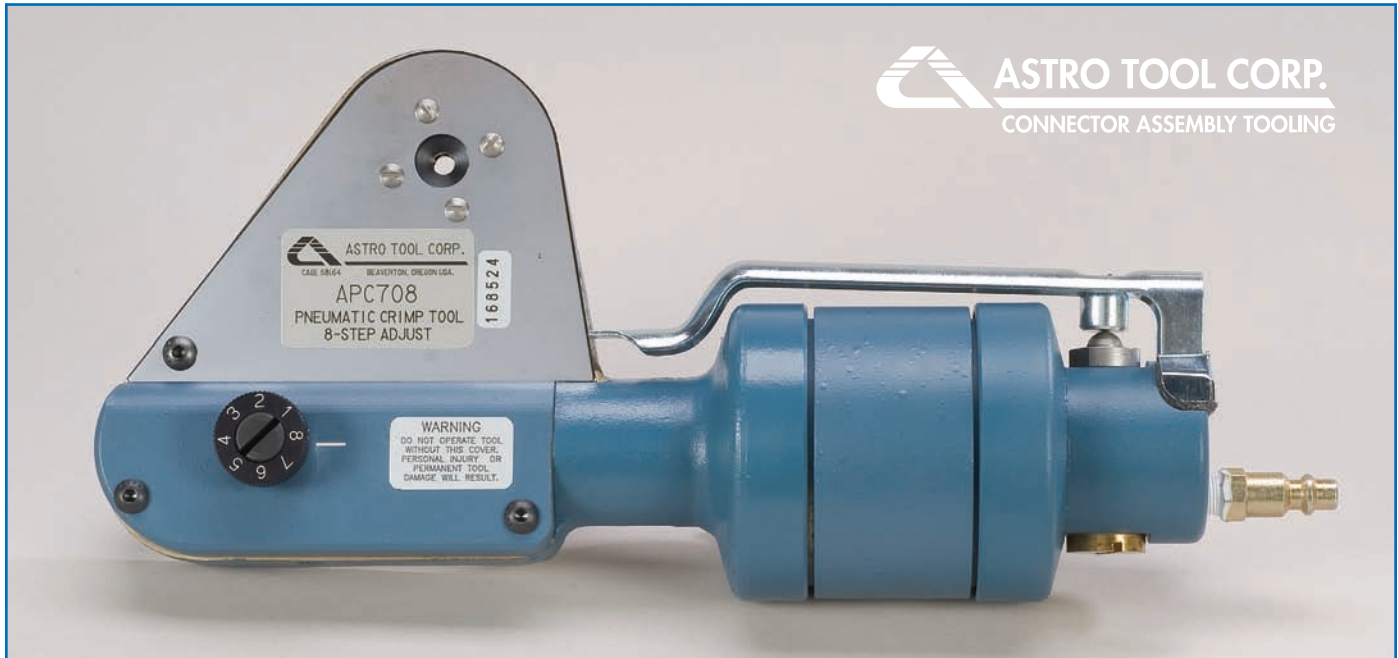


VENDOR (CAGE) CONNECTOR SERIES AND TYPE	BASIC CONNECTOR PART #	CONTACT PART #	PIN OR SKT	COLOR BANDS			BIN CODE	CONTACT SIZE		WIRE RANGE OR CABLE	CONTACT GAGE	CRIMP TOOL	ACCESSORY	INSTALLATION TOOL	REMOVAL TOOL	REMOVAL TOOL (UNWIRED CONTACTS)
				1st	2nd	3rd		MATING END	WIRE BARREL							
MIL-C-83723 SERIES II CIRCULAR THREADED COUPLING REAR RELEASE CONTACTS	M83723/17 ()	M39029/29-212	P	RED	BRN	RED	212	16	16	16-20	AT 0016	615708	615709	ATML 08207B	ATML 08208B	M81969/30
	M83723/18 ()	M39029/30-217	S	RED	BRN	VIO	217	16S						OR	OR	HANDLE
	M83723/19 ()	M39029/30-218	S	RED	BRN	GRA	218	16						M81969/14-03	M81969/14-03	WITH
	M83723/20 ()	M39029/85-454	P	YEL	GRN	YEL	454							OR	OR	ATML 3006
	M83723/21 ()	M39029/85-455	P	YEL	GRN	GRN	455							ATR 1105	ATR 2112	(BLUE)
	M83723/22 ()	M39029/85-456	P	YEL	GRN	BLU	456									
	M83723/23 ()	M39029/85-457	P	YEL	GRN	VIO	457									
	M83723/24 ()	M39029/86-462	S	YEL	BLU	RED	462									
	M83723/52 ()	M39029/86-463	S	YEL	BLU	ORN	463									
	M83723/53 ()	M39029/86-464	S	YEL	BLU	YEL	464									
		M39029/86-465	S	YEL	BLU	GRN	465									
		M39029/29-213	P	RED	BRN	ORN	213	12	12	12-14	AT 0012			ATML 08209B	ATML 08210B	M81969/30
		M39029/30-219	S	RED	BRN	WHI	219							OR	OR	HANDLE
		M39029/85-458	P	YEL	GRN	GRA	458							M81969/14-04	M81969/14-04	WITH
		M39029/85-459	P	YEL	GRN	WHI	459							OR	OR	ATML 3007
		M39029/85-460	P	YEL	BLU	BLK	460							ATR 1153	ATR 2160	(YELLOW)
		M39029/85-461	P	YEL	BLU	BRN	461									
		M39029/86-466	S	YEL	BLU	BLU	466									
		M39029/86-467	S	YEL	BLU	VIO	467									
		M39029/86-468	S	YEL	BLU	GRA	468									
		M39029/86-469	S	YEL	BLU	WHI	469									
		M39029/29-214	P	RED	BRN	YEL	214	8	8	8-10	--	AMT23B	AMT23002DA	NOT NEEDED	M81969/29-02	
		M39029/30-220	S	RED	RED	BLK	220						AMT23009L			
		M39029/29-215	P	RED	BRN	GRN	215	4	4	4-6	--		AMT23004DA		M81969/29-03	
		M39029/30-221	S	RED	RED	BRN	221						AMT23011L			
		M39029/29-216	P	RED	BRN	BLU	216	0	0	0-2	--		AMT23005DA		M81969/29-04	
		M39029/30-222	S	RED	RED	RED	222						AMT23013L			

Mil Spec Crimp Tool Selection Charts

VENDOR (CAGE) CONNECTOR SERIES AND TYPE	BASIC CONNECTOR PART #	CONTACT PART #	PIN OR SKT	COLOR BANDS			BIN CODE	CONTACT SIZE		WIRE RANGE OR CABLE	CONTACT GAGE	CRIMP TOOL	ACCESSORY	INSTALLATION TOOL	REMOVAL TOOL	REMOVAL TOOL (UNWIRED CONTACTS)
				1st	2nd	3rd		MATING END	WIRE BARREL							
MIL-C-83723 SERIES III BAYONET COUPLING REAR RELEASE CONTACTS	M83723/71 ()	M39029/4-110	P	BRN	BRN	BLK	110	20	20	20-24	AT 0020	615708	615709	ATML 08205B	ATML 08206B	M81969/30
	M83723/72 ()	M39029/5-115	S	BRN	BRN	GRN	115							OR	OR	HANDLE WITH ATML 3005 (RED)
	M83723/73 ()	M39029/9-132	P	BRN	ORN	RED	132							M81969/14-11	M81969/14-11	
	M83723/74 ()	M39029/9-133	P	BRN	ORN	ORN	133							OR	OR	
	M83723/75 ()	M39029/9-134	P	BRN	ORN	YEL	134							ATR 1078	ATR 2080	
	M83723/76 ()	M39029/9-135	P	BRN	ORN	GRN	135									
	M83723/76 ()	M39029/9-136	P	BRN	ORN	BLU	136									
	M83723/77 ()	M39029/10-138	S	BRN	OEN	GRA	138									
	M83723/78 ()	M39029/10-139	S	BRN	OEN	WHI	139									
	M83723/84 ()	M39029/10-140	S	BRN	YEL	BLK	140									
	M83723/85 ()	M39029/10-141	S	BRN	YEL	BRN	141									
	M83723/86 ()	M39029/10-142	S	BRN	YEL	RED	142									
	M83723/87 ()	M39029/4-112	P	BRN	BRN	RED	112	16	20	20-24	AT 0016			ATML 08207B	ATML 08208B	ATML 3006
	M83723/91 ()	M39029/5-117	S	BRN	BRN	VIO	117							OR	OR	
	M83723/92 ()	M39029/4-111	P	BRN	BRN	BRN	111	16	16	16-20				M81969/14-03	M81969/14-03	
	M83723/95 ()	M39029/5-116	S	BRN	BRN	BLU	116							OR	OR	
	M83723/96 ()													ATR 1105	ATR 2112	
	M83723/97 ()															
	M83723/98 ()	M39029/4-113	P	BRN	BRN	ORN	113	12	12	12-14	AT 0012			ATML 08209B	ATML 08210B	ATML 3007
		M39029/5-118	S	BRN	BRN	GRA	118							OR	OR	ATML 3006
														M81969/14-04	M81969/14-04	
														OR ATR 1153	OR ATR 2160	
		M39029/4-114	P	BRN	BRN	YEL	114	12	16	16-20				M81969/14-03	M81969/14-03	
		M39029/5-119	S	BRN	BRN	WHI	119									
		M39029/7-126	P	BRN	RED	BLU	126	12 SHIELDED				INNE CONTACT 615717 OUTER CONTACT 620175	INNER CONTACT 616413 OUTER CONTACT 620294	M81969/14-03	M81969/14-03	M81969/30 HANDLE WITH ATML 3007 (YELLOW)
		M39029/7-127	P	BRN	RED	VIO	127									
		M39029/7-128	P	BRN	RED	GRA	128									
		M39029/8-129	S	BRN	RED	WHI	129									
		M39029/8-130	S	BRN	ORN	BLK	130									
		M39029/8-131	S	BRN	ORN	BRN	131									

Pneumatic Crimp Tool APC708 (Functional Equivalent to M22520/1-01)



MS #.	ASTRO TOOL #	USAGE/DESCRIPTION	NSN.
M22520/3-1	615716	Gage For /1-01 /2-01	5220-00-165-7604
M22520/1-02	615709	Turret	5120-00-016-6382
M22520/1-03	615710	Turret	5120-00-016-6554
M22520/1-04	615711	Turret	5120-00-016-7582
M22520/1-05	615712	Universal Positioner	5120-00-165-3911
M22520/1-06	615713	Positioner	5120-00-016-7647
M22520/1-07	615714	Positioner	5120-00-016-7651
M22520/1-08	615715	Turret	5120-00-016-7654
M22520/1-09	615821	Positioner	5120-00-132-5039
M22520/1-10	615822	Positioner	5120-00-132-5095
M22520/1-11	616406	Positioner	5120-01-127-5231
M22520/1-12	616407	Turret	5120-01-036-9220
M22520/1-13	616408	Turret	5120-01-036-9221
M22520/1-14	616409	Turret	5120-01-036-9222
M22520/1-15	616410	Positioner	5120-01-036-9223
M22520/1-16	620172	Positioner	5120-01-075-8138
M22520/1-17	620537	Positioner	

- Portable or bench-mounted
- Cycle controlled ratchet

8-Step Adjustable Manual Feed Pneumatic Crimping Tool APC708

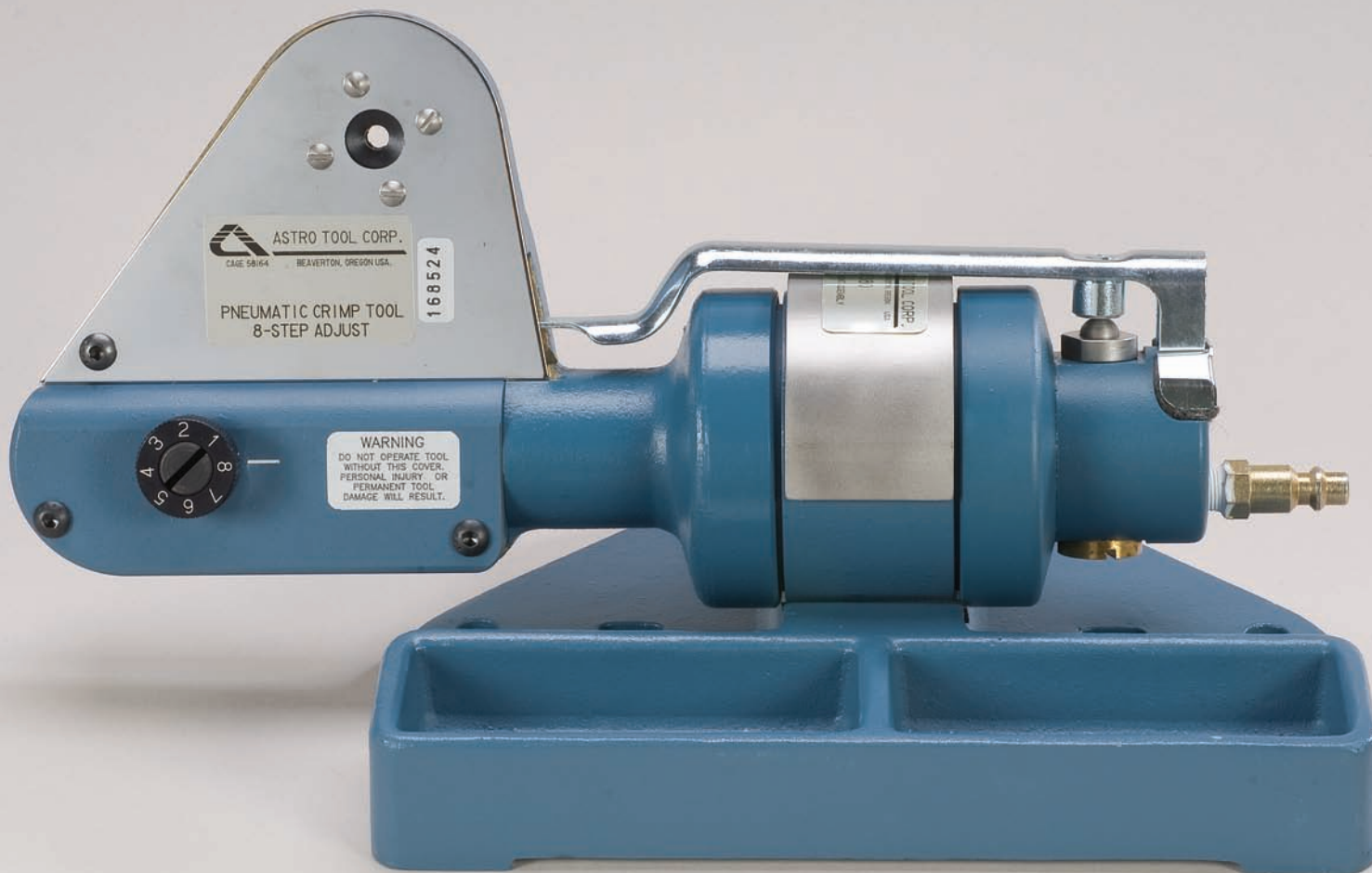
The **APC708**, 8-Step Adjustable Manual Feed Pneumatic Crimping Tool is a fast, versatile, pneumatically actuated four indenter tool for crimping MS style or proprietary circular contacts. This tool accommodates all turret head assemblies used with the M22520/1-01 crimping tool. The tool is capable of accommodating contact sizes 12 to 26 and wire sizes 12 to 30 AWG.

Astro manufactures the ATK6002 gaging kit with the gaging pin assemblies for each selector setting. Contact the factory for price and availability.

Tool can be either hand held or mounted on an optional bench mount (P/N 11380). The tool can be actuated by the tool trigger or a foot pedal assembly (P/N 11380-2). (The bench mount and foot pedal can be purchased together as P/N 11380-3). Using these accessories leaves the operator's hands free for inserting and removing contacts and wire.

This tool operates on 80-120 P.S.I. Astro recommends a filtered, regulated and lubricated air supply for optimal performance. Astro offers the 11413 air regulator for this purpose.

Pneumatic Crimp Tools for Circular Contacts



- Portable or bench-mounted
- Cycle controlled ratchet
- Foot pedal assembly available

Astro's line of **Pneumatic Crimp Tools** is designed for moderate volume production. These tools are available for a wide range of contact sizes, from 8 through 26 and wire sizes 8 through 30 AWG.

The externally and internally adjustable tools are just an example of what we can offer. The multi-function tool can also be equipped with D2 indenters for medical applications and specific crimp ranges.

Tool can be either hand held or mounted on an optional bench mount (P/N 11380). The tool can be actuated by the tool trigger or a foot pedal assembly (P/N 11380-2). (The bench mount and foot pedal can be purchased together as P/N 11380-3). Using these accessories leaves the operator's hands free for inserting and removing contacts and wire.

These tools operate on 80-120 P.S.I. Astro recommends a filtered, regulated and lubricated air supply for optimal performance. Astro offers the 11413 air regulator for this purpose.



Internally Adjusted

The internally adjusted line of crimp tools is designed for adjustments by qualified personnel only. This tool features an adjustment knob located inside the front cover plate of the tool. Once set by qualified personnel, the tool is not adjustable by the assembly line operator, thus helping to eliminate operator error. The tool operates with replaceable, single position locators. When using these locators, the internally adjustable tools can crimp a wire range of 8-30 AWG. The internally adjusted tools can be adapted to accept the MS3191-4 and M22520/1 turrets by ordering a 620754 turret adaptor assembly.

Standard internally adjustable tool: 612871

Mini tip tool: part number 612768.

4 indent style tool: part number 11221.

4 indent style tool with 3 locators: part number 10967.

3212 (20 GA.) 3213 (16 GA.) 3214 (12 GA.)

Externally Adjusted

The externally adjustable line of tools is designed to accept MS3191-4 and M22520/1 style turret head assemblies. These tools have a micrometer style adjustment knob which allows them to be adjusted and set to crimp depths ranging from .015 to .085 inches in increments of .001. The dial indicator on this style of tool has three sets of numbers. One set indicates crimp depth in thousandths of an inch. One set corresponds to the selector knob settings on the M22520/1-01 (615708) tool. The third set corresponds to the selector settings on the MS3191-4 (612179) tool. These multi-selector readings allow the tool to be used easily with the data for crimp settings located on all Mil-Spec turrets. In its turret-operated configuration these tools crimp contact sizes 12 through 26 and wire sizes 12 through 30 AWG.

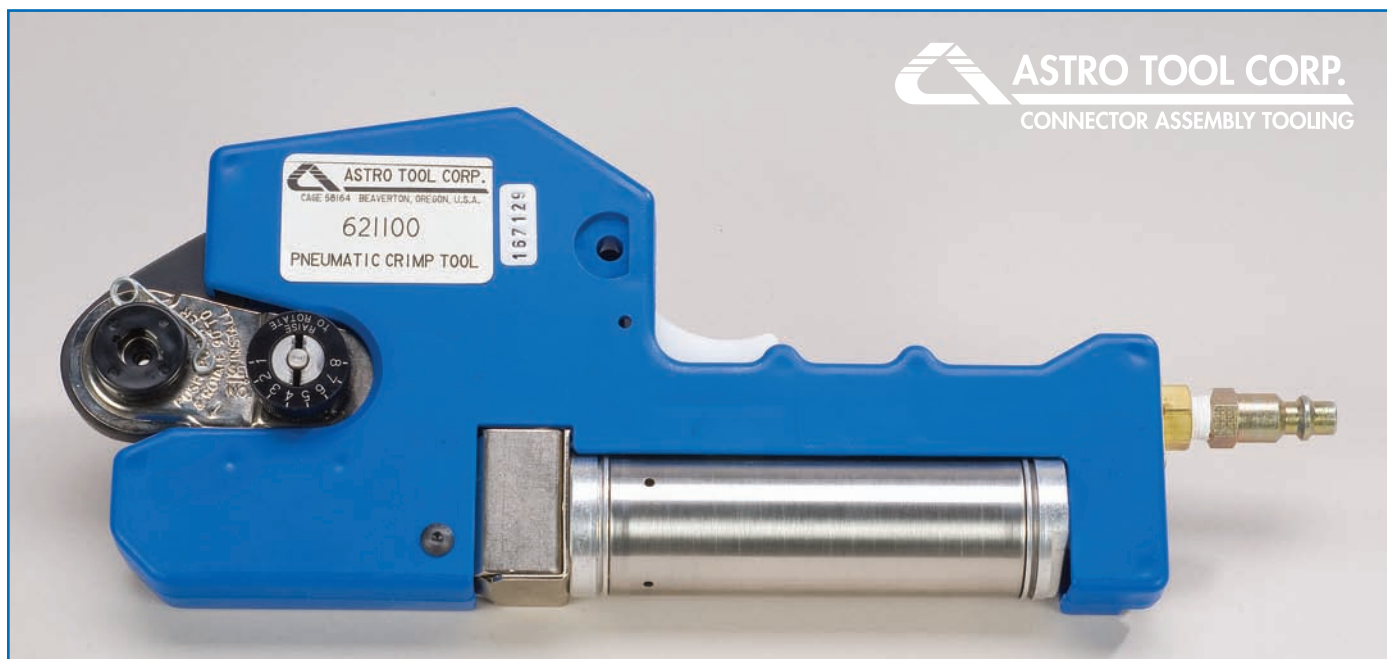
Standard externally adjustable tool: 612141

This tool can be adapted for use with locators by ordering the 615161 slide strap adaptor assembly.

A tool with a mini tip indenter is available under part number 615250.

Locators for MS Applications		
Contact Size	Locator Part #	Contacts Accommodated (Ref.)
20	3212	MS 3190 MS 24254
16	3213	MS 3192 MS 3193 MS 24225 NAS 1662 NAS 1663 MS 18134
12	3214	MS 18136 M39029/4 M39020/5
20	11568-1	MS 17803 MS 17807
16	11568-1	MS 17804 MS 17808 M39029/34 M39029/35
22	612507	MS 27491-22, 22D, 22M MS 27492-22, 22D, 22M MS 27493-22, 22D, 22M MS 27494-22, 22D, 22M M39029/57 M39029/58
	613264	M39029/56 MS 27490-22, 22D, 22M
20	7005626	M39029/56 M39029/57 M39029/58 MS 27490-20 MS27491-20 MS27492-20 MS27493-20 MS27494-20
16	7008289	M39029/58 MS 27493-16 MS 27494-16
	7008300	M39020/56 M39029/57 MS 27490-16 MS 27491-16 MS 27492-16
12	7008290	M39029/56 M39029/57 M39029/58 MS 27490-12 MS 27491-12 MS 27492-12 MS 27493-12 MS 27494-12

Portable Intermediate and Miniature Pneumatic Tools



- Conforms to performance requirements of MIL-DTL-22520
- Portable or bench-mounted operation
- Eliminates operator fatigue and reduces carpal tunnel syndrome problems

The intermediate and miniature portable pneumatic crimping tools, **621100** and **621101**, provide all the features of the M22520/2-01 and the M22520/7-01.

Reduced operator fatigue and reduced carpal tunnel syndrome occurrences make these tools ideal for assembly line operation. Both tools can be used as portable units or can be bench mounted (part number **621102**) and used with an optional foot pedal (part number **620372**). If both bench mount and foot pedal are desired, order part number **620925**.

The **621100** is color coded blue to match the M22520/2-01 and accepts all /2 positioners.

The **621101** uses the standard M22520/7 positioners and is color coded green to match the /7 tool.

Both tools feature the eight step adjustable selector found on the M22520 8-indent style crimping tools. Operating procedures for these tools are identical to the hand operated models.

Both the **621100** and **621101** operate at 80-120 PSI and require a lubricated, regulated and filtered air supply. Astro offers the 11413 regulator for this purpose.

We always recommend the periodic gaging of our tools. The gages for these tools are as follows:

621100: Use the 615716 (M22520/3-01) GAGE

621101: Use the 616337 (M22520/3-03) GAGE

These tools are each 10 ½ inches long and weigh approximately 32 ounces.

CRIMP TOOLS FOR MEDICAL AND ELECTRONICS APPLICATIONS

CRIMP TOOLS FOR MEDICAL AND ELECTRONICS APPLICATIONS



Standard Microcrimp Tools 612548, 612548-2, 612548SS, 621205



This tool has been especially designed for small increment, close tolerance adjustments.

This cycle controlled tool also features a micrometer type adjusting knob, providing continuously variable adjustments for precise crimp depths.

The **612548** can be adjusted and set at crimp depths ranging from .025-.075 inches, allowing settings to be adjusted within .001 inch.

This tool, using a locator, can crimp most pin and socket contacts #12 and smaller and can crimp wire sizes #12-26 AWG.

The **612548** is 9 inches long and weighs approximately 16 ounces.

Astro offers a version of the **612548**, which is modified to accept M22520/1 and MS3191 style turrets. Order p/n 612548-2.

An adjustable positioner is available for **612548**, P/N 613384.

The **612548SS** has specially hardened indenters for crimping stainless steel applications.

- 8 indent crimp
- Micro adjustable
- Cycle controlled ratchet
- Ejector locator operation
- Adjustable within .001 inch

The **612548** tools can be adjusted and set at crimp depths ranging from .025-.075 inches, allowing settings to be adjusted within .001 inch.



ASTRO LOCATOR #	SIZE
2421	20
2422	16
2423	12
11570-1	20
	16
7009880	20
7010394	16
7010395	12
3240	20
613327	22
	16
615092	20
615091	16
615090	12

For additional locators consult factory.

Miniature Microcrimp Tools 612118, 612118-1, 612118SS



- 8 indent crimp
- Micro adjustable
- Cycle controlled ratchet
- Ejector locator operation
- Adjustable within .0005 inch

ASTRO LOCATOR #	SIZE
612473	20
612512	20
613325	20
612955	22
612510	20
613194	22
612521	22
613192	22
615759	22
615832	20
615758	22
615834	20
612513	20
614352	22
613117	-

For additional locators consult factory.

The **Astro 612118** conforms to all requirements of MIL-DTL-22520.

This cycle controlled tool features a micrometer type adjusting knob, providing continuously variable adjustment, for precise crimp depths. The **612118** can be adjusted and set at crimp depths ranging from .015-.043 inches, with increment settings of .0005 inch.

This tool can crimp most micro-miniature pin and socket contacts #20 and smaller to wire sizes #20-#30 AWG. For ease of loading sub-miniature contacts, Astro has designed an easy load mechanism that is built into this special line of locators.



The **612118** tool is 7¼ inches long and weighs 11 ounces. Its small size permits crimping in confined areas.

Custom locators are available upon request.

The **612118** is available in a modified version, allowing it to accept M22520/2 and MS3198 style positioners. This version is ordered as part #612118-1.

612118SS has specially hardened indenters for crimping stainless steel applications.

Adjustable positioners for this tool are 612490 & 613408.

The **612118** can be adjusted and set at crimp depths ranging from .015-.043 inches, with increment settings of .0005 inch.

Metric Microcrimp Tool 621205



- Cycle controlled
- Micro adjustable
- Adjustable within .0007 inch

Astro's **621205 Metric Microcrimp Tool** is the answer to crimping circular Harting pin and socket contacts. It is a fast, versatile, manually operated, octadent tool for crimping circular pin and socket contacts.

The **621205** provides continuously variable crimp depth adjustment to optimum settings over a range of contact and wire combinations. Although mostly used in Harting applications, the micro adjustable feature allows the customer to select the precise crimp depth no matter the

use and selected need. Locating options are available once need is determined; consult the factory for your specific needs.

The **621205** is adjustable in a range of 1.0 mm to 2.0 mm. Settings to within .02 mm increments are possible for precision crimping.

For long life and optimum performance, this tool should be kept clean and handled carefully, as any other precision instrument.

The **621205** is adjustable in a range of 1.0 mm to 2.0 mm. Settings to within .02 mm increments are possible for precision crimping.



Micro Thread Crimp Tool 615466, 615466-1, 615466-8



- 4 or 8 indent crimp
- Micro thread adjustable
- Cycle controlled ratchet

The **Astro micro-thread adjustable hand crimping tools** are equipped with an adjustable limit screw which controls the proper crimping depth for contact size and wire range. These tools are designed to crimp contact sizes 12 through 20 AWG. Crimp depth is determined by loosening the lock nut and adjusting the limit screw. A gage is used to check for the desired indenter opening. The lock nut is then tightened, locking in the desired depth.

These tools use the same locators as Astro's standard size microcrimp adjustable tool (612548).

The 615466 tool is 9 inches long and weighs approximately 19 ounces.

Astro will design the micro-thread adjustable tool with a variety of locators or indenter types to fit your specific needs. Please consult the factory for further information.

Special Purpose Crimp Tools



- Easy to operate
- Built in positioner
- Small and light weight
- Precision Crimp Depth
- Full cycle ratchet
- Less operator error

The Astro Special Purpose Crimp Tool eliminates operator error caused by improper depth adjustment or incorrect positioner selection. This precision crimp tool meets the performance requirements of the **M22520** tools and was designed for miniature and sub-miniature contacts. The tools are light weight, easy to operate and the built in positioner cannot be adjusted improperly or lost. Astro uses a commonly accepted color coding system for this line of tools that results in easy assembly line identification. This tool is set at the factory to your

precise specifications and is non adjustable. This eliminates operator error and ensures that accurate crimps are obtained every time. These crimpers are designed to handle 20-32 AWG.

Cost is always a factor in the selection of tooling. These tools will not only save money, initially, but additional savings will be realized by time saved in production and quality control.

Let Astro help you design a tool to fit your special production needs.

Also available in Pneumatic versions.



C-FRAME DIE CRIMP TOOLS

C-FRAME DIE CRIMP TOOLS



Multi-Purpose C-Frame Crimping Tools 620175 (M22520/5-01), 620215 (M22520/10-01)



- Interchangeable dies
- Positive ratchet

Utilizing an extensive variety of interchangeable single, double, and triple hexagonal dies these MIL-DTL-22520 qualified tools can be used to crimp a wide range of MS and proprietary coaxial and triaxial connectors and contacts.

Astro also manufactures dies for many other crimping purposes. These include, but are not limited to, insulated and uninsulated terminal lugs, end caps and wire splicing. Astro can design and manufacture die sets for many other applications.

The interchangeable dies facilitate a large cost savings over single purpose crimpers. Instead of buying a different tool for each application, only separate dies are needed.

The **620175** and **620215** C-frame crimping tools, like other Astro crimpers, are simple to use.

1. Select the proper die.
2. Insert it into the crimp tool (the die will be firmly held in place by the internal spring clips built into each tool).

The positive ratchet in these tools will not allow the handles to retract until the tool has been fully cycled. This eliminates incomplete or partial crimps.

The **620175** is 11 inches long and weighs 22 ounces.

The **620215** is 9 inches long and weighs 11 ounces.

The 620175 (/5-01) tool is also available in a pneumatic version, P/N 621200, on page 36.

Astro has a large selection of die configurations available, in addition to those listed. As well as calibration gages.

M22520/10-01 DIES						
Military Part #	Astro Tool #	NSN	A Hex.	Length	B Hex.	Length
M22520/10-02	620285	5120-00-116-3275	.091	.270	-	-
M22520/10-03	620288	5120-00-116-3283	.255	.325	-	-
M22520/10-04	620286	5120-00-116-3003	.138	.090	.118	.270
M22520/10-05	620289	5120-00-116-3276	.128	.325	.105	.325
M22520/10-06	620216	5120-00-116-4807	.160	.400	-	-
M22520/10-07	620290	5120-00-116-3278	.213	.325	.178	.325

Astro also offers blank dies for your prototyping needs.

M22520/5-01 Interchangeable Hex Dies

Military Part #	Astro Tool #	NSN	A Hex.	Length	B Hex.	Length
M22520/5-02	620560	-	.091	.090	.068	.270
M22520/5-03	620291	5120-00-133-0534	.128	.325	.105	.325
M22520/5-04	620292	5120-00-133-0537	.138	.090	.118	.270
M22520/5-05	620293	5120-00-133-0577	.213	.325	.178	.325
M22520/5-06	620294	5120-00-133-0579	.128	.094	-	-
M22520/5-07	620295	5120-00-133-0580	.255	.325	-	-
M22520/5-08	620296	5120-00-133-0581	.128	.375	-	-
M22520/5-09	620365	5120-00-133-0582	.178	.400	.068	.093
M22520/5-10	620297	5120-00-133-0583	.160	.400	-	-
M22520/5-11	620366	5120-00-133-0584	.213	.400	.068	.093
M22520/5-13	620367	5120-00-133-0585	.255	.400	.068	.093
M22520/5-15	620528	5120-00-133-0586	.263	.400	.068	.093
M22520/5-17	620298	5120-00-133-0597	.118	.375	-	-
M22520/5-19	620299	5120-00-116-3159	.255	.400	.213	.400
M22520/5-21	620300	5120-00-116-3284	.475	.400	-	-
M22520/5-23	620301	5120-00-133-0618	.384	.400	-	-
M22520/5-25	620368	5120-00-133-0622	.429	.400	.100	.120
M22520/5-27	620302	5120-00-133-0640	.532	.400	-	-
M22520/5-29	620371	5120-00-116-3285	.324	.400	.100	.120
M22520/5-31	620303	5120-00-133-0642	.501	.400	-	-
M22520/5-33	620304	5120-00-116-3158	.343	.400	.105	.400
M22520/5-35	620305	5120-00-116-3156	.324	.400	.128	.400
M22520/5-37	620306	5120-00-116-3136	.314	.400	.151	.400
M22520/5-39	620307	5120-00-116-3134	.309	.400	.160	.400
M22520/5-41	620308	5120-00-116-3135	.290	.400	.178	.400
M22520/5-43	620309	5120-00-116-3106	.268	.400	.197	.400
M22520/5-45	620310	5120-00-116-3088	.231	.400	.218	.400
M22520/5-47	620311	5120-00-133-0643	.359	.400	-	-
M22520/5-49	620312	5120-00-133-0644	.401	.400	-	-
M22520/5-51	620313	5120-00-116-3040	.431	.400	-	-
M22520/5-53	620314	5120-00-116-3160	.454	.400	-	-
M22520/5-55	620315	5120-00-133-0653	.324	.400	-	-
M22520/5-57	620369	5120-00-133-0676	.213	.400	.100	.120
M22520/5-59	620370	5120-00-133-0683	.255	.400	.100	.120
M22520/5-61	620316	5120-00-116-3004	.429	.400	-	-
M22520/5-63	620317	5120-00-133-0533	.263	.400	.091	.270
M22520/5-100	620617	5120-00-126-0860		Special		
M22520/5-101	620618	5120-01-081-4213				
M22520/5-102	630000	5120-01-081-4212				
M22520/5-103	630001	5120-01-082-8985				
M22520/5-104	630003					

NOTE: Also available Die #620836 Combination of M22520/5-102 and M22520/5-103. We have listed above military dies available. This is only a partial listing of dies available from Astro. Please consult factory with your specific application requirement.



Pneumatic Hex Die Crimper 621200, 621500



- Cost effective
- Increases productivity
- Uses standard M22520/5 dies
- Lightweight and fully portable
- Helps reduce operator fatigue and carpal tunnel syndrome

Use **DIE SELECTION CHART** on page 35.

Astro offers two portable, pneumatic versions of the **M22520/5-01** hand die crimp tool. The 621200 has a 2" bore for standard applications, and the 621500 has a 3.5" bore for heavier duty applications.

The **621200 & 621500** are trigger or foot pedal actuated and operate at 32 cycles per minute. These sturdy, lightweight crimpers offer increased productivity, reduced operator fatigue and reduced carpal tunnel syndrome.

Using standard **M22520/5** dies, the full cycling feature of these tools consistently produces quality crimps while delivering over one ton of crimping force at the die face.

Weighing just over five pounds this versatile system can be easily moved from station to station.

Designed with safety in mind, these tools have a cover over the crimping area to help prevent the accidental crimping of fingers.

Both the **621200 & 621500** require 80-120 PSI and a regulated, filtered and lubricated air supply. For this purpose Astro offers the 11413 air regulator. These tools can be easily adapted for field use by simply attaching an air cylinder.

The **621500** pneumatic C-frame crimp tool is fitted with a larger pneumatic cylinder for applications that require crimping larger gages and/or harder materials. This 3.5" cylinder delivers approximately an 80% increase of power (crimp die force) over the standard **621200** tool with no noticeable increase in cycle time.

Accessories for 621200 & 621500

621201 Benchmount only

621202 Swivel Mount with Foot Switch

621224 Foot Switch only

CT Terminal Die Crimping Tools 11707-1 (MS90413-1A), 11545



- Meets all performance requirements for M22910 and M22520
- Permanently attached dies
- Cycle controlled

The Astro **11707-1** (miniature) and **11545** (standard) crimping tools are versatile and easy to use.

Among their many applications, these durable, all-steel tools crimp MS-25036 terminal lugs, MS25181 splices, MS25274 endcaps and other types of fittings.

The **11545** (standard) crimps 12-10 through 26-24.

The **11707-1** (miniature) crimps 16-14 through 26-24. The 11707-1 is especially useful in hard to reach places where space is limited.

Both the **11707-1** and **11545** have selector knob adjustments, allowing a choice of precise crimp settings over a wide range of applications.

These tools are equipped with retractable locators for the positioning of terminal lugs and wire. When crimping splice fittings the locator can be easily adjusted to its retracted position. The same inline die system combined with the positioner ratchet found in Astro's other C-Frame tools are featured in these terminal crimping tools.

Astro recommends the periodic gaging of all its tools, p/n 612406 for gaging the **11545** and 621069 for **11707-1**.

The **11707-1** is 8 ½ inches long and weighs 14 ounces.

The **11545** is 10 ½ inches long and weighs 29 ounces.

AMT4001 Crimp Tool for Terminals (M22520/40 Ref*)



The height of the insulation crimp barrel can be adjusted to accommodate different insulation diameters.



- Cycle controlled
- Wire sizes 22 through 14
- Adjustable insulation barrel

Astro's **AMT4001** crimp tool is a fast, manually operated tool for crimping AS7928 (MIL-T-7928) Ring Terminals and Splices for wire sizes 22 through 14 (terminal and splice color codes Small Yellow, Red, White/Clear, and Blue).

The **AMT4001** provides a ratchet controlled crimp to ensure full crimp force/closure is applied. The handles will not open until they have been fully closed and the crimp completed.

The tool is equipped with a locator to hold terminals and splices in place for crimping.

The **AMT4001** is 10 ¾ inches long, and weighs approximately 1.48 lbs. For long life and optimum performance, this tool should be kept clean and handled carefully, as any other precision instrument.

Gages are available for checking calibration.

* Confirm qualification status with Astro Tool Customer Service.

Blue-White = Large Cavity
Red-Yellow = Small Cavity

MS25036 Terminals	
Terminal P/N	Crimp Cavity
MS25036-143	Red-Yellow
MS25036-144	Red-Yellow
MS25036-145	Red-Yellow
MS25036-146	Red-Yellow
MS25036-147	Red-Yellow
MS25036-159	Red-Yellow
MS25036-148	Red-Yellow
MS25036-101	Red-Yellow
MS25036-102	Red-Yellow
MS25036-149	Red-Yellow
MS25036-103	Red-Yellow
MS25036-150	Red-Yellow
MS25036-104	Red-Yellow
MS25036-105	Red-Yellow
MS25036-151	Red-Yellow
MS25036-152	Blue-White
MS25036-106	Blue-White
MS25036-107	Blue-White
MS25036-153	Blue-White
MS25036-108	Blue-White
MS25036-154	Blue-White
MS25036-109	Blue-White
MS25036-110	Blue-White
MS25036-155	Blue-White

MS17143 Terminals	
Terminal P/N	Crimp Cavity
MS17143-1	Red-Yellow
MS17143-2	Blue-White
MS17143-4	Red-Yellow
MS17143-5	Blue-White
MS17143-7	Red-Yellow
MS17143-8	Blue-White
MS17143-10	Red-Yellow
MS17143-11	Blue-White
MS17143-13	Red-Yellow
MS17143-14	Blue-White
MS17143-16	Red-Yellow
MS17143-17	Blue-White
MS17143-19	Red-Yellow
MS17143-20	Blue-White
MS17143-22	Red-Yellow
MS17143-23	Red-Yellow
MS17143-24	Red-Yellow
MS17143-25	Red-Yellow
MS17143-26	Red-Yellow
MS17143-27	Red-Yellow
MS17143-28	Red-Yellow
MS17143-109	Blue-White
MS17143-110	Blue-White
MS17143-155	Blue-White



CH Hex Die Crimping Tools 612648 (M22910/7-01), 613214



These tools are the forerunners of the M22520/5 and M22520/10. Due to their ongoing popularity and reliability we continue to offer them as an integral part of our tool line.

These all steel, C-frame crimping tools feature interchangeable, pop-in hex dies for either MS or proprietary applications including BNC, TNC and N series RF connectors. Astro will design dies for special applications upon request.

The **612648** (standard) and **613214** (miniature) tools are easy to use. Simply install the proper interchangeable die set and squeeze the handles. The positive bottoming of the inline die system, along with the cycle controlled ratchet assures perfect uniform crimping.

The **612648** (standard) is 10½ inches long and weighs approximately 27 ounces.

The **613214** (miniature) is 9½ inches long and weighs approximately 15 ounces.

The dies listed are a portion of what is manufactured for your application requirements. Please consult the factory.

- All steel construction
- Interchangeable dies
- Cycle controlled

612648 SINGLE HEX	
HEX DIMENSION	DIE SET #
.082	613317
.093	613218
.100 x .175 wide	614242
.105	612734
.112	612948
.128	612778
.151	612981
.151 x .275 wide	613622
.156 x .095 wide	613461
.160	612661
.165	613545
.172	612195
.178	612742
.183	613456
.195	613125
.198 x 3/16 wide	613967
.197	612746

612648 SINGLE HEX	
HEX DIMENSION	DIE SET #
.197 (closed frame)	612746
.202	613313
.213	612763
.218	612971
.232 x 3/16 wide	913968
.231	612748
.240	613455
.255	612766
.263	613573
.268	612676
.272 x 3/16 wide	613801
.290 x .400 wide	612893
.309	612978
.296 x 3/16 wide	612308
.314	612899
.324	612989
.327	614325

612648 SINGLE HEX	
HEX DIMENSION	DIE SET #
.333	613292
.343	612992
.359 (M22910/7-19)	613369
.372	613289
.384 (M22910/7-20)	613396
.401 (M22910/7-21)	613394
.415	613452
.425	614326
.429	612807
.431 (M22910/7-22)	613377
.440	612943
.454 (M22910/7-23)	613375
.475 (M22910/7-24)	613373
.501 (M22910/7-25)	613398
.532 (M22910/7-26)	613378

NOTE

Blank die assembly (unhardened) 615135. All dies .400" wide unless otherwise noted. The 612648 frame and military dies are available in kit form: (M22910/6-1) 613437.

CH Hex Die Crimping Tools 612648 (M22910/7-01), 613214 (continued)

612648 DOUBLE HEX					
A HEX	WIDTH	B HEX	WIDTH	MS #	DIE SET #
.068	.125	.100	.125		613550
.068	.090	.213	.400		613869
.069	.093	.213	.400		612700
.096	.090	.251	.400		613870
.096	.125	.384	.400		613872
.096	.125	.431	.400		613871
.080	.093	.215	.400		612880
.084	.400	.244	.400		613569
.100	.400	.197	.400		613788
.100	.125	.324	.400		613146
.100	.125	.415	.400		613148
.100	.125	.429	.400		613802
.102	.400	.255	.400		612823
.102	.093	.255	.400		613842
.102	.400	.268	.400		612804
.105	.400	.128	.400		612665
.105	.400	.160	.400		613759
.105	.400	.328	.400		613249
.105	.400	.343	.400	M22910/7-11	613399
.105	.400	.429	.400		613207
.112	.400	.128	.400		612962
.120	.400	.197	.400		613779
.128	.400	.160	.400		612481

612648 DOUBLE HEX					
A HEX	WIDTH	B HEX	WIDTH	MS #	DIE SET #
.128	.400	.178	.400		612720
.128	.400	.213	.400		613279
.128	.400	.255	.400		612820
.128	.400	.324	.400	M22910/7-12	613392
.151	.400	.160	.400		613212
.151	.400	.255	.400		612791
.151	.400	.314	.400	M22910/7-13	613389
.160	.400	.195	.400		613730
.160	.400	.268	.400		613729
.160	.400	.309	.400	M22910/7-14	613387
.178	.400	.197	.400		612912
.178	.400	.231	.400		612663
.178	.400	.268	.400		613178
.178	.400	.290	.400	M22910/7-15	613386
.178	.400	.324	.400		613209
.197	.400	.268	.400	M22910/7-16	613371
.197	.400	.309	.400		612762
.213	.400	.250	.400		612997
.213	.400	.255	.400	M22910/7-17	613367
.213	.400	.290	.400		612673
.218	.400	.231	.400	M22910/7-18	613365
.218	.400	.290	.400		612787
.255	.400	.268	.400		612797

612648 TRIPLE HEX	
HEX DIMENSION	DIE SET #
.067 x .177 x .212	612876
.068 x .178 x .213	614234
.105 x .128 x .151	613233
.105 x .128 x .197	612310
.105 x .128 x .178	612784
.105 x .128 x .202	613189
.105 x .134 x .202	612972
.105 x .151 x .255	612892
.112 x .128 x .213	612841
.112 x .160 x .197	613184
.128 x .160 x .213	612825
.128 x .160 x .218	612886

613214 SINGLE HEX	
Hex Dimension	Die Set #
.087	614243
.093	614245
.100	614414
.105	613812
.107	613035
.112	614342
.118	613845
.128	613848
.151	613003
.160	613847
.166	612494

613214 SINGLE HEX	
Hex Dimension	Die Set #
.178	613849
.197	613810
.213	613851
.218	613005
.231	613846
.255	613850
.268	613009
.290	613011
.300	613099
.309	613013

NOTE

Blank die assembly (unhardened) - 613599.

All dies .375" wide unless otherwise noted.



TOOL KITS



Astro Connector Service Kits for Maintenance and Production



Astro kit containers are constructed of molded plastic, fiberglass or metal depending upon varying applications or customer preference.

- Military aircraft kits
- General aviation kits
- Commercial aircraft kits
- Installation and removal tool kits

Let Astro's experience and in-depth knowledge take the guesswork out of your service kit requirements. It's difficult for you to have all the answers, so Astro has done the work for you. Our research team has years of experience in kit design. Let Astro put that knowledge to work for you!

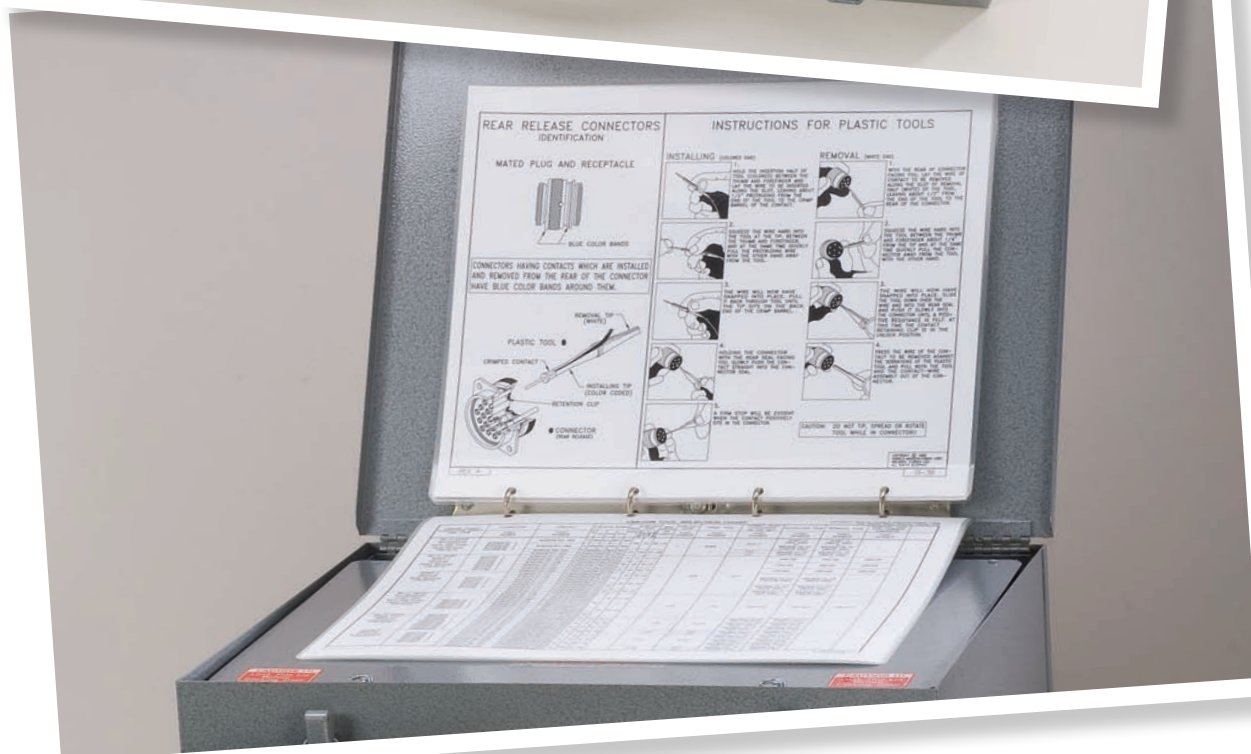
Astro offers customized crimping tool kits for a wide variety of applications. Many kits are designed for specific aircraft or system maintenance while others cover a particular connector series or other special customer needs.

Kits are not only a convenient way to keep all your tools together, but they keep the information that you require for your connector wiring repair at your fingertips.

Whether you are buying individual tools or complete service kits, Astro is in the connector assembly tool business to serve you and to make your job faster and easier.



Components are contained in foam cavities, for protection and ease of identification. Contents charts, corresponding to each foam cavity, identify components stored in that location.



Each kit contains instruction sheets that detail application and explain how each tool is used. Tool selection sheets further add to the ease of kit use by referencing tool requirements for each connector series covered by the kit. All reference sheets in each kit are coated to protect against the elements.



CONTACT INSERTION AND REMOVAL TOOLS



INSERTION AND REMOVAL TOOLS ARE ASTRO'S HERITAGE...

Astro is dedicated to serving the connector tooling needs of the electronics industry. We, therefore, top off our product package with a wide variety of contact insertion and removal tools.

Although we supply both plastic and metal tools, we recommend the use of the metal tools because of their durability. When used properly, they are more cost effective because they withstand thousands of contact insertion and removal cycles. The trend toward metal tools is actively encouraged by most departments of the government.

Astro insertion and removal tools are of proven high quality and reliability. In addition to the tools listed in the reference table, we have many more for other connector applications. Consult our factory for details.

Illustrated on the following page are typical rear and front release retention methods found in today's connectors.

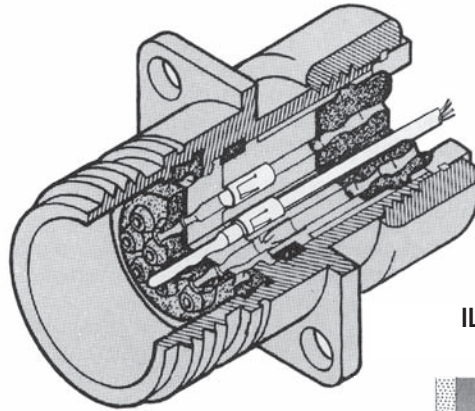
Pin Locking and Releasing Methods

ILL A

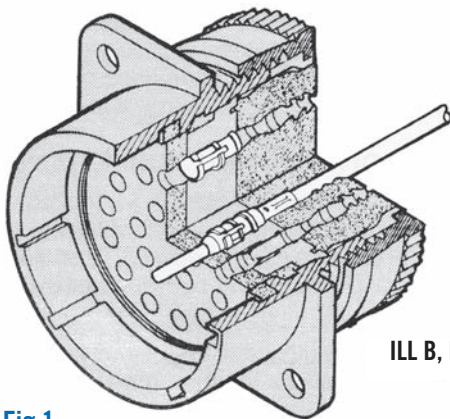
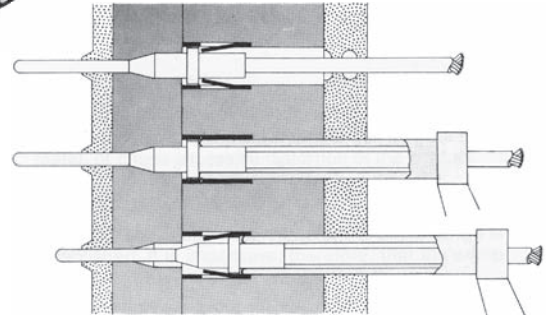
REAR RELEASE NAS 1599, MIL-C-38999 RETENTION METHOD

These clips are one-piece, stamped metal parts, rolled into a tubular shape with large tines deflected inwardly. These tines lock securely behind the shoulder of the contact, assuring positive contact retention. To remove, insert removal tool, firmly seat on shoulder of contact pushing locking tines back, and then pull on wire and tool together. This will pull the contact and tool out as a unit.

See Illustrations 2, 10, & 17 for service tools on pages 80, 81, & 83.



ILL A, FIG 1



ILL B, FIG 1

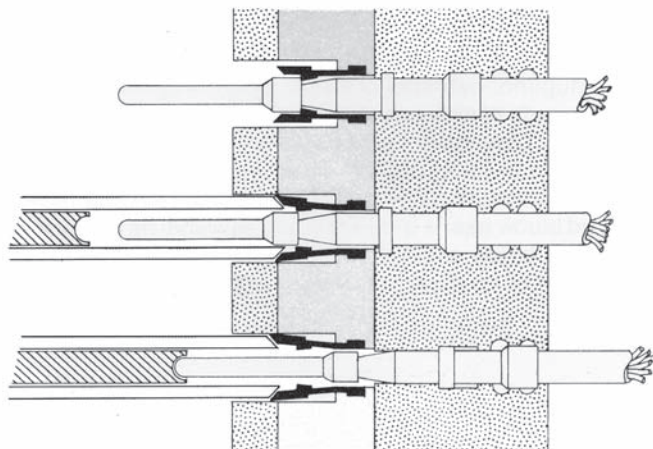
ILL B

Front release used in MIL-C-5015, MIL-C-26482, 26500 and 26636 type connectors for service tools.

See illustrations: 5 & 6 for removal and 2, 26, & 27 for installation of contacts on pages 80 & 86.

ILL B, Fig 1

MIL-C-26482, 26500, 26636 & 5015 cutaway front release.



A. Contact in "locked" position.

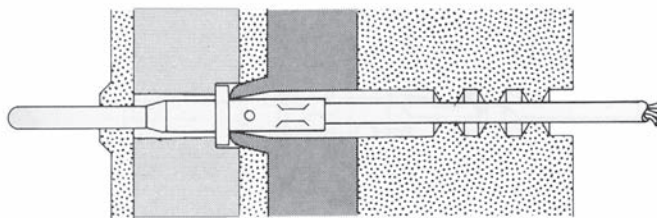
B. Tool probe shown opening retaining clip.

C. While clip is open, plunger moves contact out of the rear of connector.

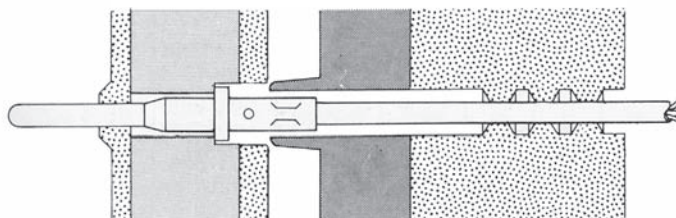
ILL C**GANG RETENTION MIL-C-81511, SERIES 1 & 2**

Using a rear locking screw, the retention plate may be “locked” by compressing it to the dielectric, (fig. 1) or “unlocked” by backing the nut out, releasing the locking plate. In an unlocked position (fig. 2), contacts may be inserted or removed with proper tooling.

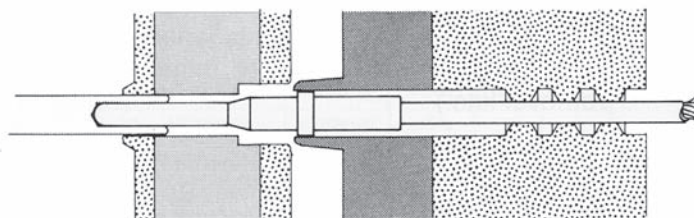
See tooling illustrations 3 & 7 for removal and illustration 4 for insertion on pages 80 & 81.

**ILL C, FIG 1**

Locked

LOCKING PLATE**ILL C, FIG 2**

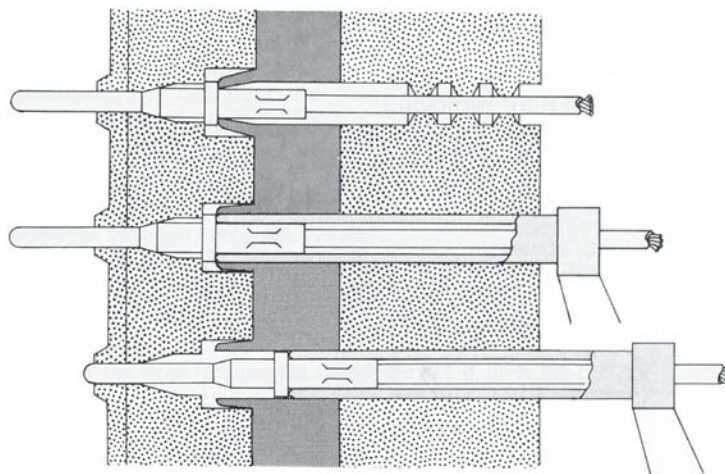
Unlocked

**ILL C, FIG 3**

Contact being removed.

ILL D**MIL-C-81511, SERIES 3 & 4**

Rear release connectors using molded dielectric locking clips. These contacts are removed by using a rear removal tool. See tool illustrations 10 & 30 for removal and illustrations 2 & 30 for insertion. See pages 80, 81, & 86.

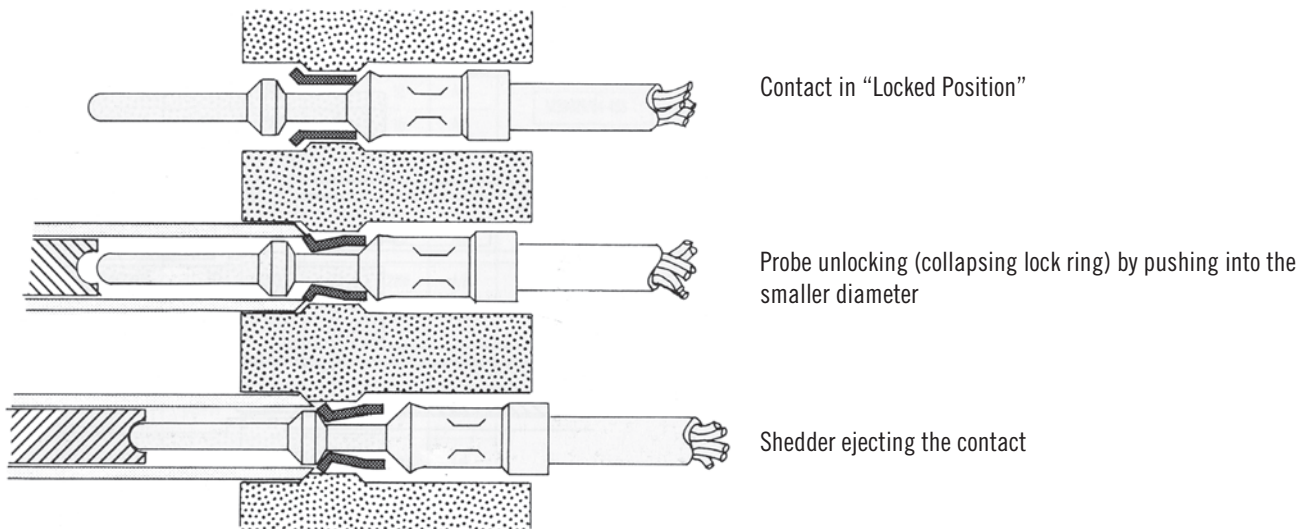


Pin Locking and Releasing Methods

ILL E

FRONT RELEASE

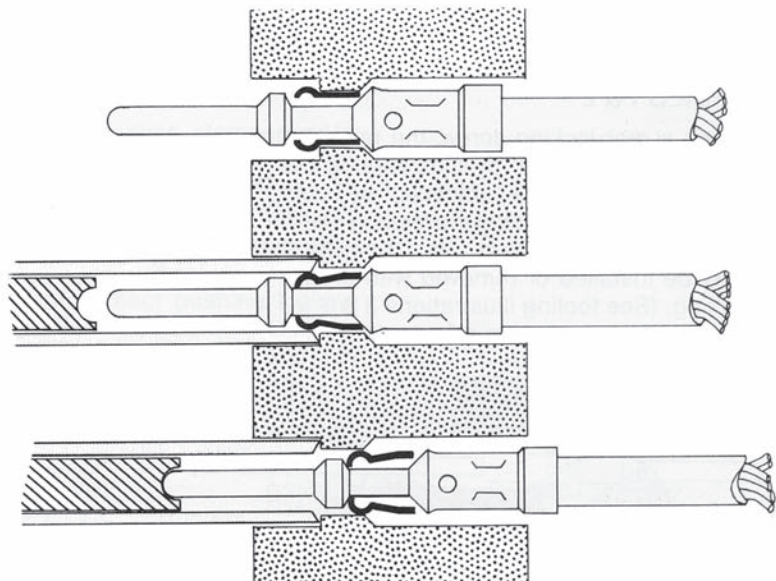
This locking mechanism is carried on the contact. It is pushed into the small diameter of the dielectric, collapsing the locking clip and permitting the contact to be removed. See tool illustration 8 on page 81. This locking method is common with Hughes Aircraft in sizes 22, 20, & 16.



ILL F

FRONT RELEASE CONNECTORS

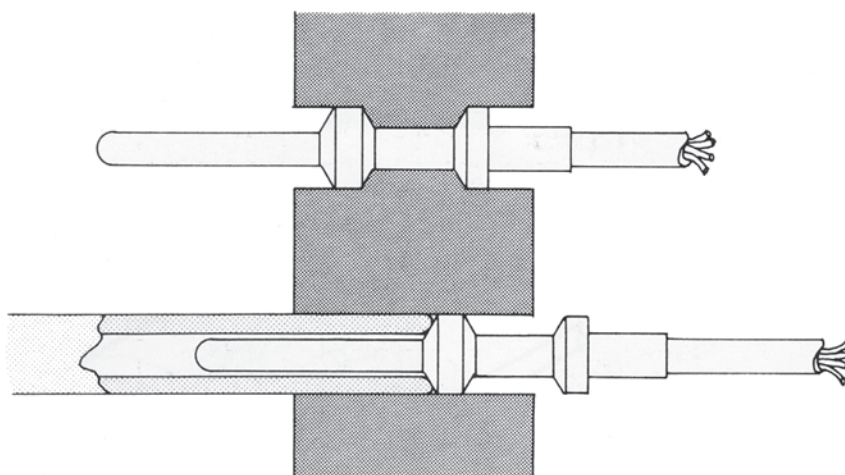
Similar to Hughes locking clips, these are found in some Winchester connectors. The clip is expanded in a "locked" position. To remove contact, insert tool, probe will collapse the clip and unlock the contact. The shedder (plunger) will follow through ejecting the contact. For contact insertion see tool illustrations 1 & 2 on page 80, and illustration 8 for removal on page 81.



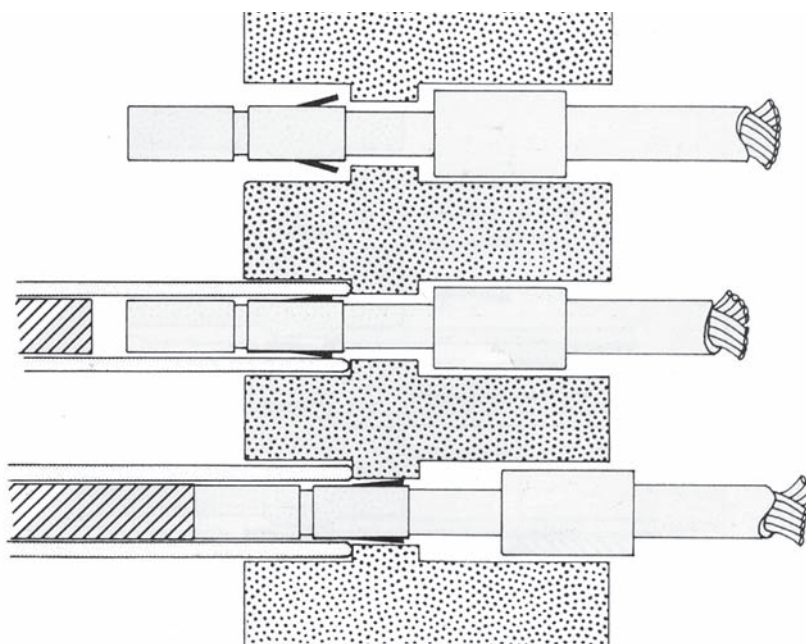
ILL G**INTERFERENCE LOCK CONNECTORS**

Used by Cannon, Bendix, and Amphenol, the contacts are inserted and removed by force using the proper tooling.

See tool illustrations 12 and 13 for insertion tools and illustrations 14 & 15 for insertion/removal kits on page 82.

**ILL H****FRONT RELEASE—
WINCHESTER, AMP
AND ELCO CONNECTORS**

The contacts may be held in by a locking clip or spear action. Some contacts of this nature are machined with a locking clip attached, while others are stamped with the spur-lock made into them.



Insertion and Removal Tool Selection Charts

How to Read Selection Charts

For ATA 1052

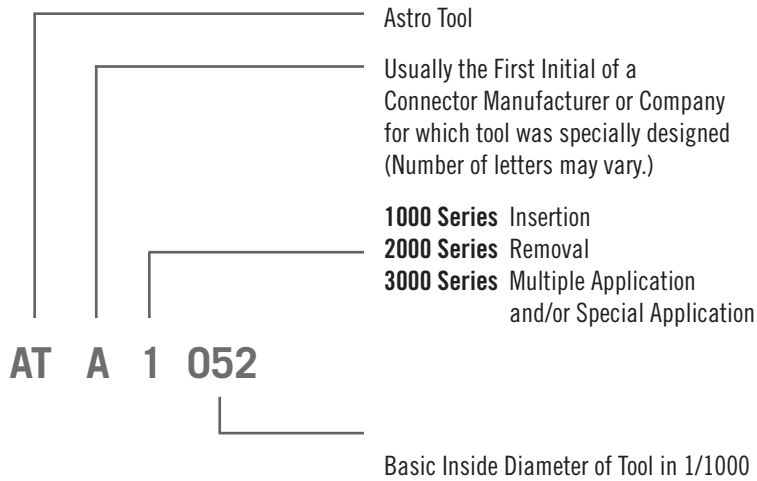


CHART ABBREVIATIONS

I/R	Insertion or Removal designation column
I	Insertion Tool
R	Removal Tool
I & R	Insertion & Removal Tool
R/F	Rear or Front Release designation column
R	Rear Release
F	Front Release
R & F	Rear and Front Release
ILL	Illustration reference number
GA	Gage designation
NAATT	Not Available At This Time

ASTRO WILL DESIGN CUSTOM INSERTION AND REMOVAL TOOLS TO FIT YOUR NEEDS.

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AIRBORN	ASTRO TOOL #						
TIR 1610	ATIR 1610	I & R	R	Metal Tool, Tweezer	10	22	WTK
	ATIR 1610-L	I & R	R	Modified version of ATIR 1610 .62 tips	10	22	WTK
TR 1883	ATR 1883	I & R	R	Metal Tool, Tweezer-Straight	10	22	WTK
TR 1886	ATR 1886	I & R	R	Metal Tool, Tweezer-.455 ext.	10	22	WTK482
2597	See ATIR 1610	I & R	R	TIR 1610 (Same as TIR1610)	10	22	WTK
2598	See ATIR 1883	I & R	R	TR 1883 (Same as TR1883)	10	22	WTK
	AT 4000	I	R	Pins & Sockets	2	22	TW
	AT 4001	I	R	Pins & Sockets	2	20	TW
	AT 4002	I	R	Comparable to ATH 1094	2	16	TM
	AT 4003	I	R	Deep Insertion	2	20	W
	AT 4004	I	R	Deep Insertion MRS, MRE, MRA, Jogged	2	16	C, M, R
	AT 5000	R	F	Pins & Sockets, Metal Spring-Loaded Probe Tool	8	22	TW
	AT 5001	R	F	Pins & Sockets, Metal Spring-Loaded Probe Tool	8	20	TW
	AT 5001-S	R	F	Pins Only, Metal Spring-Loaded Probe Tool	8	20	TW
	AT 5002	R	F	Comparable to ATH 2102, Metal Spring-Loaded Probe Tool	8	16	TM



Listed by Contact Manufacturer

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AMPHENOL	ASTRO TOOL #						
294-27	ATA 1079 or	I	R	Pins & Sockets	2	20	348
	ATA 1080	I	R	Pins & Sockets	4	20	348
294-28	ATA 2042 or	R	F	Pins Only	3	20	348
	ATA 2348-20	R	F	Pins & Sockets	9	20	348
294-29	ATA 2038 or	R	F	Sockets Only	7	20	348
	ATA 2048 or	R	F	Pins & Sockets	9	20	348
294-30	ATA 1102 or	I	R	Pins & Sockets	2	16	348
	ATA 1104	I	R	Pins & Sockets	4	16	348
294-31	ATA 2065 or	R	F	Pins Only	3	16	348
	ATA 2348-16	R	F	Pins & Sockets	9	16	348
294-32	ATA 2060 or	R	F	Sockets Only	7	16	348
	ATA 2348-16	R	F	Pins & Sockets	9	16	348
294-33	ATA 1159 or	I	R	Pins & Sockets	2	12	348
	ATA 1158 or	I	R	Pins & Sockets	4	12	348
	ATA1159-S	I	R	Modified version of ATA 1159, Straight	1	12	348
294-34	ATA 2120 or	R	F	Pins Only	3	12	348
	ATA 2348-12	R	F	Pins & Sockets	9	12	348
294-35	ATA 2093 or	R	F	Sockets Only	7	12	348
	ATA2348-12	R	F	Pins & Sockets	9	12	348
294-39	ATA 3069	I & R	F & R	Tool Kit	15	16	69
294-40	ATA 3095	I & R	F & R	Tool Kit	15	12	69
294-48	ATA 2125	R	R	Metal Tool, Rear Release, Plunger	6	16	84, 94
294-58	ATA 2085	R	F	Short Metal Tool, Front Release, Plunger	6	20	84, 94
294-66	ATA 3050	I	R	Tool, Double-Ended Tip, Dual Purpose	9	16, 20	84
294-72	AT 1000-12 or	I	R	Metal Tool, Joggled	2	12	48, 217
	ATA 1144	I	R	Metal Interchangeable Probe Tool	26	12	48, 217
294-73	AT 2012	R	F	Metal Tool, Front Release, Plunger	6	12	48, 217
294-88	AT 1000-20 or	I	R	Metal Tool, Joggled	2	20	48, 217
	ATA 1086	I	R	Metal Interchangeable Probe Tool	26	20	48, 217
294-89	AT 2020	R	F	Metal Tool, Front Release, Plunger	6	20	48, 217
294-96	AT 1000-16 or	I	R	Metal Tool, Joggled	2	16	48, 217
	ATA 1101	I	R	Metal Interchangeable Probe Tool	26	16	48, 217
294-97	AT 2016	R	F	Metal Tool, Front Release, Plunger	6	16	48, 217
294-108	ATA 1080 and	I	R	Metal Joggled Tool	2	20	M83723
	ATA 2080	R	R	Metal Tool, Tweezer Tool	10	20	M83723
294-109	ATA 1107 and	I	R	Metal Joggled Tool	2	16	M83723
	ATA 2112	R	R	Metal Tool, Tweezer Tool	10	16	M83723
294-110	ATA 1160 and	I	R	Metal Joggled Tool	2	12	M83723
	ATA 2160	R	R	Metal Tool, Tweezer Tool	10	12	M83723

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AMPHENOL	ASTRO TOOL #						
294-123	ATD 1035	I	R	Metal Tool, Joggled	2	22	
294-127	ATA 2255	R	F	#2 Shielded Contacts	6	Coax	48
294-128	ATA 1189	I	R	#2 Shielded Contacts	4	8	94
294-152	ATC 2040 and	R	F	Pins & Sockets	9	20	67, 906
	ATA 1075	I	R	Insertion tool for above	1	20	67, 906
294-155	ATA 2040 and	R	F	Pins & Sockets	9	22	17
	ATA 1040	I	R	Insertion tool for above	1	22	17
294-189	ATA 2185	R	F	#10 Contacts	6	10	213
294-190	ATA 1175	I	R	#10 Contacts	4	10	213
294-192	ATF 1101 or	I	R	Metal Long-Slot Tool	27	16	246
	ATF 1105	I	R	Comparable	2	16	246
294-219	ATF 2115	R	F	Metal Tool, Front Release, Plunger	5	16	246
294-229	ATF 1144 or	I	R	Metal Long-Slot Tool	27	12	246
	ATF 1160	I	R	Comparable	2	12	246
294-230	ATF 2162	R	F	Metal Tool, Front Release, Plunger	5	12	246
294-235	ATF 1558 or	I	R	Metal Long-Slot Tool	27	0	246
	ATF 1554	I	R	Comparable	2	0	246
294-236	ATF 1378 or	I	R	Metal Long-Slot Tool	27	4	246
	ATF 1359	I	R	Comparable	2	4	246
294-237	ATF 1260 or	I	R	Metal Long-Slot Tool	27	8	246
	ATF 1256	I	R	Comparable	2	8	246
294-238	ATA 2254	R	F	Coaxial 94-621	6	Coax	94
294-239	ATF 2336	R	F	Metal Tool, Front Release, Plunger	5	4	246
294-240	ATF 2252	R	F	Metal Tool, Front Release, Plunger	5	8	246
294-241	ATF 2518	R	F	Metal Tool, Front Release, Plunger	5	0	246
294-278	ATA 1052 or	I	R	Pins & Sockets	2	22	348
	ATA 1051 or	I	R	Pins & Sockets	4	22	348
	ATA 1052-S	I	R	Modified Version of ATA 1052, straight	1	22	348
294-280	ATA 2079	R	F	Metal Tool, Front Release, Plunger	6	20	213
294-286	ATA 2030 or	R	F	Pins Only	3	23	348
	ATA2348-22	R	F	Pins & Sockets	9	23	348
294-287	ATA 2026 or	R	F	Sockets Only	7	23	348
	ATA 2348-22	R	F	Pins & Sockets	9	23	348
294-296	ATSE 2070	R	F	MIL-C-28840	5	20	213
294-465	ATA 1114	I	R	Tip for ATA 3069 Kit (16-A)	15	16	69
356-400-1, 3	ATA 1040	I	R	Pins & Sockets Min-Rac, Relia-Tac	1	22	17
356-400-5, 6, 7, 8	ATA 2040	R	F	Pins & Sockets Min-Rac	9	22	17
356-400-11	ATA 1033	I	R	Pins & Sockets Min-Rac, Wire Form	1	22	17

Listed by Contact Manufacturer

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AMPHENOL	ASTRO TOOL #						
356-400-1, 3	ATA 1040	I	R	Pins & Sockets Min-Rac, Relia-Tac	1	22	17
356-400-5,6, 7, 8	ATA 2040	R	F	Pins & Sockets Min-Rac	9	22	17
356-400-11	ATA 1033	I	R	Pins & Sockets Min-Rac, Wire Form	1	22	17
356-400-12	ATA 2029	R	F	Sockets, Min-Rac, 220-501	1	22	17
356-400-13	ATA 2033	R	F	Pins Minc-Rac, Wire Form	1	22	17
	ATA 2033-L	R	F	Pins-Librascope, Long Tip	1	22	17
356-400-2	ATA 1109	I	R	Pins & Sockets Mini-Rac, Wire Form	9	22	
356-400-15, 14	ATA 2032	R	F	Pins & Sockets Min-Rac, Wire Form	9	22	17
356-400-11, 12, 13	ATA 3032	I & R	R & F	Tool Kit, Min-Rac, 220-501	15	22	17
494-1 Handles	ATA 3482	I & R	R & F	Tool, Double-Ended Tip-Filter Pins	9	20	482
494-1-2 Insertion Tip	ATA 1186	I	R	Straight Coaxial	1	Coax	
494-1-3 Removal Tip	ATA 2073	R	F	Stamped Contacts	6	20	M
	ATA 2112	R	F	Pins & Sockets	6	16	M
	ATA 3035	I & R	R & F	Tool Kit, Pins & Sockets, Min-Rac, Wire Form	15	22	17
200-4000-240-20	ATA 3120	I & R	R & F	Contact Clip Removal & Replacement	--	16	5015
11-3695	ATBX 2-3695	R	F	Tool Kit	14	12, 16	AN/MS
11-3696	ATBX 2-3696	R	F	Tip Only	25	12	AN/MS
11-3697	ATBX 2-3697	R	F	Tip Only, Pins	25	16	AN/MS
11-3698	ATBX 2-3698	R	F	Tip Only, Sockets	25	12, 16	AN/MS
11-6147-1	ATBX 3-6147-1	--	--	Connector Plier	--	--	
11-6781	ATBX 1-6781	I	R	Plier for Pygmy CE Connector	12	16	CE
11-6782	ATBX 1-6782	I	R	Plier for Pygmy CE Connector	12	20	CE
11-6783	ATBX 2-6783	R	F	Tip, CE Pygmy Pins	25	20	CE
11-6784	ATBX 2-6784	R	F	Tip, CE Pygmy Sockets	25	20	CE
11-6900	ATBX 2-6900	R	F	Tool Kit, CE Pygmy	14	16, 20	CE
11-6911	0148-0141			Handle & Cap Only	14	--	
11-7082	ATBX 1-7082	I	R	Solderless Contacts	12	12	AN/MS
11-7260	ATBX 2-7260	R	F	Tool Kit, CE Contacts incl.	14	12, 16, 20	AN/MS & CE
11-7345	ATBX 1-7345	I	R	Plier for 75, 81 & 85 Connector	12	16	AN/MS
11-7401-12	ATA 1144 or	I	R	MS24254 & MS24255 CONTACTS, Metal Interchangeable Probe Tool	26	12	AN/MS
	AT 1000-12	I	R	Metal Tool Joggled	2	12	AN/MS
11-7401-16	ATA 1101 or	I	R	MS24254 & MS24255 CONTACTS, Metal Interchangeable Probe Tool	26	16	AN/MS
	AT 1000-16	I	R	Metal Tool Joggled	2	16	AN/MS
11-7401-20	ATA 1086 or	I	R	MS24254 & MS24255 CONTACTS, Metal Interchangeable Probe Tool	26	20	AN/MS
	AT 1000-20	I	R	Metal Tool Joggled	2	20	AN/MS
11-7736	ATBX 1-7736	I	R	Angled Pliers (214000 Series)	13	16	AN/MS
11-7763	ATBX 1-7763	I	R	Angled Pliers (214000 Series)	13	12	AN/MS
11-7837	ATBX 2-8250	R	F	Tool Kit	14	8, 12, 16	AN/MS

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AMPHENOL/BENDIX	ASTRO TOOL #						
11-7880-8	ATBX 2291	R	F	Coaxial	6	8	SE/MS
11-7880-12	AT 2012	R	F	MS24254 & MS24255 CONTACTS	6	12	SE/MS
11-7880-16	AT 2016	R	F	MS24254 & MS24255 CONTACTS	6	16	SE/MS
11-7880-20	AT 2020	R	F	MS24254 & MS24255 CONTACTS	6	20	SE/MS
11-8107-16	ATBX 1-8107-16	I	R	Pliers, SE Contacts	12	16	SE
11-8107-20	ATBX 1-8107-20	I	R	Pliers, SE Contacts	12	20	SE
11-8154-1	ATBX 2288	R	F	Coaxial Contacts	6	8	SE
11-8220	ATBX 1-8220	I	R	Coaxial		8	AN/MS
11-8250	ATBX 2-8250	R	F	Tool Kit	14	8, 12, 16	AN/MS
11-8251	ATBX 2-8251	R	F	Tip Only, Sockets	14	8	AN/MS
11-8252	ATBX 2-8252	R	F	Tip Only, Pins	14	8	AN/MS
11-8475	ATBX 2-8475	R	F	Tool Kit	14	12, 16	AN/MS
11-8860-1	ATBX 1133	I	R	Coaxial contacts 10 PT-CE	2	Coax	CE
11-8860-2	ATBX 1160	I	R	Coaxial contacts 10 PT-CE	2	Coax	CE
11-8860-3	ATBX 1203	I	R	Coaxial contacts 10 PT-CE	2	Coax	CE
11-8860-4	ATBX 1231	I	R	Coaxial contacts 10 PT-CE	2	Coax	CE
11-8860-5	ATBX 1253	I	R	Coaxial contacts 10 PT-CE	2	Coax	CE
11-8369-4	ATBX 1231	I	R	Coaxial contacts 10 PT-CE	2	Coax	CE
11-8674-12	ATBX 1154	I	R	Metal Tool, Joggled	2	12	JT
	ATBX 1154-90	I	R	Metal Tool, 90 Degree Angle	1	12	JT
	ATBX 1157	I	R	Metal Tool, Tweezer Tool	10	12	JT
11-8674-16	ATBX 1103	I	R	Metal Tool, Pencil Style	24	16	JT
	ATR 1107	I	R	Metal Tool, Joggled	2	16	JT
	ATBX 1108	I	R	Metal Tool, Tweezer Tool	10	16	JT
11-8674-20	ATBX 1070	I	R	Metal Tool, Pencil Style	24	20	JT
	ATBX 1071	I	R	Metal Tool, Straight Style	1	20	JT
	ATBX 1073	I	R	Metal Tool, Offset	2	20	JT
	ATBX 1072	I	R	Metal Tool, Tweezer Tool	10	20	JT
	ATBX 1075	I	R	Metal Tool, Tweezer Tool, .75 tip length	10	20	JT
11-8674-22	ATBX 1057	I	R	Metal Tool, Pencil Style	24	22	JT
	ATBX 1055	I	R	Metal Tool, Offset	2	22	JT
	ATBX 1055-S	I	R	Metal Tool, Special	1	22	JT
	ATBX 1058	I	R	Metal Tool, Tweezer Tool	10	22	JT
	ATBX 1059	I	R	Metal Tool, Tweezer Tool, .260 of Straight	10	22	JT



TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AMPHENOL/BENDIX	ASTRO TOOL #						
11-8674-24	ATBX 1046	I	R	Metal Tool, Pencil Style	24	22M/D	JT
	ATBX 1046-90	I	R	Metal Tool, 90 Degree Angle	24	22M/D	JT
	ATBX 1046-135	I	R	Metal Tool, 45 Degree Angle	24	22M/D	JT
	ATBX 1049	I	R	Metal Tool, Offset	2	22M/D	JT
	ATBX 1049-S	I	R	Metal Tool, Special	2	22M/D	JT
	ATBX 1052	I	R	Metal Tool for .052 dia. wire	2	22D	JT
	ATBX 1048	I	R	Metal Tool, Tweezer Tool	10	22M/D	JT
	ATBX 1051	I	R	Metal Tool, Tweezer Tool, .055 dia. wire	10	22M/D	JT
11-8675-12	ATBX 2155	R	R	Metal Tool, Tweezer Tool	10	12	JT
11-8675-16	ATBX 2103	R	R	Metal Tool, Tweezer Tool	10	16	JT
11-8675-20	ATBX 2070	R	R	Metal Tool, Tweezer Tool	10	20	JT
	ATBX 2075	R	R	Metal Tool, Tweezer Tool, .75 Tip Length	10	20	JT
11-8675-22	ATBX 2057	R	R	Metal Tool, Tweezer Tool	10	22	JT
	ATBX 2058	R	R	Metal Tool, Tweezer Tool, Long Tip	10	22	JT
11-8675-24	ATBX 2046	R	R	Metal Tool, Tweezer Tool	10	22M/D	JT
	ATBX 2048	R	R	Metal Tool, Tweezer Tool, .560 Tip Length	10	22M/D	JT
11-8794-12	ATBX 1159	I	R	Metal Tool, Tweezer Tool, Straight	10	12	JT
11-8794-16	ATBX 1109	I	R	Metal Tool, Tweezer Tool, Straight	10	16	JT
11-8794-20	ATBX 1078	I	R	Metal Tool, Tweezer Tool, Straight	10	20	JT
11-8794-22	ATBX 1060	I	R	Metal Tool, Tweezer Tool, Straight	10	22	JT
11-8794-24	ATBX 1054	I	R	Metal Tool, Tweezer Tool, Straight	10	22M/D	JT
11-8795-12	ATBX 2160	R	R	Metal Tool, Tweezer Tool, Straight	10	12	JT
11-8795-16	ATBX 2109	R	R	Metal Tool, Tweezer Tool, Straight	10	16	JT
11-8795-20	ATBX 2073	R	R	Metal Tool, Tweezer Tool, Straight	10	20	JT
11-8795-22	ATBX 2059	R	R	Metal Tool, Tweezer Tool, Straight	10	22	JT
11-8795-24	ATBX 2050	R	R	Metal Tool, Tweezer Tool, Straight	10	22M/D	JT
	ATBX 2047	R	R	Metal Tool, Tweezer Tool, Modified Version of ATBX 2050	10	22M/D	JT
11-8952	ATBX 2052	R	R	Metal Tool, Tweezer Tool, Oversize Wire, Min.	10	22M/D	JT
11-8953-1	ATBX 1053	I	R	Modified version of ATBX 1048, .375 Long Straight Section	10	22M/D	JT
11-10050-1	ATX 2014	R	R	Unwired Contacts	16	22D	JT
11-10050-2	ATX 2004	R	R	Unwired Contacts	16	22	JT
11-10050-3	ATX 2003	R	R	Unwired Contacts	16	20	JT
11-10050-4	ATX 2002	R	R	Unwired Contacts	16	16	JT

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
AMPHENOL/MATRIX	ASTRO TOOL #						
90-0001-022	ATM 1046	I	R	Mini-Mate	23	22	
	ATM 1046-135	I	R	Modified version of ATM 1046, 45 degree angle	23	22	
90-0002-022	ATM 2052	R	F	Mini-Mate, Metal Spring-Loaded Probe Tool	8	22	
258-6018-16	ATR 2112	R	R	Metal Tool, Tweezer	10	16	
258-6019-16	ATR 1107	I	R	Metal Tool, Joggled	2	16	
259-6002-20	ATR 2080	R	R	Metal Tool, Tweezer	10	20	
5000-026-22	ATRX 2052	R	R	Metal Tool, Tweezer	10	22	
6500-001-20	ATR 1080 and	I	R	Metal Tool, Joggled	2	20	
	ATR 2080	R	R	Metal Tool, Tweezer	10	20	
6500-001-16	ATR 1107 and	I	R	Metal Tool, Joggled	2	16	
	ATR 2112	R	R	Metal Tool, Tweezer	10	16	
6500-001-12	ATR 1160 and	I	R	Metal Tool, Joggled	2	12	
	ATR 2160	R	R	Metal Tool, Tweezer	10	12	
6500-018-0	ATC 2565	R	R	5015 Connector, Rear Release	19	0	
6500-018-4	ATC 2426	R	R	5015 Connector, Rear Release	19	4	
6500-018-8	ATC 2281	R	R	5015 Connector, Rear Release	19	8	
6500-028-12	ATC 2157	R	R	Modified version of ATR 2160, straight	10	12	
6500-028-16	ATC 2106	R	R	Modified version of ATR 2112, straight	10	16	
6500-028-20	ATC 2079	R	R	Modified version of ATR 2080, straight	10	20	
6500-029-12	ATR 2160	R	R	PLASTIC Tweezer, 70 degree angle	10	12	
6500-029-16	ATR 2112-L	R	R	PLASTIC Tweezer, 70 degree angle	10	16	
6500-029-20	ATR 2080	R	R	PLASTIC Tweezer, 70 degree angle	10	20	
6500-030-12	ATGH 1160	I	R	Straight In-Line, PLASTIC	1	12	
6500-030-16	ATGH 1112	I	R	Straight In-Line, PLASTIC	23	16	
6500-030-20	ATGH 1079	I	R	Straight In-Line, PLASTIC	23	20	
6500-045-20	ATC 1071 and	I	R	Metal Comparable for Hydraulic Research	23	20	
	ATC 2076	R	R	Metal Comparable for Hydraulic Research	10	20	
	ATM 1050	I	R	Special Close 90 degree Bend	23	22	



TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
BOEING	ASTRO TOOL #						
	ATBO 1053	I	R	Special Plier Repair Tool for m39029/11-22 & 12-22	13	22	
	ATBO 1054	I	R	Modified version of ATC 1054, 1.1 Long Tip (CIT DPXMA22-1)	2	22	
	ATBO 1070	I	R	Contact BACC47DT&S	-	20	
	ATBO 1075	I	R	NAS 1599 Connector	-	20	
	ATBO 1075-L	I	R	Modified version of ATBO 1075, Longer Tip	-	20	
	ATBO 1081	I	R	Contact BACC47DT&S	-	16	
	ATBO 1081-L	I	R	Modified version of ATBO 1081, Longer Tip	-	16	
	ATBO 1082	I	R	NAS 1599 Connector	2	20	
	ATBO 1105	I	R	Metal Tool, Tweezer Tool	10	16	
ST 2342A-T1	ATBO 1107	I	R	Metal Tool, Joggled "Horses Head"	2	16	
	ATBO 1108	I	R	Arbor Press	2	16	
	ATBO 1108-90	I	R	Modified version of ATBO 1108, 90 Degree Angle	1	16	
ST 2342A-T5	ATBO 1154	I	R	Metal Tool, Joggled "Horses Head"	2	12	
	ATBO 2054	R	R	Special Boeing Tool (CET DPXMA22)	2	22	
	ATBO 2073	R	R	Hypertronics Connector, Metal Spring-Loaded Probe Tool	8	20	K65
	ATBO 2082	R	R	NAS 1599 -- Oversize Wire	2	20	
ST 2342PB	ATBO 2342-PB	I	R	Handle inserts wire wrap contacts	-	-	
	ATBO 2342-PB			(Replaceable tips for basic tool listed below)			
	/1	I	R	Original Tip	-	22	
	/2	I	R	Modified .050 I.D.	-	22	
	/3	I	R	Modified ATC 1054 Tip	-	22	
	/4	I	R	Modified to .062 I.D.	-	22	

CHART ABBREVIATIONS

I/R Insertion or Removal designation column
I Insertion Tool
R Removal Tool
I & R Insertion & Removal Tool
R/F Rear or Front Release designation column

R Rear Release
F Front Release
R & F Rear and Front Release
ILL Illustration reference number
GA Gage designation
NAATT Not Available At This Time

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
BURNDY/FCI	ASTRO TOOL #						
J-1276-1		I & R	R	YHMM-22-1 Pins, plastic tip, recommended ATB 3062-2	-	2	YHMM
J-1276-3	ATB 3062-2	I & R	R	YHMM-22-1 Pins, plastic tip	29	2	YHMM
J-1276-4	ATB 3062-4	I & R	R	YHMM-22-1 Pins, plastic tip (Longer Handle)	29	2	YHMM
RTM-12-5	ATA 1144 or	I	R	MIL-C-26500, Metal Interchangeable Probe Tool	26	12	HYFEN
	AT 1000-12	I	R	MIL-C-26500, Metal Tool, Joggled	2	12	HYFEN
RTM-12-8	ATBX 1157	I	R	MIL-C-38999, Metal Tool, Joggled	10	12	JT
RTM-16-2V	ATA 1101	I	R	MIL-C-26482, Metal Interchangeable Probe Tool	26	16	HYFEN
RTM-16-4	ATBX 1108	I	R	MIL-C-38999, Metal Tool, Tweezer	10	16	JT
RTM-20-5	ATB 1064 or	I	R	MIL-C-26482, 26500, 26636, Metal Interchangeable Probe Tool	26	20	HYFEN
	ATB 1067 or	I	R	Modified version of ATB 1064, Long Tip, Metal Interchangeable Probe Tool	26	20	HYFEN
	ATB 1068	I	R	Modified version of ATB 1067, Joggled	2	20	HYFEN
RTM-20-5PI	ATB 1067-R	I	R	Tip to fit Burndy RTM-20-5	25	20	HYFEN
RTM-20-17	ATBX 1072	I	R	MIL-C-38999, Metal Tool, Tweezer	10	20	JT
RTM-22-1	ATBX 1058	I	R	MIL-C-38999, Metal Tool, Tweezer	10	22	JT
RTM-24-3	ATBX 1053	I	R	MIL-C-38999, Metal Tool, Tweezer	10	24	JT
RTM-20-16	AT1000-20	I	R	Metal Tool, Joggled	2	20	
RX-8-1	ATH 2202	R	F	Metal Tool, Coaxial	6	8	
RX-12-7	AT 2012	R	F	MIL-C-26636, 26482	6	12	HYFEN
RX-12-9	ATBX 2155	R	R	MIL-C-38999	10	12	JT
RX-16-7-V1	ATB 2114	R	F	Modified MS24256R-16, Revision E	6	16	HYFEN
RX-16-7-V2	ATB 2114	R	F	Modified MS24256R-16, Revision E	6	16	HYFEN
RX-16-8	AT 2016	R	F	MIL-C-26482	6	16	HYFEN
RX-16-9	ATBX 2103	R	R	MIL-C-38999	10	16	JT
RX-20-10	ATB 2088	R	F	MIL-C-26500, 26636, Metal Spring-Loaded Probe Tool	8	20	HYFEN
RX-20-24	AT 2020	R	F	MIL-C-26482	6	20	HYFEN
RX-20-24V3	ATB 2080	R	F	MIL-C-26482 (MS24256R-20, Revision E) Modified	6	20	HYFEN
RX-20-24V5	ATB 2080	R	F	MIL-C-26482 (MS24256R-20, Revision E) Modified	6	20	HYFEN
RX-20-36	ATBX 2070	R	R	MIL-C-38999	10	20	JT
RX-22-1	ATBX 2057	R	R	MIL-C-38999	10	22	JT
RX-24-3	ATBX 2046	R	R	MIL-C-38999	10	22D	JT
	ATB 1035	I	R	Unwired Contact 28-91-S-9000	1	22	
	ATB 1043	I	R	Unwired Contact 39029/18-20-20	1	20	
	ATB 1044	I	R	Unwired Contact 2749420	1	20	
	ATB 1066	I	R	Unwired Contact 0641-1-1631	1	16	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
COLLINS RADIO	ASTRO TOOL #						
372-8091-010	ATC 2026	R	F	Tuning Fork Contacts	11	--	
372-8091-060	ATC 1032	I	R	Tweezer, Filter Pins	30	--	



Listed by Contact Manufacturer

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
CONTINENTAL	ASTRO TOOL #						
2512	AT 5002	R	F	Metal Spring-Loaded Probe Tool	8	16	25
2534	AT 4002	I	R	Metal Tool, Joggled	2	16	25
2558	ATBX 1057	I	R	Metal Tool, Pencil Style	24	22	25
2559	ATCL 2061	R	F	Metal Spring-Loaded Probe Tool	8	22	25

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
DELPHI/HUGHES	ASTRO TOOL #						
TD-202-IT-000	AT 4003	I	R	Deep Insertions G. D. Pomona	2	20	W
TE-022-RT-001	ATH 2027	R	F	PC Connector Jack Pins, Metal Spring-Loaded Probe Tool	8	22	EMS
TG-22-IT	ATH 1053	I	R	Metal Tool, Tweezer	10	22D	W
TG-22-RT	ATH 2053	R	R	Metal Tool, Tweezer	10	22D	W
THM-22-B000	ATBX 2046	R	R	Metal Tool, Tweezer	10	22M	W
TM-016-IT-001	AT 4002 or 4004	I	R	Joggled Push-In Style	2	16	C-M-R
TM-016-IT-003	AT 4004	I	R	Deep Insertion-MRS-MRE-MRA	2	16	MR
TM-016-RT-001	AT 5002	R	F	MRP Connector, Pins & Sockets, Metal Spring-Loaded Probe Tool	8	16	MR
TM-016-RT-006	ATH 2103	R	F	Pins & Sockets	6	16	M
TR-22D-IT	ATH 1050	I	R	Metal Tool, Tweezer #1035415	10	22D	W
TR-22D-RT	ATH 2050	R	R	Metal Tool, Tweezer #1035416A	10	22D	W
TU-016-IT-002	ATH 1102	I	R	Contacts UP 16Y16C000	2	16	U
TU-016-RT-000	ATH 2120	R	F	Universal Contacts, Metal Spring-Loaded Probe Tool	8	16	U
TU-016-RT-006	ATH 2121	R	F	Pins & Sockets	6	16	U
TU-020-IT-002	ATH 1067	I	R	UR-UTE-UTS	1	20	U
TU-020-RT-002	AT 5001-S	R	F	URS-UTE-UTS, Metal Spring-Loaded Probe Tool	8	20	U
TU-020-RT-006	ATH 2088	R	F	Pins & Sockets	6	20	U
TU-180-RT-000	ATH 2221	R	F	Co-ax RG 180/U	6	8	U
TU-195-RT-000	ATH 2206	R	F	Co-ax RG 195/U	6	8	U
TW-020-IT-000	AT 4001	I	R	Pins & Sockets	2	20	W
TW-020-RT-002	AT 5001	R	F	WMS-WMW-O-Line, Metal Spring-Loaded Probe Tool	8	20	W
TW-020-RT-006	ATH 2088	R	F	Pins & Sockets	6	20	W
TW-022-IT-000	ATH 1046	I				22	W
TW-022-IT-001	AT 4000	I	R	Pins & Sockets	2	22	W
TW-022-IT-007	ATH 1052	I	R	Pins & Sockets	23	22	W
TW-022-RT-001	AT 5000	R	F	WSS 0244 P08-RN-549, Metal Spring-Loaded Probe Tool	8	22	W
TW-022-RT-006	ATH 2052	R	F	Pins & Sockets, Metal Spring-Loaded Probe Tool	8	22	W
652636	AT 5000	R	F	WSS 0244P08 -Airborn, Metal Spring-Loaded Probe Tool	8	22	W
722698-328	AT 5002	R	F	Pins & Sockets -Documented, Metal Spring-Loaded Probe Tool	8	16	MR
722698-329	ATAMP 3070			Transfer Tool Termipoint Clib	21		
722699-224	ATH 3260			Forming Tool Microelectronic Leads	20		
722699-224-1	ATH 3261			Forming Pliers-To form leads before Insertion on circuit board	20		
722699-224-2	ATH 3262			Forming Pliers-To form leads before Insertion on circuit board	20		
722699-224-3	ATH 3263			Forming Pliers-To form leads before Insertion on circuit board	20		

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
DELPHI/HUGHES	ASTRO TOOL #						
	ATH 1031	I	R	Special for General Dynamics	1	22	
	ATH 1033	I	R	Special for General Dynamics	2	22	
	ATH 1054	I	R	Metal Tool	23	22	
	ATH 1094	I	R	MIL-C-22857	1	16	
	ATH 2089	R	F	URS-UTE-UTS-Deep, Metal Spring-Loaded Probe Tool	8	20	U
	ATH 2102	R	F	MIL-C-22857, Metal Spring-Loaded Probe Tool	8	16	
	ATH 3037-12			Contact Guide 12" Long used on rear insert 22 GA contacts	22		
	ATH 3037-18			Contact Guide 18" Long used on rear insert 22 GA contacts	22		

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
DEUTSCH	ASTRO TOOL #						
15513-12	ATA 1144	I	R	MIL-C-26636, Metal Interchangeable Probe Tool	26	12	DD, DTK, DPK
15513-16	ATA 1101	I	R	MIL-C-26636, Metal Interchangeable Probe Tool	26	16	DD, DTK, DPK
15513-20	ATA 1086	I	R	MIL-C-26636, Metal Interchangeable Probe Tool	26	20	DD, DTK, DPK
81515-20	ATD 1061 and	I	R	MIL-C-81511, Series III & IV	2	20	
	ATD 2062	R	F	MIL-C-81511, Series III & IV	10	20	
81515-16	ATD 1094 and	I	R	MIL-C-81511, Series III & IV	2	16	
	ATD 2094	R	F	MIL-C-81511, Series III & IV	10	16	
81517-23	ATD 2044	R	R	Metal Tool	17	22	
81517-20	ATD 2058	R	R	Metal Tool	17	20	
81517-16	ATD 2090	R	R	Metal Tool	17	16	
81517-12	ATD 2150	R	R	Metal Tool	17	12	
M-15513-12	ATA 1159	I	R	800 Series	2	12	DS, MDR, DA
M-15513-16	ATR 1107	I	R	800 Series	2	16	DS, MDR, DA
M-15513-20	ATD 1081 or	I	R	800 Series	2	20	DS, MDR, DA
	ATD 1081-S	I	R	Modified version of ATD 1081 Straight	1	20	
M-15513-25	ATD 1206	I	R	Coaxial & 8 GA, Metal Long-Slot Tool	27	8	
M-15514-12	AT 2012	R	F	MIL-C-26636	6	12	DD, DTK, DPK
M-15514-16	AT 2016	R	F	MIL-C-26636	6	16	DD, DTK, DPK
M-15514-20	AT 2020	R	F	MIL-C-26636	6	20	DD, DTK, DPK
M-15514-25	ATA 2254	R	F	800 Series	6	Coax	DD, DTK, DPK
M-15515-12	ATD 2191 or	R	F	Pins & Sockets	17	12	DS
	ATD 2190	R	F	Pins & Sockets	6	12	DS
M-15515-16	ATD 2127 or	R	F	Connector #6820	17	16	DS
	ATD 2128	R	F	Connector #6820	6	16	DS
M-15515-20	ATD 2097 or	R	F	Pins & Sockets	17	20	DS
	ATD 2095	R	F	Pins & Sockets, Spring Loaded	6	20	DS
M-15515-22P/S	ATD 2040	R	F	Metal Tool	23	22	DS



TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
DEUTSCH	ASTRO TOOL #						
M-15513-12	ATA 1159	I	R	800 Series	2	12	DS, MDR, DA
M-15513-16	ATR 1107	I	R	800 Series	2	16	DS, MDR, DA
M-15513-20	ATD 1081 or	I	R	800 Series	2	20	DS, MDR, DA
	ATD 1081-S	I	R	Modified version of ATD 1081 Straight	1	20	
M-15513-25	ATD 1206	I	R	Coaxial & 8 GA, Metal Long-Slot Tool	27	8	
M-15514-12	AT 2012	R	F	MIL-C-26636	6	12	DD, DTK, DPK
M-15514-16	AT 2016	R	F	MIL-C-26636	6	16	DD, DTK, DPK
M-15514-20	AT 2020	R	F	MIL-C-26636	6	20	DD, DTK, DPK
M-15514-25	ATA 2254	R	F	800 Series	6	Coax	DD, DTK, DPK
M-15515-12	ATD 2191 or	R	F	Pins & Sockets	17	12	DS
	ATD 2190	R	F	Pins & Sockets	6	12	DS
M-15515-16	ATD 2127 or	R	F	Connector #6820	17	16	DS
	ATD 2128	R	F	Connector #6820	6	16	DS
M-15515-20	ATD 2097 or	R	F	Pins & Sockets	17	20	DS
	ATD 2095	R	F	Pins & Sockets, Spring Loaded	6	20	DS
M-15515-22P/S	ATD 2040	R	F	Metal Tool	23	22	DS
M-15515-25	ATD 2250	R	F	Coaxial, Metal Spring-Loaded Probe Tool	6	8	DSM
M-15570-12	ATR 1160 and	I	R	Metal Tool, Joggled	2	12	JTA
	ATR 2160	R	R	Metal Tool, Tweezer	10	12	JTA
M-15570-16	ATR 1107 and	I	R	Metal Tool, Joggled	2	16	JTA
	ATR 2112	R	R	Metal Tool, Tweezer	10	16	JTA
M-15570-20	ATR 1080 and	I	R	Metal Tool, Joggled	2	20	JTA
	ATR 2080	R	R	Metal Tool, Tweezer	10	20	JTA
M-15570-22	ATD 2048	R	R	Metal Tool	23	22	RSM-RTK
M-15570-22-1	ATD 1035 and	I	R	Metal Tool, Joggled	2	22	RSM-RTK
	ATD 2047	R	R	Metal Tool, Tweezer	10	22	RSM-RTK
	ATD 1035-135	I	R	Joggled version of ATD 1035, 45 degree angle	2	22	RSM-RTK
M-15571	ATK 2115	R	R	NAS 1599, Unwired Contacts	17	12, 16, 20	JTA
M83723-31-12, 16 & 20	SEE THE NATIONAL AEROSPACE STANDARD SECTION						
	ATD 1020	I	R	RTK Connector Twist Pin	1	22	RTK
	ATD 3312			Wire comb, 6" taper flap, modified version of ATWC 3312	--	--	
	ATDL 2050	R	R	MIL-C-38999, tweezer	10	22D	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
ELCO	ASTRO TOOL #						
061742-04	ATD 1081	I	R	Metal Tool, Joggled	2	20	
T-06-1877-02	ATE 2057	R	R	D11890977 Connector, Metal Spring-Loaded Probe Tool	8	20	

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
FLIGHT CONN.	ASTRO TOOL #						
	ATF 1101	I	R	Metal Long-Slot Tool	27	16	
716-1227-000	ATF 1105	I	R	Joggled version of ATF 1101	2	16	
	ATF 1144	I	R	Metal Long-Slot Tool	27	12	
712-1229-000	ATF 1160	I	R	Joggled version of ATF 1144	2	12	
708-1258-000	ATF 1256	I	R	Version of ATF 1260	2	8	
	ATF 1260	I	R	Metal Long-Slot Tool	27	8	
704-1260-000	ATF 1359	I	R	Joggled version of ATF 1378	2	4	
	ATF 1378	I	R	Metal Long-Slot Tool	27	4	
700-1262-000	ATF 1554	I	R	Joggled version of ATF 1558	2	0	
	ATF 1558	I	R	Metal Tool	27	0	
716-1168-000	ATF 2115	R	F	Front Release	5	16	
712-1172-000	ATF 2162	R	F	Front Release	5	12	
708-1138-000	ATF 2255	R	F	Front Release	5	8	
704-1134-000	ATF 2336	R	F	Front Release	5	4	
700-1130-000	ATF 2518	R	F	Front Release	5	0	



TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
G & H TECHNOLOGY	ASTRO TOOL #						
847-101-COTO-1 &-2	ATGH 1055	I & R	R	Single Tip, No Wire Slot	23	22	847/848
847-101-COTO-3 &-4	ATGH 1081	I & R	R	Single Tip, No Wire Slot	23	20	847/848
847-101-COTO-5 &-6	ATGH 1104	I & R	R	Single Tip , No Wire Slot	23	16	847/848
847-101-COTO-7 &-10	ATGH 2057	I & R	R	Single Tip	23	22	847/848
847-101-COTO-8 &-11	ATGH 2081	I & R	R	Single Tip	23	20	847/848
847-101-COTO-9 & -12	ATGH 2105	I & R	R	Single Tip	23	16	847/848
866-1078-COTO-3	ATGH 2048	I & R	R	Single Tip , Straight with Slot	23	22	866
866 -1078-COTO-4	ATGH 1070	I & R	R	Single Tip, Straight	23	20	866
882-94	ATGH 2110	R	R	Metal Tool, Tweezer	10	16	
885-277-COTO-001	ATGH 2051	R	R	MIL-C-38999, Breech Lok	10	22D	
885-277-COTO-002	ATGH 2078	R	R	MIL-C-38999, Breech Lok	10	20	
885-277-COTO-003	ATGH 2109	R	R	MIL-C-38999 , Breech Lok	10	16	
998-062	ATGH 1079	I	R	NAS 1599 Connectors	23	20	843
998-063	ATGH 2079	R	R	NAS 1599 Connectors	23	20	843
998-102	ATGH 1112	I	R	NA S 1599 Connectors	23	16	843
998-103	ATGH 1160	I & R	R	NAS 1599 Connectors	1	12	843
998-104	ATGH 1190	I & R	R	NAS 1599 Connectors	1	8	843
998105	ATGH 1079	I & R	R	NAS 1599 Connectors	23	20	843
998-142-001	ATGH 2330	R	R	Coaxial, Metal Long-Slot Tool	27	Coax	
998-145-001	ATGH 1050	I	R	Metal Tool, Tweezer	10	22	847/848
998-145-002	ATGH 2052	R	R	Metal Tool, Tweezer	10	22	847/848
998-145-003	ATGH 1076	I	R	Metal Tool, Tweezer	10	20	847/848
998-145-004	ATGH 2076	R	R	Metal Tool, Tweezer	10	20	847/848
998-145-005	ATGH 1101	I	R	Metal Tool, Tweezer	10	16	847/848
998-145-006	ATGH 2101	R	R	Metal Tool, Tweezer	10	16	847/848
	ATGH 1071	I & R	R	Modified for Lockheed S-2406-30	23	20	
	ATGH 1077	I	R	Modified version of ATBX 1072 .66 tip length , MIL-C-38999	10	20	
	ATGH 1109	I	R	Modified version of ATBX 1108 .66 tip length , MIL-C-38999	10	16	
	ATGH 2049	R	R	Metal Tool, Tweezer	10	22	847/848
	ATGH 2054	R	R	Metal Tool, Tweezer	10	22	847/848
	ATGH 2075	R	R	Metal Tool, Tweezer	10	20	847/848
	ATGH 2077	R	R	Metal Tool, Tweezer	10	20	847/848
	ATGH 2080	R	R	Modified version of ATBX 2070 .66 tip length, MIL-C-38999	10	20	
	ATGH 2103	R	R	Metal Tool, Tweezer	10	16	
	ATGH 2104	R	R	NAS1599, 15° tip angle	10	16	
	ATGH 2108	R	R	Modified version of ATBX 2103 .66 tip length, MIL-C-38999	10	16	
	ATGH 2160	R	R	Metal Tool, Tweezer	10	12	

Insertion and Removal Tool Selection Charts

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TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
ITT/CANNON	ASTRO TOOL #						
CET 4	ATC 2234	R	F	Push out, Pins & Sockets	9	4	RX
CET 8	ATC 2150	R	F	Push out, Pins & Sockets	9	8	RX
CET 8-2	ATC 2281	R	R	MS3483-1 (Ref. 5015)	19	8	5015
CET 12	ATC 2092	R	F	Impact Tool, Ring-Lok Connector	22	12	KMBA
CET 12-1A	ATC 2105	R	F	Push out, Pins & Sockets	9	12	CA/RX
CET 12-2	ATC 2105	R	F	Push out, Pins & Sockets	9	12	MS-E, EX-G
CET 12-4	ATR 2160	R	R	Metal Tool, Tweezer, NAS 1599	10	12	
CET 12-16	0159-0051			Tip Only, Delrin			
CET 16	ATC 2062	R	F	Impact Tool, Ring-Lok DPGM	22	16	KMBA
CET 16-3A	ATC 2070	R	F	Push out, Pins & Sockets	9	16	CA/RX
CET 16-4	ATC 2070	R	F	Push out, Pins & Sockets	9	16	MS-E, EX-G
CET 16-9	ATR 2212	R	R	MIL-C-83723	10	16	
CET 16-21	ATML 3006			Tip Only, Delrin			
CET 16KJ	ATBX 2103	R	R	MIL-C-38999	10	16	KJ
CET 20-3	ATC 2040-L	R	F	Push out, Pins & Sockets (Long Tip)	9	20	RX
CET 20-4	ATC 2040	R	F	Push out, Pins & Sockets	9	20	KPTM
CET 20-5A	ATC2046	R	F	Impact Tool DDSMF Ring-Lok	22	20	D*SM
CET 20-8	ATR 2080	R	R	Metal Tool, Tweezer, NAS 1664	10	20	
CET 20-11	ATC 2071	R	R	Metal Tool, Tweezer	10	20	D*C
CET 20-11, 20HD	ATC 2076	R	R	Metal Tool, Tweezer, DCB-DPX-DDCE	10	20	DD
CET 20-24	ATML 3005			Tip Only, Delrin			
CET 20-A	ATC 2046-L	R	F	Impact Tool Ring-Lok, Long Tip	22	20	DPGM
CET 20-D	ATC 2071	R	R	Metal Tool, Tweezer	10	20	D*C
CET 20-D-1	ATC 2073	R	R	Metal Tool, Tweezer (Dwg. #995-0001-768)	10	20	
CET 20KJ	ATBX 2070	R	R	MIL-C-38999	10	20	KJ
CET 22KJ	ATBX 2057	R	R	MIL-C-38999	10	22	KJ
CET 22M-KJ	ATBX 2046	R	R	MIL-C-38999	10	22M	KJ
CET C1	ATC 2170	R	F	Impact Tool	22	20	
CET C4	ATC 2200	R	F	Impact Tool	22	Coax	DPXMS
CET C6B	ATC 2188	R	F	D Miniature Coax	6	Coax	DPXA26
CET C11	ATC 2276	R	F	D Sub-Miniature	6	Coax	
CET DPKB 22	ATC 2053	R	R	Metal Tool, Tweezer	10	22	DPK
CET DPKB 22 Revision C	ATC 2054	R	R	Metal Tool, Tweezer	10	22	DPK
CET FRF-0	ATF 2518	R	F	MIL-C-5015, Front Release	5	0	
CET FRF-4	ATF 2336	R	F	MIL-C-5015, Front Release	5	4	
CET FRF-8	ATF 2252	R	F	MIL-C-5015, Front Release	5	8	
CET FRF-12	ATF 2162	R	F	MIL-C-5015, Front Release	5	12	
CET FRF-16	ATF 2115	R	F	MIL-C-5015, Front Release	5	16	
CET KPSE 20A	AT 2020	R	F	MIL-C-26500, 26482, 26636	6	20	



Listed by Contact Manufacturer

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
ITT/CANNON	ASTRO TOOL #						
CET P-CTA	ATC 2035	R	F	Centi Lok 2DD Pins	1	22	DD
CET S-CTA	ATC 2036	R	F	Centi Lok 2DD Sockets	1	22	DD
CET TF	ATC 2026	R	F	Tuning Fork Contacts	11	--	
CET VE-0	ATC 2565	R	R	MIL-C-5015, Rear Release	19	0	
CET VE-4	ATC 2426	R	R	MIL-C-5015, Rear Release	19	4	
CET VE-8	ATC 2281	R	R	MIL-C-5015, Rear Release	19	8	
CET VE-12	ATC 2184	R	R	MIL-C-5015, Rear Release	10	12	
CET VE-16	ATC 2136	R	R	MIL-C-5015, Rear Release	10	16	
CIET 12	ATR 1160	I	R	Metal Tool, NAS 1664 for NAS 1599	2	12	KV/PV/DPK
	ATR 2160	R	R	Metal Tool, NAS 1664 for NAS 1599	10	12	KV/DPK/PV
CIET 16	ATR 1107	I	R	Metal Tool, NAS 1664 for NAS 1599	2	16	DPXME
	ATR 2112	R	R	Metal Tool, NAS 1664 for NAS 1599	10	16	DPXME
CIET 20	ATR 1080	I	R	Metal Tool, NAS 1664 for NAS 1599	2	20	DPXME
	ATR 2080	R	R	Metal Tool, NAS 1664 for NAS 1599	10	20	DPXME
CIET 20-18	ATC 1081	I	R	Metal Tool, Joggled	2	20	D*C
	ATC 2076	R	R	Metal Tool, Tweezer	10	20	D*C
CIET 20HD	ATC 1076	I	R	Metal Tool, Tweezer	10	20	D*RA
	ATC 2076	R	R	Metal Tool, Tweezer	10	20	D*RA
CIET 20HDL	ATC 2076-L	R	R	Metal Tool, Tweezer, Long Tip	10	20	DPXME
CIET CK-1	ATC 3050	R	R	Metal Tool	3	22	DPX
CIET 22	ATC 1054	I	R	Metal Tool, Joggled	2	22	DPX2MA
	ATC 2053	R	R	Metal Tool, Tweezer (ref. ATC 2054)	10	22	CENTI-K
	ATC 2053-70	R	R	Modified version of ATC 2053 (70 degree angle)	10	22	
	ATC 1054-S	I	R	Modified version of ATC 1054 (straight)	1	22	
CIT 4	ATC 1377	I	R	Metal Tool, Straight	1	4	RX
CIT 8	ATC 1265	I	R	Metal Tool, Straight	1	8	RX
CIT 12	ATC 1160	I	R	DP*M, DPS, MS-E, KMBA Connector	2	12	RX
CIT 12-1	ATC 1160	I	R	RX Contacts	2	12	RX
CIT 12-2	ATC 1160	I	R	RX Contacts	2	12	RX
CIT 16	ATC 1111	I	R	Ring-Lok DP*M, KMB, SRC	2	16	RX
CIT 16-1	ATC 1111	I	R	Ring-Lok DP*M, KMB, SRC	2	16	RX
CIT 16-2	ATC 1111-1	I	R	Ring-Lok DP*M, KMB, SRC, Long Tip	2	16	RX
CIT 16-9	ATC 1112	I	R	Ring-Lok DP*M, KMB, SRC	2	16	RX
CIT 16KJ	ATBX 1108	I	R	MIL-C-38999	10	16	KJ
CIT 20	ATA 1086	I	R	DP*M, KQ, KR, KTM, MIL-C-26636, Metal Interchangeable Probe Tool	26	20	SRC
CIT 20-2	ATC 1079	I	R	DSM	2	20	BFRX
CIT 20-5A	ATC 1084	I	R	KPTM	2	20	KPTM
CIT 20-18	ATC 1081	I	R	038894-0018	2	20	KPTM
CIT 20A	ATC 1055	I	R	DDSMI	2	20	D
CIT 20D	ATC 1072	I	R	DPXME-20 H.D.	2	20	D



Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
ITT/CANNON	ASTRO TOOL #						
CIT 20KJ	ATBX 1072	I	R	MIL-C-38999	10	20	KJ
CIT 22KJ	ATBX 1058	I	R	MIL-C-38999	10	22	KJ
CIT 22M-KJ	ATBX 1048	I	R	MIL-C-38999	10	22M/D	KJ
CIT C2	ATC 1156	I	R	DP*M	2	COAX	DP
CIT CTA-1	ATC 1046	I	R	Metal Tool, Tweezer	10	22	CTA
CIT DPKB	ATC 1053	I	R	DPKB	2	22	DPKB
CIT DPX2MA22	ATC 1054	I	R	DPX	2	22	DPX
CIT DPXMA22-1	ATC 1052	I	R	DPXMA	2	22	DPXMA
CIT PS-CTA-22	ATC 1046	I	R	Tweezer, Pins & Sockets	10	22	D
CIT SS-14	ATCS 1105	I	R	Super Seal Connector	1	20	SS
CIT TF/FP	ATC 1032	I	R	Metal Tool, Tweezer, Filter Pins	30	--	--
	ATC 1071	I	R	D*C Connectors	23	20	D*
	ATC 1080	I	R	Equivalent NSN 5120-00-409-5217	1	20	
CET-CTA-2	ATC 3035	I & R	F & R	Tool Kit, Centi Lok Pins & Sockets	15	22	DD

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
KLIXON	ASTRO TOOL #						
	ATK 1052	I	R	Klixon circuit breaker contacts	1		
	ATK 1130	I	R	Insertion Kit - MIL-C-26482, 26500, 26636 connectors, Metal Interchangeable Probe Tool	26	12,16,20	
	ATK 2115	R	R	Removal Kit for unwired contacts, NAS 1599	17	12,16,20	
	ATK 2120	R	F	Removal Kit-MIL-C-26482, 26500, 26636 connectors, Metal Interchangeable Probe Tool	26	12,16,20	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
LOCKHEED	ASTRO TOOL #						
L525C19-24	ATL 1112	I	R	Tip used with L525C19-44 Handle	25	16	
L525C19-28	ATL 2097	R	F	Tip used with L525C19-44 Handle	25	12	
L525C19-32	ATL 2095	R	F	Tip used with L525C19-44 Handle	25	12	69
L525C19-40	ATL 1108	I	R	Tip used with L525C19-44 Handle	25	20	
L525C19-42	ATL 1105	I	R	Tip used with L525C19-44 Handle	25	20	
L525C19-58	ATL 2040	R	F	Tip used with L525C19-44 Handle	25	20	69
L525C19-59	ATL 2064	R	F	Tip used with L525C19-44 Handle	25	16	69
L525C19-68	ATL 2044	R	F	Tip used with L525C19-44 Handle	25	20	
L525C19-69	ATL 2062	R	F	Tip used with L525C19-44 Handle	25	16	
L525C19-86	ATL 1154	I	R	Tip used with L525C19-44 Handle	25	12	
LITTON	ATL 2048	R	R	MIL-C-38999 with wire wrap pins for wrapped contacts (Developed for Litton).	-	22M	



Listed by Contact Manufacturer

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
MASTER SPEC..	ASTRO TOOL #						
800-P2	ATMS 2050	R	R	Modified version of ATBX 2046, Tip .8	10	22M	
	ATMS 2062	R	R	Indicator light case contacts	-	22	
	ATMS 2073	R	R	Unwired contacts NAS 1599	17	20	
	ATMS 2101	R	R	Unwired contacts NAS 1599	17	16	
	ATMS 2148	R	R	Unwired contacts NAS 1599	17	12	
	ATMS 90562-1	R	F	MIL-C-22992, Class L Connector	-	4/0	
	ATMS 90562-2	R	F	MIL-C-22992, Class L Connector	-	2/0	
	ATMS 90562-3	R	F	MIL-C-22992, Class L Connector	-	1/0	
	ATMS 90562-4	R	F	MIL-C-22992, Class L Connector	-	2	
	ATMS 90562-5	R	F	MIL-C-22992, Class L Connector	-	4	
	ATMS 90562-6	R	F	MIL-C-22992, Class L Connector	-	6	
	ATMS 3115	R	F	MIL-C-38300 Ultra-mate Connector	-	16	
	ATMS 3080	R	F	MIL-C-38300 Ultra-mate Connector	-	20	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
MOLEX	ASTRO TOOL #						
HT 2285	ATMO 2081	R	F	20 GA rolled contacts	6	20	
HT 2038	ATMO 2124	R	F	16 GA rolled contacts	6	16	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
NAT'L. AERO	ASTRO TOOL #						
NAS 1664-12	ATR 1160 and	I	R	Single Tip Tool	2	12	
	ATR 2160	R	R	Metal Tool, Tweezer	10	12	
	ATR 1160-135	I	R	Modified Version of ATR 1160, 45 degree angle	2	12	
	ATR 1153	I	R	Metal Tool, Tweezer	10	12	
	ATR 2160-S	R	R	Modified Version of ATR 2160, straight	10	12	
	ATR 1107 and	I	R	Single Tip Tool	2	16	
NAS 1664-16	ATR 2112	R	R	Metal Tool, Tweezer	10	16	
	ATR 1107-135	I	R	Modified Version of ATR 1107, 45 degree angle	2	16	
	ATR 1105	I	R	Metal Tool, Tweezer	10	16	
	ATR 2112-L	R	R	Same as ATR 2112	10	16	
	ATR 2112-LS	R	R	Modified Version of ATR 2112, long tip-straight	10	16	
	ATR 1080 and	I	R	Single Tip Tool	2	20	
NAS 1664-20	ATR 2080	R	R	Metal Tool, Tweezer	10	20	
	ATR 1080-135	I	R	Modified Version of ATR 1080, 45 degree angle	2	20	
	ATR 1078	I	R	Metal Tool, Tweezer	10	20	
	ATR 2080-S	R	R	Modified Version of ATR 2080, straight	10	20	
	ATR 2109	R	R	MS3162 contacts, tip extension to one inch	10	16	

Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
POSITRONICS	ASTRO TOOL #						
9081	ATG 2103	R	F	Metal Spring-Loaded Probe Tool	8	16	
9099	AT 4004	I	R	Metal Tool, Joggled	2	16	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
S.A.E.	ASTRO TOOL #						
M81969/33-01	ATSE 1077	I	R	MIL-C-28840	2	20	
M81969/33-02	ATSE 1078	I	R	MIL-C-28840	1	20	
M81969/34-01	ATSE 2071	R	F	MIL-C-28840	5	20	
	ATSE 2070	R	F	MIL-C-28840	5	20	
T10149-0	ATC 2565	R	R	MIL-C-5015, Rear Release	19	0	
T10149-4	ATC 2426	R	R	MIL-C-5015, Rear Release	19	4	
T10149-8	ATC 2281	R	R	MIL-C-5015, Rear Release	19	8	
T10149-12	ATSE 2166	R	R	MIL-C-5015, Rear Release	10	12	
T10149-16	ATSE 2109	R	R	MIL-C-5015, Rear Release	10	16	
T10150-0	ATF 1554	I	R	MIL-C-5015, Rear Release	2	0	
T10150-4	ATF 1359	I	R	MIL-C-5015, Rear Release	2	4	
T10150-8	ATF 1256	I	R	MIL-C-5015, Rear Release	2	8	
T10150-12	ATSE 1158-B	I	R	MIL-C-5015, Rear Release	2	12	
T10150-16	ATSE 1108	I	R	MIL-C-5015, Rear Release	2	16	
T10438	ATSE 1077	I	R	MIL-C-28840	1	20	
	ATSE 1080	I	R	Metal Tool, Joggled	2	20	
	ATSE 2049	R	R	Metal Tool, Tweezer	10	22	
	ATSE 2112	R	R	5015 connector, Tweezer	10	16	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
TRANSITRON	ASTRO TOOL #						
PCD 91-023	ATT 1059	I	R	Metal Tool, Straight	1	22	
	ATT 1060-B	I	R	Metal Tool, Straight	1	22	
	ATT 1060-SGA	I	R	Metal Tool, Tweezer			
PCD 91-021	ATT 2059	R	R	Metal Tool, Tweezer	10	22	
	ATT 2059-S	R	R	Modified version of ATT 2059, straight	10	22	
	ATT 2060-S	R	R	Metal Tool, Tweezer, Straight	10	22	



Listed by Contact Manufacturer

IDENTIFICATION INFORMATION

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
TYCO/AMP	ASTRO TOOL #						
20823-2	AT 2016	R	F	Metal Tool, Front Release, Plunger	6	16	2017
20823-3	AT 2020	R	F	Metal Tool, Front Release, Plunger	6	20	2017
200826-1	AT 1000-20	I	R	Metal Tool, Joggled	2	20	2017
200826-2	AT 1000-16	I	R	Metal Tool, Joggled	2	16	2017
305141-1	ATAMP 2302	R	F	Coaxial	6	Coax	
305183-0	A 305183	R	F	AMP 16, 20	17	16, 20	M, W
305183-2	ATAMP 2103	R	F	Metal Spring-Loaded Probe Tool	8	20	
91002-1	ATAMP 1085	I	R	Series M, Type 3	1	20, 16	M
91039-1	ATSE 1078	I	R	MIL-C-28840	1	20	Sub 20
91040-1	ATSE 2070	R	F	MIL-C-28840	5	20	Sub 20
91040-7	ATF 2518	R	F	MIL-C-5015	5	0	
91066-1	ATC 1054 and	I	R	Metal Tool, Joggled	2	22	RME
	ATC 2053	R	R	Metal Tool, Tweezer Tool	10	22	RME
91066-2, 4	ATC 1071 and	I	R	Metal Straight Probe Tool	23	20	RME
	ATC 2071	R	R	Metal Tool, Tweezer Tool	10	20	RME
91066-3	ATR 1107 and	I	R	Metal Tool, Joggled	2	16	RME
	ATR 2112	R	R	Metal Tool, Tweezer Tool	10	16	RME
91067-1	ATBX 1048 and	I	R	Metal Tool, Tweezer Tool	10	22D	
	ATBX 2046	R	R	Metal Tool, Tweezer Tool	10	22D	
91067-2	ATBX 1055 and	I	R	Metal Tool, Tweezer Tool	10	22	
	ATBX 2057	R	R	Metal Tool, Tweezer Tool	10	22	
91067-3	ATC 1076-L and	I	R		10	20	
	ATC 2076-L	R	R		10	20	
91074-1	ATAMP 2250	R	R	Metal Tool, Tweezer Tool	10	Coax	RM #5
	ATA 2073	R	F	Metal Tool, Front Release, Plunger	6	20	M
	ATA 2112	R	F	Metal Tool, Front Release, Plunger	6	16	M
202476-6	ATAMP 1231	I	R	Connector #202476-6	1		
	ATAMP 3040			Miniclip Transfer Tool for .025 Square Pins	21		
	ATAMP 3070			Transfer Tool Kit-transfers AMP terminal climps from gun to terminal's single wires.	21		

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
U.S. COMPONENTS	ASTRO TOOL #						
R.T.2260	ATBX 2046	R	R	Metal Tool, Tweezer	10	22D	
	ATUS 1050	I	R	#2260 contacts	23	22	
	ATUS 2052	R	F	Pins & Sockets, Metal Spring-Loaded Probe Tool	8	22	



Insertion and Removal Tool Selection Charts

LISTED BY CONTACT MANUFACTURER

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
VEAM/WINCHESTER	ASTRO TOOL #						
107-1001	ATW 2104	R	F	Metal Spring-Loaded Probe Tool	8	16	MRAC
107-1005	AT 5002	R	F	Comparable to ATH 2102, Metal Spring-Loaded Probe Tool	8	16	MRAC
107-1007	ATW 2055	R		Flat contacts 8617	11	--	
107-1011	ATW 1055	I	R	Proto at Litton	1	22	SREC
107-1012	ATCL 2061	R	F	Winchester 4040-4024, Metal Spring-Loaded Probe Tool	8	22D	SREC
107-1015	ATH 1094	I	R	MIL-C-22857	1	16	MRAC
107-1026	ATS 2133	R	F	Submarine Connector	6	16	
	ATWC 3032	--	--	Wire comb, 8" long, hook on one end, blade on other	--	--	
	ATWC 3312	--	--	12" long phenolic 5/16" dia., point on one end, blade on other	--	--	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
VIKING	ASTRO TOOL #						
000407-0003	ATV 1086	I	R	Metal Tool, Straight	1	20	
000407-0004	ATV 2073	R	F	Metal Spring-Loaded Probe Tool	8	20	
000407-0006	AT 2016	R	F	Miniature relay sockets	6	16	
000407-0027	ATA 1101 or	I	R	MIL-R-6106, Metal Long-Slot Tool	27	16	
	AT 1000-16	I	R	MIL-R-6106	2	16	
000407-0031	ATV 2052	R	F	Metal Spring-Loaded Probe Tool	8	22	
000407-0603	ATV 2073	R	F	Revision B, Metal Spring-Loaded Probe Tool	8	20	
980-0007-002	ATR 1107 and	I	R	NAS 1599 metal tools	2	16	
	ATR 2112	R	R	NAS 1599 metal tools	10	16	
	ATV 2075	R	F	Modified version of ATV 2073 I.D. .075, Metal Spring-Loaded Probe Tool	8	20	
	ATV3125	R	F	Impact Tool	22	20	

TOOL IDENTIFICATION NUMBERS		I/R	R/F	USAGE/ DESCRIPTION	ILL.	GAGE	CONNECTOR SERIES
VIRGINIA PANEL	ASTRO TOOL #						
166223	ATVP 2101	R	F	Locktite Extraction	--	20	
223848	ATVP 1120-2	I	R	Locktite 12	1	20	
223849	ATVP 1120-1	I	R	Locktite 14-20 AWG	1	20	
223850	ATVP 1120-3	I	R	Locktite 22-24 AWG	1	20	



Insertion and Removal Tool Selection Charts

Insertion and Removal Tool Selection Charts listed by Military Standard

LISTED BY MILITARY STANDARD

TOOL IDENTIFICATION NUMBERS					I/R	COMMENTS
MILITARY STANDARD	ILL.	ASTRO TOOL #	ASTRO FUNCTIONAL ALTERNATIVE	ILL.		
MS3156-16	28	SEE M81969/1	ATR 1107 and	2	I	Used on MIL-C-81659 Series II
			ATR 2112	10	R	
MS3156-20	28	SEE M81969/1	ATC 1072 and	2	I	
			ATC 2076	10	R	
MS3156-22	28	SEE M81969/1	ATC 1054 and	2	I	
			ATC 2053	10	R	
MS3159-12	17	ATD 2150		17	R	MIL-C-81511 Series III & IV, Unwired contacts
MS3159-16	17	ATD 2090		17	R	
MS3159-20	17	ATD 2058		17	R	
MS3159-22	17	ATD 2044		17	R	
MS3159-12A	17	0214-1251		17	R	Tip Only
MS3159-16A	17	0214-1641		17	R	Tip Only
MS3159-20A	17	0214-2031		17	R	Tip Only
MS3159-22A	17	0214-2251		17	R	Tip Only
MS3165-16	28	SEE M81969/29	ATC 2136			
MS3165-8	28	SEE M81969/29	ATC 2281	19	R	MIL-C-5015 Rear Release Contacts
MS3165-4	28	SEE M81969/29	ATC 2426	19	R	
MS3165-0	28	SEE M81969/29	ATC 2565	19	R	
MS3323-12	4	ATA 1158	ATA 1159	2	I	MIL-C-81511 Series I & II Pins & Contacts
MS3323-16	4	ATA 1104	ATA 1102	2	I	
MS3323-20	4	ATA 1080	ATA 1079	2	I	
MS3323-22	4	ATA 1051	ATA 1052	2	I	
MS3342-12	3	ATA 2120	ATA 2348-12*	9	R	MIL-C-81511 Series I & II Pins
MS3342-16	3	ATA 2065	ATA 2348-16*	9	R	
MS3342-20	3	ATA 2042	ATA 2348-20*	9	R	
MS3342-23	3	ATA 2030	ATA 2348-22*	9	R	
MS3344-12	7	ATA 2093	ATA 2348-12*	9	R	MIL-C-81511 Series I & II Sockets
MS3344-16	7	ATA 2060	ATA 2348-16*	9	R	
MS3344-20	7	ATA 2038	ATA 2348-20*	9	R	
MS3344-23	7	ATA 2026	ATA 2348-22*	9	R	
			* ATA 2348XX tool removes both pins and sockets			
MS3347-12	28	SEE M81969/14	ATR 1160 and	2	I	NAS 1599 Connector Series
			ATR 2160	10	R	
MS3347-16	28	SEE M81969/14	ATR 1107 and	2	I	
			ATR 2112	10	R	
MS3347-20	28	SEE M81969/14	ATR 1080 and	2	I	
			ATR 2080	10	R	

Verify QPL status (if required) at time of purchase.



Insertion and Removal Tool Selection Charts

LISTED BY MILITARY STANDARD

CHART ABBREVIATIONS

I/R Insertion or Removal designation column
I Insertion Tool
R Removal Tool

I & R Insertion & Removal Tool
R/F Rear or Front Release designation column
R Rear Release

F Front Release
R & F Rear and Front Release
ILL Illustration reference number
GA Gage designation
NAATT Not Available At This Time

TOOL IDENTIFICATION NUMBERS					I/R	COMMENTS
MILITARY STANDARD	ILL.	ASTRO TOOL #	ASTRO FUNCTIONAL ALTERNATIVE	ILL.		
MS3448-001	17	ATK 2115		17	R	NAS 1599 Unwired contacts
MS3448-001A	17	0161-0031		17	R	Tip Only
	17	ATMS 2073		17	R	Single Tip Tool
MS3448-001B	17	0160-0041		17	R	Tip Only
	17	ATMS 2101		17	R	Single Tip Tool
MS3448-001C	17	0159-0051		17	R	Tip Only
	17	ATMS 2148		17	R	Single Tip Tool
MS3483-1 (or size 8)	19	ATC 2281		19	R	MIL-C-5015 Rear Release Contacts
MS3483-2 (or size 4)	19	ATC 2426		19	R	
MS3483-3 (or size 0)	19	ATC 2565		19	R	
MS17805	1	ATH 1094	AT 4002	2	I	MIL-C-22857 Connector Series
MS17806	7	ATH 2102	AT 5002	8	R	
MS18278-1	19	NONE	ATC 1072 and	2	I	MIL-C-24308 Connector Series
			ATC 2076	10	R	
MS24256A-12	27	ATA 1144	AT 1000-12	2	I	MIL-C-26482, 265000 & 26636 Connectors
MS24256A-16	27	ATA 1101	AT 1000-16	2	I	
MS24256A-20	27	ATA 1086	AT 1000-20	2	I	
MS24256B-20	27	ATB 1064	ATB 1067 or	1	I	
			ATB 1068	1	I	
MS24256K	26	ATK 1130			I	
MS24256R-12	6	AT 2012			R	
MS24256R-16	6	AT 2016			R	
MS24256R-20	6	AT 2020			R	
MS24256RH-16	--	ATMS 3115		--	R	
MS24256RH-20	--	ATMS 3080		--	R	MIL-C-38300 ultra-mate Connectors
MS27495A-12	10	ATBX 1157	ATBX 1154	2	I	
MS27495A-16	10	ATBX 1108	ATR 1107	2	I	MIL-C-38999 Connectors - "S" designates straight in-line version
MS27495A-20	10	ATBX 1072	ATBX 1073	2	I	
MS27495A-22	10	ATBX 1058	ATBX 1055	2	I	
MS27495A-22D	10	ATBX 1048	ATBX 1049	2	I	
MS27495A-22M	10	ATBX 1048	ATBX 1049	2	I	
MS27495A-12-S	10	ATBX 1159			I	
MS27495A-16-S	10	ATBX 1109			I	
MS27495A-20-S	10	ATBX 1078			I	
MS27495A-22-S	10	ATBX 1060			I	
MS27495A-22D-S	10	ATBX 1054			I	
MS27495A-22M-S	10	ATBX 1054			I	

Verify QPL status (if required) at time of purchase.



TOOL IDENTIFICATION NUMBERS					I/R	COMMENTS
MILITARY STANDARD	ILL.	ASTRO TOOL #	ASTRO FUNCTIONAL ALTERNATIVE	ILL.		
MS27495R-12	10	ATBX 2155			R	MIL-C-38999 Connectors - "S" designates straight in-line version
MS27495R-16	10	ATBX 2103			R	
MS27495R-20	10	ATBX 2070			R	
MS27495R-22	10	ATBX 2057			R	
MS27495R-22D	10	ATBX 2046			R	
MS27495R-22M	10	ATBX 2046			R	
MS27495R-12-S	10	ATBX 2160			R	
MS27495R-16-S	10	ATBX 2109			R	
MS27495R-20-S	10	ATBX 2073			R	
MS27495R-22-S	10	ATBX 2059			R	
MS27495R-22D-S	10	ATBX 2050			R	
MS27495R-22M-S	10	ATBX 2050			R	
MS27509	28	NONE	Use MS27495 series tools	10	I & R	MIL-C-38999 Connectors - plastic double-ended tool
MS27534	28	SEE M81969/14	Use MS27495 series tools	10	I & R	MIL-C-38999 Connectors - plastic double-ended tool
M83723-12	28	SEE M81969/14	ATR 1160 and	2	I	Astro Metal Equivalents for Plastic Tools
			ATR 2160	10	R	
M83723-16	28	SEE M81969/14	ATR 1107 and	2	I	
			ATR 2112	10	R	
M83723-20	28	SEE M81969/14	ATR 1080 and	2	I	
			ATR2080	10	R	
MS90455-0	27	ATF 1558	ATF 1554	2	I	MIL-C-005015 Connectors
MS90455-4	27	ATF 1378	ATF 1359	2	I	
MS90455-8	27	ATF 1260	ATF 1256	2	I	
MS90455-12	27	ATF 1144	ATF 1160	2	I	
MS90455-16	27	ATF 1101	ATF 1105	2	I	
MS90456-0	5	ATF 2518		5	R	MIL-C-005015 Series 3400 & MIL-C-81659 (16 GA only) front release contacts
MS90456-4	5	ATF 2336		5	R	
MS90456-8	5	ATF 2252		5	R	
MS90456-12	5	ATF 2162		5	R	
MS90456-16	5	ATF 2115		5	R	
MS90562-1	--	ATMS 90532-1		--	R	MIL-C-22992, Class I Connector, MS90566, MS90559 & MS90560
MS90562-2	--	ATMS 90532-2		--	R	
MS90562-3	--	ATMS 90532-3		--	R	
MS90562-4	--	ATMS 90532-4		--	R	
MS90562-5	--	ATMS 90532-5		--	R	
MS90562-6	--	ATMS 90532-6		--	R	

Verify QPL status (if required) at time of purchase.

Plastic Insertion & Removal Tool Selection Charts

LISTED BY MIL #

Plastic Insertion and Removal Tool Selection Charts listed by MIL#

CHART ABBREVIATIONS

I/R Insertion or Removal
designation column
I Insertion Tool
R Removal Tool

I & R Insertion & Removal Tool
R/F Rear or Front Release
designation column
R Rear Release

F Front Release
R & F Rear and Front Release
ILL Illustration reference number
GA Gage designation
NAATT Not Available At This Time

MIL #	MANUFACTURERS P/N	COLOR CODE	SIZE	APPLICATION REFERENCE	ASTRO TOOL METAL EQUIVALENT
MIL-C-83723	83723/31-12	Yellow - Ins.		83723	ATML 08209B
		White - Rem.		83723	ATML 08210B
	83723/31-16	Blue - Ins.		83723	ATML 08207B
		White - Rem.		83723	ATML 08208B
	83723/31-20	Red - Ins.		83723	ATML 08205B
		White - Rem.		83723	ATML 08206B
	83723/31-22	Brown - Ins.		83723	ATBX 1058
		White - Rem.		83723	ATBX 2057
	83723/31-22D	Black - Ins.		83723	ATBX 1048
		White - Rem.		83723	ATBX 2046
MIL-I-81969	M81969/1-01*	Green - Ins.	22	MIL-C-24308	ATC 1054
		White - Rem.		MIL-C-81659 Series II	ATC 2053
	M81969/1-02*	Red - Ins.	20	MIL-C-24308	ATC 1076-L
		White - Rem.		MIL-C-81659 Series II	ATC 2076-L
	M81969/1-03*	Blue - Ins.	16	MIL-C-81659 Series II	ATR 1105
		White - Rem.			ATR 2112
	M81969/1-04*	Green - Ins.	22D	MIL-C-24308	--
		White - Rem.			
	* Plastic body with metal tips				
	M81969/14-01	Green - Ins.	22D	MIL-C-38999	ATML 0801B (Ins.)
		White - Rem.			
				MIL-C-24308	ATML 0802B (Rem.)
				MIL-C-83733	
				MIL-T-81714	
				MIL-C-55302/68/69	
	M81969/14-02	Red - Ins.	20	MIL-C-38999	ATML 0805B (Ins.)
		White - Rem.			
					ATML 0806B (Rem.)
					ATR 1078 (Ins.)
				MIL-C-26482 Series II	ATR 2080 (Rem.)
				MIL-C-81703 Series III	ATML 08205B (Ins.)

MIL #	MANUFACTURERS P/N	COLOR CODE	SIZE	APPLICATION REFERENCE	ASTRO TOOL METAL EQUIVALENT
MIL-I-81969	M81969/14-02			MIL-C-83723 Series I & III	ATML 08206B (Rem.)
				MIL-C-83733	
				MIL-T-81714 (Size 20 & 22)	
	M81969/14-03	Blue - Ins.	16	MIL-C-38999	ATML 0807B (Ins.)
		White - Rem.			ATML 0808B (Rem.)
				MIL-C-5015 (MS3450 Series)	ATR 1105 (Ins.)
				MIL-C-26482 Series II	ATR 2112 (Rem.)
				MIL-C-81703 Series III	ATML 08207B (Ins.)
				MIL-C-83723	ATML 08208B (Rem.)
				MIL-T-81714	
				MIL-C-83733	
				MIL-C-81659	
	M81969/14-04	Yellow - Ins.	12	MIL-C-38999	ATML 0809B (Ins.)
		White - Rem.			ATML 0810B (Rem.)
				MIL-C-5015 (MS3450 Series)	ATR 1153 (Ins.)
				MIL-C-81703 Series III	ATR 2160 (Rem.)
				MIL-T-81714 Series III	ATML 08209B (Ins.)
				MIL-C-83723	ATML 08210B (Ins.)
				MIL-C-83723	
				MIL-C-26482 Series II	
				MIL-C-81659	
	M81969/14-05	Gray - Ins.	10	MIL-C-38999	ATML 0811B (Ins.)
		White - Rem.			ATML 0812B (Rem.)

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MIL #	MANUFACTURERS P/N	COLOR CODE	SIZE	APPLICATION REFERENCE	ASTRO TOOL METAL EQUIVALENT
MIL-I-81969	M81969/14-06	Red - Rem.	8	MIL-C-83723	ATML 0813B (Ins.)
				MIL-C-5015	ATML 0814B (Rem.)
				Suggested Application	Suggested ATML 1501
	M81969/14-07	Blue - Rem.	4	MIL-C-83723	Suggested ATML 1502
				MIL-C-5015	
	M81969/14-08	Yellow - Rem.	0	MIL-C-83723	Suggested ATML 1503
				MIL-C-5015	
	M81969/14-09	Brown - Ins.	22	MIL-C-55302/169, MIL-C-55302/171 only	ATML 0803B (Ins.)
		White - Rem.			ATML 0804B (Rem.)
	M81969/14-10	Red - Ins.	20	MIL-C-38999	ATML 0805B (Ins.)
		Orange-Rem.			ATML 0806B (Rem.)
	M81969/14-11	Red - Ins.	20	MIL-C-26482 Series II	ATML 08205B (Ins.)
		White - Rem.		MIL-C-81703 Series III	ATML 08206B (Rem.)
				MIL-C-83723 Series I & III	
				MIL-C-83733	
	M81969/14-12	Green - Rem.	8	MIL-C-38999	ATML 0813B (Ins.)
					ATML 0814B (Rem.)
	M81969/29-01	Blue - Rem.	16	MIL-C-5015	Suggest ATC 2136
	M81969/29-02	Red - Rem.	8	MIL-C-5015	ATC 2281
	M81969/29-03	Blue - Rem.	4	MIL-C-5015	ATC 2426
	M81969/29-04	Yellow - Rem.	0	MIL-C-5015	ATC 2565
	M81969/39	Green - Ins.		MIL-C-24308	Suggest ATC 1072
		White - Rem.		(Size 20)	Suggest ATC 2076

MIL #	MANUFACTURERS P/N	COLOR CODE	SIZE	APPLICATION REFERENCE	ASTRO TOOL METAL EQUIVALENT
M81969/29	MS3165-0			MIL-C-5015	ATC 2565
	MS3165-4			MIL-C-5015	ATC 2426
	MS3165-8			MIL-C-5015	ATC 2281
M81969/14	MS27534-12	White - Rem.		MIL-C-38999	ATBX 2155
		Yellow - Ins.		MIL-C-38999	ATBX 1157
	MS27534-16	White - Rem.		MIL-C-38999	ATBX 2103
		Blue - Ins.		MIL-C-38999	ATBX1108
	MS27534-20	White - Rem.		MIL-C-38999	ATBX 2070
		Red - Ins.		MIL-C-38999	ATBX 1072
	MS27534-22	White - Rem.		MIL-C-38999	ATBX 2057
		Brown - Ins.		MIL-C-38999	ATBX 1058
	MS27534-22D	White - Rem.		MIL-C-38999	ATBX 2046
		Black - Ins.		MIL-C-38999	ATBX 1048
	MS27534-22M	White - Rem.			
		Black - Ins.		MIL-C-38999	ATBX 1048
	NAS 1664-12	Yellow - Ins.		NAS 1599 Connector	ATR 1160
		White - Rem.		NAS 1599 Connector	ATR 2160
	NAS 1664-16	Blue - Ins.		NAS 1599 Connector	ATR 1107
		White - Rem.		NAS 1599 Connector	ATR 2112
	NAS 1664-20	Red - Ins.		NAS 1599 Connector	ATR 1080
		White - Rem.		NAS 1599 Connector	ATR 2080

LISTED BY MIL #

Verify QPL status (if required) at time of purchase.

Plastic Insertion & Removal Tool Selection Charts

LISTED BY MANUFACTURER

Plastic Insertion and Removal Tool Selection Charts listed by Manufacturer

MANUFACTURER	MANUFACTURERS P/N	COLOR CODE	APPLICATION REFERENCE	ASTRO TOOL METAL EQUIVALENT
AMPHENOL	294-108	Red - Ins.	NAS 1664-20	ATR 1080
		White - Rem.	NAS 1664-20	ATR 2080
	294-109	Blue - Ins.	NAS 1664-16	ATR 1107
		White - Rem.	NAS 1664-16	ATR 2112
	294-110	Yellow - Ins.	NAS 1664-12	ATR 1160
		White - Rem.	NAS 1664-12	ATR 2160
AMPHENOL / BENDIX	MS27534-22D	Black - Ins.	JT/LJT, MIL-C-38999	ATBX 1048
		White - Rem.	JT/LJT, MIL-C-38999	ATBX 2046
	MS27534-22	Brown - Ins.	JT/LJT, MIL-C-38999	ATBX 1058
		White - Rem.	JT/LJT, MIL-C-38999	ATBX 2057
	MS27534-20	Red - Ins.	JT/LJT, MIL-C-38999	ATBX 1072
		White - Rem.	JT/LJT, MIL-C-38999	ATBX 2070
	MS27534-16	Blue - Ins.	JT/LJT, MIL-C-38999	ATBX 1108
		White - Rem.	JT/LJT, MIL-C-38999	ATBX 2103
	MS27534-12	Yellow - Ins.	JT/LJT, MIL-C-38999	ATBX 1157
		White - Rem.	JT/LJT, MIL-C-38999	ATBX 2155
AMPHENOL / MATRIX	6500-001-12	Yellow - Ins.		ATR 1160
		White - Rem.		ATR 2160
	6500-018-0	Yellow-Rem.	MS3165-0	ATC 2565
	6500-018-4	Blue - Rem.	MS3165-0	ATC 2426
	6500-018-4	Red - Rem.	MS3165-0	ATC 2281
	6500-028-12	White - Rem.	NAS 1599 Connector	ATR 2157
	6500-029-12	White - Rem.	NAS 1599 Connector	ATR 2160
	6500-030-12	Yellow - Ins.	NAS 1599 Connector	ATGH 1160
	6500-028-16	White - Rem.	NAS 1599 Connector	ATR 2106
	6500-029-16	White - Rem.	NAS 1599 Connector	ATR 2112
	6500-030-16	Blue - Ins.	NAS 1599 Connector	ATGH 1112
	6500-028-20	White - Rem.	NAS 1599 Connector	ATR 2080
	6500-029-20	White - Rem.	NAS 1599 Connector	ATR 2080
	6500-030-20	Red - Ins.	NAS 1599 Connector	ATGH 1079
	6500-045-20	Green - Ins.		ATC 1071
		White - Rem.		ATC 2076
BURNDY/FCI	RXT 22-10	Red - Ins.		ATR 1080
		White - Rem.		ATR 2080
	RXT 16-1	Blue - Ins.		ATR 1107
		White - Rem.		ATR 2112
	RXT 12-1	Yellow - Ins.		ATR 1160
		White - Rem.		ATR 2160
DEUTSCH	81515-23	Yellow - Ins.	81511 3 & 4	ATD 1049
		White - Rem.	81511 3 & 4	ATD 2047
	81515-20	Red - Ins.	81511 3 & 4	ATD 1061
		White - Rem.	81511 3 & 4	ATD 2062
	81515-16	Blue - Ins.	81511 3 & 4	ATD 1094
		White - Rem.	81511 3 & 4	ATD 2094
	M15570-12	Yellow - Ins.	83723	ATR 1160
		White - Rem.	83723	ATR 2160
	M15570-16	Blue - Ins.	83723	ATR 1107
		White - Rem.	83723	ATR 2112

MANUFACTURER	MANUFACTURERS P/N	COLOR CODE	APPLICATION REFERENCE	ASTRO TOOL METAL EQUIVALENT
DEUTSCH (con't)	M15570-20	Red - Ins.	83723	ATR 1080
		White - Rem.	83723	ATR 2080
	M15570-22	Green - Ins.	83723	ATC 1054
		White - Rem.	83723	ATD 2048
	M15570-22-1	Yellow - Ins.	83723	ATD 1035
		White - Rem.	83723	ATD 2047
ITT/CANNON	CET-0-1		MIL-C005015 Series	ATC 2565
	CET-4-8		MIL-C005015 Series	ATC 2526
	CET-8-2		MIL-C005015 Series	ATC 2281
	CET-12-4		DPD	ATR 2160
	CET-16-9		DPJ	ATR 2112
	CET-20-8	Red - Rem.	83723-20	ATR 2080
	CET-20-11	Green - Rem.	D*MA	ATC 2071
	CET-20-11HD	Green - Rem.	D*MA	ATC 2076
	CET-20-14		DF D*MA	ATR 2080
	CET-C8		MIL-C005015 Series	ATC 2281
	CIET 12	Yellow - Ins.	NAS 1664-12	ATR 1160
		White - Rem.	NAS 1664-12	ATR 2160
	CIET 16	Blue - Ins.	NAS 1664-16	ATR 1107
		White - Rem.	NAS 1664-16	ATR 2112
	CIET 20	Red - Ins.	NAS 1664-20	ATR 1080
		White - Rem.	NAS 1664-20	ATR 2080
	CIET 20-18	- Ins.	D*C	ATC 1081
		White - Rem.	D*C	ATC 2076
	CIET 20HD	- Ins.	D*C	ATC 1076
		White - Rem.	D*C	ATC 2076
	CIET 20HDL	- Ins.	D*C	ATC 1076-L
		White - Rem.	D*C	ATC 2076-L
	CIET 22	Yellow - Ins.	DPX*MA	ATC 1054
		White - Rem.	DPX*MA	ATC 2053
	CIET 22D		38999	
			38999	
TRANSITRON	91-021	White - Rem.		ATT 2059
	91-023	Green - Ins.		ATT 1059
TYCO/AMP	91066-1	Black - Ins.	MS3156-22	ATC 1054
		White - Rem.	MS3156-22	ATC 2053
	91066-4	Red - Ins.	MS3156-20	ATC 1071
		White - Rem.	MS3156-20	ATC 2071
	91066-3	Blue - Ins.	MS3156-16	ATR 1107
		White - Rem.	MS3156-16	ATR 2112
	91067-1	Black - Ins.	MS27534-22M	ATBX 1048
		White - Rem.	MS27534-22M	ATBX 2046
	91067-2	Yellow - Ins.	MS27534-22	ATBX 1055
		White - Rem.	MS27534-22	ATBX 2057

Verify QPL status (if required) at time of purchase.



Special Service Tools for Connectors

LISTED BY ASTRO TOOL #

VARIOUS SPECIAL TOOLS FOR CONNECTORS		
ASTRO TOOL #	NOMENCLATURE	USAGE
ATA 3120	Wire Contact Clip	Insertion & removal clip for 16 GA.
ATAMP 3040	Miniclip Transfer Tool	Transfers terminal clips for .025 square pins.
ATAMP 3070	Transfer Tool Kit HAC #722698-329	Transfers AMP terminal clips from gun to terminal's single wires.
ATBX 3050	Special Removal Tool	Special rear release tool for 22M/D contact using .060 dia. wire.
ATBX 3-6147-1	Special Connector Plier	Assembly & disassembly of connectors.
ATC 2046-100	Compliant Pin Tool	Insertion/removal of compliant pins
ATD 3312	Wire Comb	Six inch long phenolic 5/16" diameter with a point on one end and a blade on the other end.
ATH 3037-12	Contact Guide	Twelve inch long guide used on rear insert 22 GA contacts.
ATH 3037-18	Contact Guide	Eighteen inch long guide used on rear insert 22 GA contacts.
ATH 3260, 3261, 3262, & 3263	Forming Plier	Forms jogged leads for flatpack circuits while removing from carrier - HAC P/N 772699-224, -1, -2, & -3.
ATWC 3032	Wire Comb	Eight inch long metal comb with a hook on one end and a blade on the other end.
ATWC 3312	Wire Comb	Twelve inch long phenolic 5/16" diameter with a point on one end and a blade on the other end.

METAL UNWIRED CONTACT TOOL		
ASTRO TOOL #	NOMENCLATURE	USAGE
ATX 2001	Metal Unwired Contact Tool	MIL-C-38999 Uncrimped Contacts
ATX 2002	Metal Unwired Contact Tool	MIL-C-38999 Uncrimped Contacts
ATX 2003	Metal Unwired Contact Tool	MIL-C-38999 Uncrimped Contacts
ATX 2004	Metal Unwired Contact Tool	MIL-C-38999 Uncrimped Contacts
ATX 2005	Metal Unwired Contact Tool	MIL-C-38999 Uncrimped Contacts
ATX 2006	Metal Unwired Contact Tool	NAS-1599 Uncrimped Contacts
ATX 2007	Metal Unwired Contact Tool	NAS-1599 Uncrimped Contacts
ATX 2008	Metal Unwired Contact Tool	NAS-1599 Uncrimped Contacts
ATX 2009	Metal Unwired Contact Tool	Deutsch RSM & RTK Uncrimped Contacts
ATX 2010	Metal Unwired Contact Tool	Cannon D*C Uncrimped Contacts
ATX 2011	Metal Unwired Contact Tool	Cannon CK, DPX2MA, DPKB Uncrimped Contacts
ATX 2012	Metal Unwired Contact Tool	Douglas 2022B Uncrimped Contacts
ATX 2013	Metal Unwired Contact Tool	G & H Tech. Uncrimped Contacts (ATGH 2054)
ATX 2014	Metal Unwired Contact Tool	MIL-C-38999 Uncrimped Contacts

RETENTION TEST TOOLS		
ASTRO TOOL #	NOMENCLATURE	USAGE
ATC 3074	Retention Test Tool	Tests contact retention in 22 GA Connector.
ATC 3075	Retention Test Tool	Tests contact retention in 20 GA Connector.
ATC 3076	Retention Test Tool	Tests contact retention in 16 GA Connector.
ATC 3077	Retention Test Tool	Tests contact retention in 12 GA Connector.
The above Retention Test Tool are designed to universally cover MIL-C-5015, MIL-C-26482, MIL-C-26500, MIL-C-38999, MIL-C-81511, MIL-C-83723, MIL-C-81703. Consult the factory for special applications.		
ATC 3078	Retention Test Tool	Tests pin and socket contact retention in co-axial connector.



Mil-I-81969 Cross Reference Chart

LISTED BY MIL DOCUMENT

MIL-I-81969 Cross Reference Chart

CHART ABBREVIATIONS

I/R Insertion or Removal
designation column
I Insertion Tool
R Removal Tool

I & R Insertion & Removal Tool
R/F Rear or Front Release
designation column
R Rear Release

F Front Release
R & F Rear and Front Release
ILL Illustration reference number
GA Gage designation
NAATT Not Available At This Time

CURRENT DOCUMENT	ASTRO TOOL #	I/R	ILL.	GAGE	SUPERSEDED DOCUMENT
MIL-I-81969/1-01	M81969/1-01	I & R	28	22	MS3156-22
MIL-I-81969/1-02	M81969/1-02	I & R	28	20	MS3156-20, MS24308/18-2
MIL-I-81969/1-03	M81969/1-03	I & R	28	16	MS3156-16, MS24308/18-3
MIL-I-81969/1-04	M81969/1-04	I & R	28	22D	MS24308/18-1
FOR ASTRO'S METAL EQUIVALENTS OF /1 TOOLS SEE PAGE 73.					
MIL-I-81969/2-01	ATML 0201	I	4	23	MS3323-22
MIL-I-81969/2-02	ATML 0202	I	4	20	MS3323-20
MIL-I-81969/2-03	ATML 0203	I	4	16	MS3323-16
MIL-I-81969/2-04	ATML 0204	I	4	12	MS3323-12
MIL-I-81969/3-01	ATML 0301	R	7	23	MS3344-23
MIL-I-81969/3-02	ATML 0302	R	7	20	MS3344-20
MIL-I-81969/3-03	ATML 0303	R	7	16	MS3344-16
MIL-I-81969/3-04	ATML 0304	R	7	12	MS3344-12
MIL-I-81969/3-05	ATML 0305	R	3	23	MS3344-23
MIL-I-81969/3-06	ATML 0306	R	3	20	MS3344-20
MIL-I-81969/3-07	ATML 0307	R	3	16	MS3344-16
MIL-I-81969/3-08	ATML 0308	R	3	12	MS3344-12
MIL-I-81969/4-01		R			MIL-C-55302/106
MIL-I-81969/4-02		R			
MIL-I-81969/5-01		I			MIL-C-55302/105
MIL-I-81969/6-01		R			MIL-C-21097/18C
MIL-I-81969/7-01		I & R			MIL-C-21097/12B
MIL-I-81969/8-01	ATML 0801B	I	10	22M	MS27495A22M, M55302/79-01
MIL-I-81969/8-02	ATML 0802B	R	10	22M	MS27495R22M, M55302/79-02
MIL-I-81969/8-03	ATML 0803B	I	10	22	MS27495A22
MIL-I-81969/8-04	ATML 0804B	R	10	22	MS27495R22
MIL-I-81969/8-05	ATML 0805B	I	10	20	MS27495A20
MIL-I-81969/8-06	ATML 0806B	R	10	20	MS27495R20
MIL-I-81969/8-07	ATML 0807B	I	10	16	MS27495A16
MIL-I-81969/8-08	ATML 0808B	R	10	16	MS27495R16
MIL-I-81969/8-09	ATML 0809B	I	10	12	MS27495A12
MIL-I-81969/8-10	ATML 0810B	R	10	12	MS27495R12
MIL-I-81969/8-11	ATML 0811B	I	10	10	
MIL-I-81969/8-12	ATML 0812B	R	10	10	

CURRENT DOCUMENT	ASTRO TOOL #	I/R	ILL.	GAGE	SUPERSEDED DOCUMENT
MIL-I-81969/8-13	ATML 0813B	I	10	8	
MIL-I-81969/8-14	ATML 0814B	R	10	8	
MIL-I-81969/8-205	ATML 08205B	I	10	20	
MIL-I-81969/8-206	ATML 08206B	R	10	20	
MIL-I-81969/8-207	ATML 08207B	I	10	16	
MIL-I-81969/8-208	ATML 08208B	R	10	16	
MIL-I-81969/8-209	ATML 08209B	I	10	12	
MIL-I-81969/8-210	ATML 08210B	R	10	12	
MIL-I-81969/9-01		R			MIL-C-55302/28-01
MIL-I-81969/10-01		I			MIL-C-55302/86
MIL-I-81969/10-02		R			
MIL-I-81969/11-01		R			MIL-C-28731/22
MIL-I-81969/12-01	ATML 1201	I & R	10	22	--
MIL-I-81969/11-01		R			MIL-C-28731/22
MIL-I-81969/12-01	ATML 1201	I & R	10	22	--
MIL-I-81969/12-02	ATML 1202	I & R	10	22	--
MIL-I-81969/13-01	ATML 1301	I			MIL-C-28731/21
MIL-I-81969/14-01	M81969/14-01	I & R	28	22D	MS27534-22D
MIL-I-81969/14-02	M81969/14-02	I & R	28	20	NAS 1664-20, MS3447-20, M83723/31-20, MS27534-20
MIL-I-81969/14-03	M81969/14-03	I & R	28	16	NAS 1664-16, MS3447-16, M83723/31-16, MS27534-16
MIL-I-81969/14-04	M81969/14-04	I & R	28	12	NAS 1664-12, MS3447-12, M83723/31-12
MIL-I-81969/14-05	M81969/14-05	I & R	28	10	
MIL-I-81969/14-06	M81969/14-06	R	28	8	
MIL-I-81969/14-07	M81969/14-07	R	28	4	
MIL-I-81969/14-08	M81969/14-08	R	28	0	
MIL-I-81969/14-09	M81969/14-09	I & R	28	22	
MIL-I-81969/14-10	M81969/14-10	I & R	28	20	
MIL-I-81969/14-11	M81969/14-11	I & R	28	20	
MIL-I-81969/14-12	M81969/14-12	R	28	8	
FOR ASTRO'S METAL EQUIVALENTS OF /14 TOOLS SEE PAGE 73 & 74.					



CURRENT DOCUMENT	ASTRO TOOL #	I/R	ILL.	GAGE	SUPERSEDED DOCUMENT
MIL-I-81969/15-01	ATML 1501	R	19	8	MS3483-1
MIL-I-81969/15-02	ATML 1502	R	19	4	MS3483-2
MIL-I-81969/15-03	ATML 1503	R	19	0	MS3483-3
MIL-I-81969/16-01	M81969/16-01	I & R	28	20	MS3160-20
MIL-I-81969/16-02	M81969/16-02	I & R	28	16	MS3160-16
MIL-I-81969/16-03	M81969/16-03	I & R	28	12	MS3160-12
MIL-I-81969/16-04	M81969/16-04	I & R	28	22	MS3160-22
MIL-I-81969/17-01	ATML 1701	I	27	16	MS90455-16
MIL-I-81969/17-02	ATML 1702	I	27	12	MS90455-12
MIL-I-81969/17-03	ATML 1703	I	27	20	MS90455-A20
MIL-I-81969/17-04	ATML 1704	I	27	16	MS90455-A16
MIL-I-81969/17-04	ATML 1704	I	27	16	MS90455-A16
MIL-I-81969/17-05	ATML 1705	I	27	12	MS90455-A12
MIL-I-81969/17-06	ATML 1706	I	27	8	MS90455-8
MIL-I-81969/17-07	ATML 1707	I	27	4	MS90455-4
MIL-I-81969/17-08	ATML 1708	I	27	0	MS90455-0
MIL-I-81969/17-09	ATML 1709	I	27	20	MS90455-B20
MIL-I-81969/18-01	ATML 1801	I	1	16, 20	MS17805
MIL-I-81969/18-02	ATML 1802	I	1	22	
MIL-I-81969/19-01	ATML 1901	R	5	16	MS90456-16
MIL-I-81969/19-02	ATML 1902	R	5	12	MS90456-12
MIL-I-81969/19-03	ATML 1903	R	5	8	MS90456-8
MIL-I-81969/19-04	ATML 1904	R	5	4	MS90456-4
MIL-I-81969/19-05	ATML 1905	R	5	0	MS90456-0
MIL-I-81969/19-06					
MIL-I-81969/19-07	ATML 1907	R	6	20	MS24256-R20
MIL-I-81969/10-01		I			MIL-C-55302/86
MIL-I-81969/10-02		R			
MIL-I-81969/11-01		R			MIL-C-28731/22
MIL-I-81969/12-01	ATML 1201	I & R	10	22	--
MIL-I-81969/19-08	ATML 1908	R	6	16	MS24256-R16
MIL-I-81969/19-09	ATML 1909	R	6	12	MS24256-R12
MIL-I-81969/19-10	ATML 1910	R	--	20	MS24256-RH20
MIL-I-81969/19-11	ATML 1911	R	--	16	MS24256-RH16

CURRENT DOCUMENT	ASTRO TOOL #	I/R	ILL.	GAGE	SUPERSEDED DOCUMENT
MIL-I-81969/20-01	ATML 2001	R	7	16, 20	MS17806
MIL-I-81969/20-02	ATML 2002	R	--	22	--
MIL-I-81969/21-01	ATML 2101	I & R	--	--	--
MIL-I-81969/22-01	ATML	R	--	16, 20	--
MIL-I-81969/23-01	ATML	I	--	16, 20	--
MIL-I-81969/23-02	ATML	I	--	16, 20	--
MIL-I-81969/23-03	ATML	I	--	16, 20	--
MIL-I-81969/23-04	ATML	I	--	16, 20	--
MIL-I-81969/24-01		R	--	--	--
MIL-I-81969/25-01		I & R		18	
MIL-I-81969/25-02		I & R		18	
MIL-I-81969/25-03		I & R		16	
MIL-I-81969/25-04		I & R		16	
MIL-I-81969/25-05		I & R		16	
MIL-I-81969/25-06		I & R		16	
MIL-I-81969/26-01		R		--	--
MIL-I-81969/27-01	ATML 2701	R	--	4/0	MS90562-1
MIL-I-81969/27-02	ATML 2702	R	--	2/0	MS90562-2
MIL-I-81969/27-03	ATML 2703	R	--	1/0	MS90562-3
MIL-I-81969/27-04	ATML 2704	R	--	2	MS90562-4
MIL-I-81969/27-05	ATML 2705	R	--	4	MS90562-5
MIL-I-81969/27-06	ATML 2706	R	--	6	MS90562-6
MIL-I-81969/28-01	ATML 2801	R	--	5, 9	MS3178-001
MIL-I-81969/28-02	ATML 2802	R	--	12	MS3178-002
MIL-I-81969/28-03	ATML 2803	R	--	8	--
MIL-I-81969/29-01	M81969/29-01	R	--	16	MS3165-16
MIL-I-81969/29-02	M81969/29-02	R	--	8	MS3165-8, M83723/32-08
MIL-I-81969/29-03	M81969/29-03	R	--	4	MS3165-4, M83723/32-04
MIL-I-81969/29-04	M81969/29-04	R	--	0	MS3165-0, M83723/32-00
FOR ASTRO'S METAL EQUIVALENTS OF /29 TOOLS SEE PAGE 74.					

Verify QPL status (if required) at time of purchase.

Mil-I-81969 Cross Reference Chart

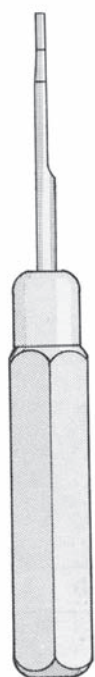
LISTED BY MIL DOCUMENT

CURRENT DOCUMENT	ASTRO TOOL #	I/R	ILL.	GAGE	SUPERSEDED DOCUMENT
MIL-I-81969/30B-01	ATML 3001B	R	17	22	MS3159-22
MIL-I-81969/30B-02	ATML 3002B	R	17	20	MS3159-20
MIL-I-81969/30B-03	ATML 3003B	R	17	16	MS3159-16
MIL-I-81969/30B-04	ATML 3004B	R	17	12	MS3159-12
MIL-I-81969/30B-05	ATML 3005B	R	17	20	MS3448-001A
MIL-I-81969/30B-06	ATML 3006B	R	17	16	MS3448-001B
MIL-I-81969/30B-07	ATML 3007B	R	17	12	MS3448-001C
MIL-I-81969/30B-08	ATML 3008B	R	17	22D	
MIL-I-81969/30B-09	ATML 3009B	R	17	22M	
MIL-I-81969/30B-10	ATML 3010B	R	17	22	
MIL-I-81969/30B-11	ATML 3011B	R	17	20	
MIL-I-81969/30B-12	ATML 3012B	R	17	16	
MIL-I-81969/30B-13	ATML 3013B	R	17	12	
MIL-I-81969/30B-19	ATML 3019B	R	17	22D-12	
MIL-I-81969/30B-20	ATML 3020B	R	17	--	
MIL-I-81969/30B-21	ATML 3021B	R	17	22	
MIL-I-81969/30B-22	ATML 3022B	R	17	20	
MIL-I-81969/30B-23	ATML 3023B	R	17	16	
MIL-I-81969/30B-24	ATML 3024B	R	17	12	
MIL-I-81969/30B-25	ATML 3025B	R	17	20	
MIL-I-81969/30B-26	ATML 3026B	R	17	16	
MIL-I-81969/30B-27	ATML 3027B	R	17	12	
MIL-I-81969/30B-28	ATML 3028B	R	17	22D	
MIL-I-81969/30B-29	ATML 3029B	R	17	22M	
MIL-I-81969/30B-30	ATML 3030B	R	17	22	
MIL-I-81969/30B-31	ATML 3031B	R	17	20	
MIL-I-81969/30B-32	ATML 3032B	R	17	16	
MIL-I-81969/30B-33	ATML 3033B	R	17	12	
MIL-I-81969/30B-34	ATML 3034B	R	17	22-12	
MIL-I-81969/30B-35	ATML 3035B	R	17	20-12	
MIL-I-81969/30B-36	ATML 3036B	R	17	22D-12	
NOTE: ATML 30567 is available as a set consisting of a handle and 1 each of ATML 3005, ATML 3006, ATML 3007					MS3448-001

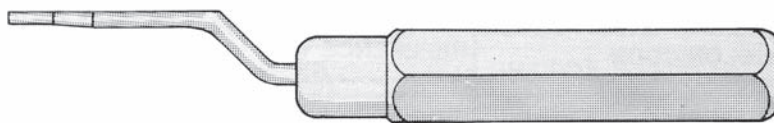
CURRENT DOCUMENT	ASTRO TOOL #	I/R	ILL.	GAGE	SUPERSEDED DOCUMENT
MIL-I-81969/31-01					MS3178-20-1
MIL-I-81969/31-02		I			MS3178-20-2
MIL-I-81969/31-03		R			MS3178-20-3
MIL-I-81969/31-04		R			MS3178-20-4
MIL-I-81969/31-05		I			MS14035-02
MIL-I-81969/31-06		I			MS14035-03
MIL-I-81969/31-07		R			MS14035-01
MIL-I-81969/31-08		I			MS14036-01
MIL-I-81969/31-09		I			MS14036-02
MIL-I-81969/21-10		I			MS14036-03
MIL-I-81969/32-01		R			
MIL-I-81969/33-01	ATML 3301	I			
MIL-I-81969/33-02	ATML 3302	I			
MIL-I-81969/34-01	ATML 3401	R			
MIL-I-81969/38-01					
MIL-I-81969/38-02					
MIL-I-81969/38-03					
MIL-I-81969/38-04					
MIL-I-81969/38-05					
MIL-I-81969/38-06					
MIL-I-81969/38-07					
MIL-I-81969/38-08					
MIL-I-81969/38-09					
MIL-I-81969/38-10					
MIL-I-81969/38-11					
MIL-I-81969/38-12					
MIL-I-81969/38-13					
MIL-I-81969/38-14					
MIL-I-81969/38-15					
MIL-I-81969/38-16					
MIL-I-81969/38-17					
MIL-I-81969/38-18					
MIL-I-81969/39-01	M81969/39-01	I & R	28	20	

Verify QPL status (if required) at time of purchase.





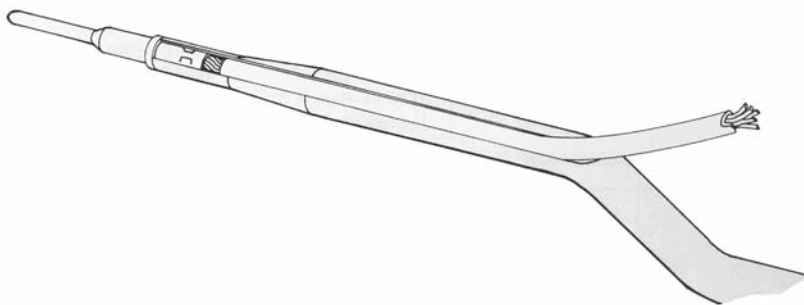
ILL 1



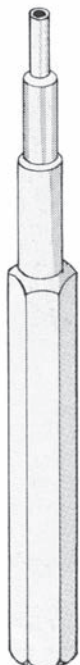
ILL 2

INSERTION TOOLS

Straight (ILL. 1) and jogged tools (ILL. 2) hold contact and wire in line with center or side of the tool handle. Tool sizes are "0" to "24" gage. Handles are color coded aluminum. Tools range from 4 1/2" to 6" long with replaceable tips.

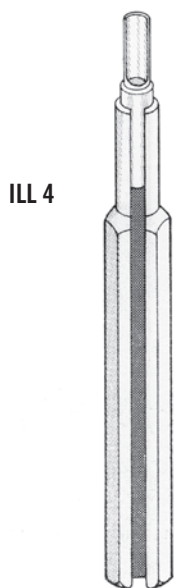


FRONT REMOVAL, REAR INSERTION TOOLS



ILL 3

Both front removal (ILL. 3) and rear insertion (ILL. 4) Military Standard tools offer a convenient and practical approach to servicing the MIL-C-81511, Series 1 & 2 connectors. Tools are color coded for contact size with half-inch hex metal handles.



ILL 4

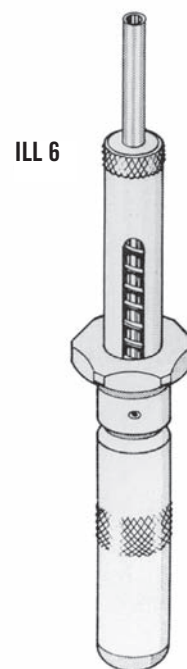
FRONT RELEASE

Front release connectors are easily serviced with these military spec removal tools. Handles are color coded for contact size. Replaceable tips are available.

REF: MIL-C-005015, MIL-C-26482, MIL-C-26500, and MIL-C-26636 Connectors.

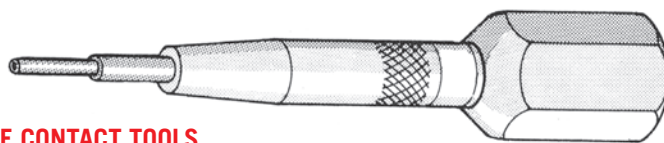


ILL 5



ILL 6

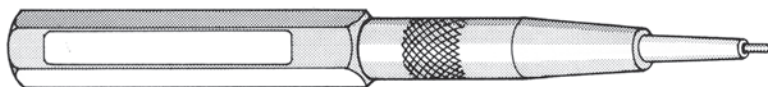
Insertion & Removal Tool Illustrations



ILL 8

FRONT REMOVAL SPRING-LOADED PROBE CONTACT TOOLS

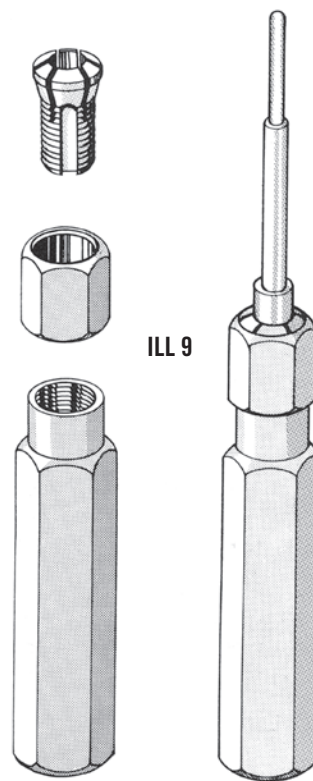
Employing the floating tip concept, these tools offer quality, as well as ease in operation. Body and handle are anodized aluminum alloy and color coded. Replaceable tips are available and require no special insertion tools.



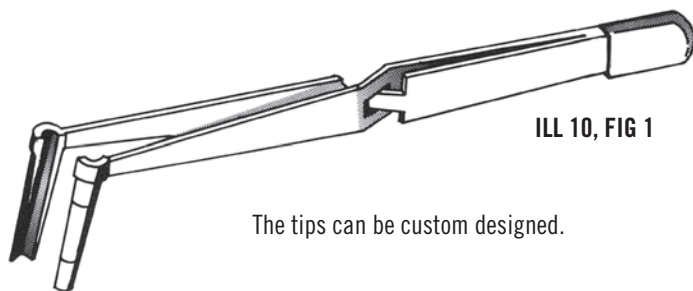
ILL 7

INTERFERENCE FIT CONTACTS

A collect grip in the handle allows for a multi-purpose tool. The tips can be set to remove both pins and sockets or insert multi-sized contacts by reversing the replaceable tip. Handles are aluminum alloy and color coded. Sizes are from 1/8" diameter to 1/4" diameter.



ILL 9

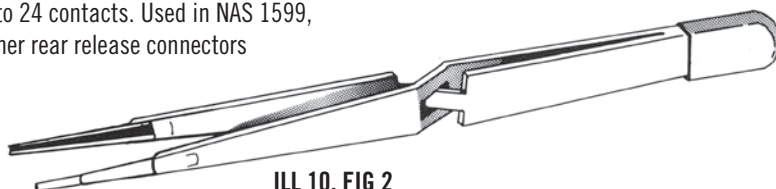


ILL 10, FIG 1

The tips can be custom designed.

REAR REMOVAL AND INSERTION TWEEZERS

Tools are for sizes 8 to 24 contacts. Used in NAS 1599, MIL-C-38999 and other rear release connectors

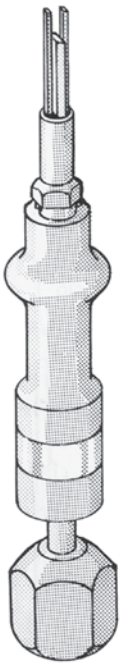


ILL 10, FIG 2

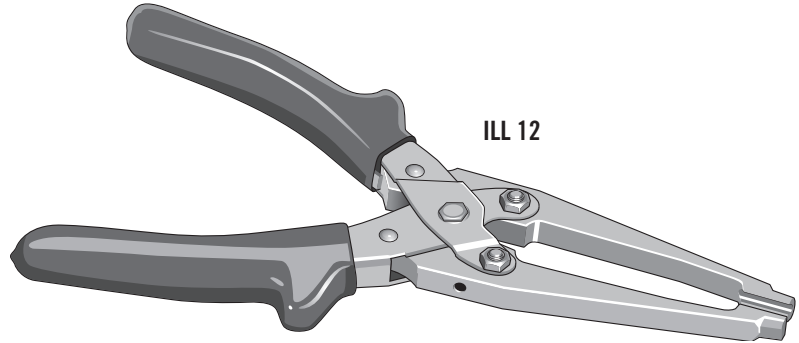
The tips can be custom designed.

FLAT CONTACT REMOVAL TOOLS

Tool is used in the Elco, Winchester, Tri-Star and Collins Radio connectors. Tool slides down both sides of contact from front and releases locking clip (spur). Shedder then ejects contact out of the rear.



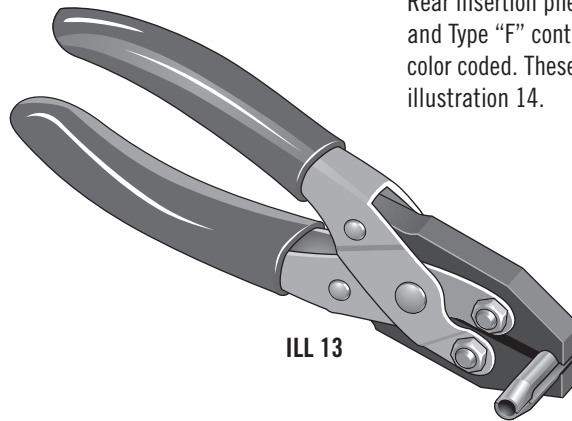
ILL 11



ILL 12

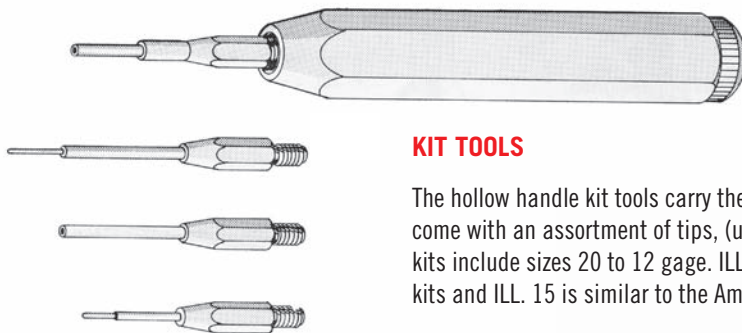
INSERTION PLIERS

Rear insertion pliers are for Amphenol/Bendix, CE, SE, AN/MS and Type "F" contacts in sizes 12, 16, & 20 gage. Handles are color coded. These pliers are used in conjunction with kits in illustration 14.



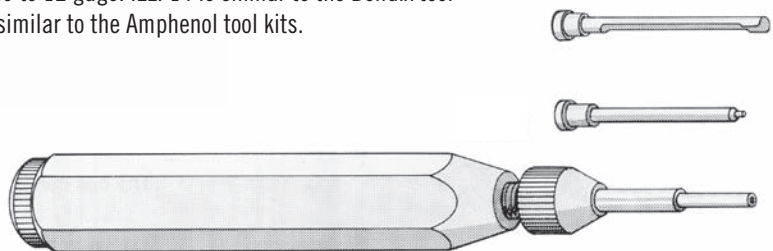
ILL 13

ILL 14



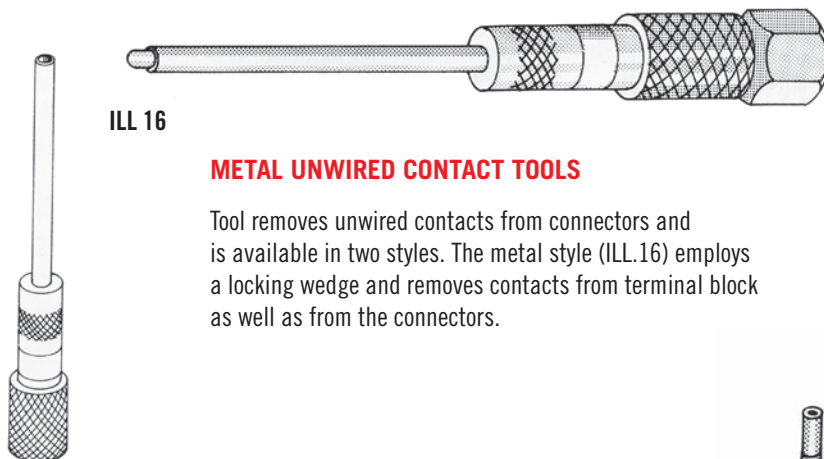
KIT TOOLS

The hollow handle kit tools carry the tips inside the handle and come with an assortment of tips, (usually 3 to 5 per kit). Various kits include sizes 20 to 12 gage. ILL. 14 is similar to the Bendix tool kits and ILL. 15 is similar to the Amphenol tool kits.



ILL 15

Insertion & Removal Tool Illustrations



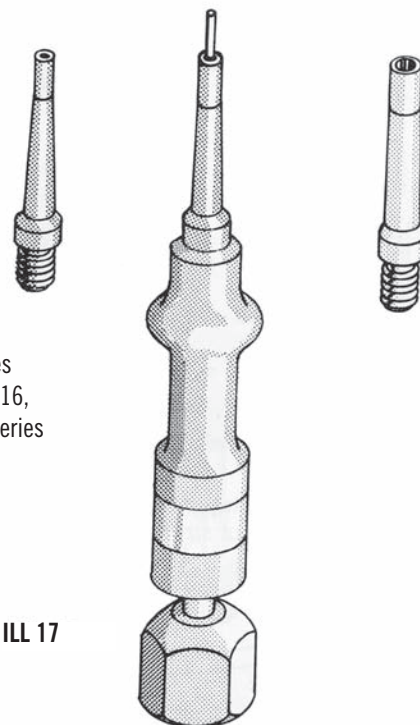
ILL 16

METAL UNWIRED CONTACT TOOLS

Tool removes unwired contacts from connectors and is available in two styles. The metal style (ILL.16) employs a locking wedge and removes contacts from terminal block as well as from the connectors.



The Military Standard tools (ILL.17) use plastic probes which are interchangeable and available in sizes 12,16, 20 (MS3448-001 kit) and 12 through 22 (MS3159), series NAS 1599 and MIL-C-81511, Series 3 and 4.



ILL 17

RETENTION TEST TOOL

This tool is designed to test contacts in connectors to verify a properly “locked in” condition after insertion. These tools impose a controlled spring pressure against pin or socket contacts and will displace when not properly locked.

Each tool has interchangeable probes for testing either pin or socket contacts and three sizes of compression springs (light, medium or heavy, covering from 1 ½ to 18 lbs). Tool is easily adjusted to any requirement. Design features a “visual check” with an indicator button showing when full compression is reached.

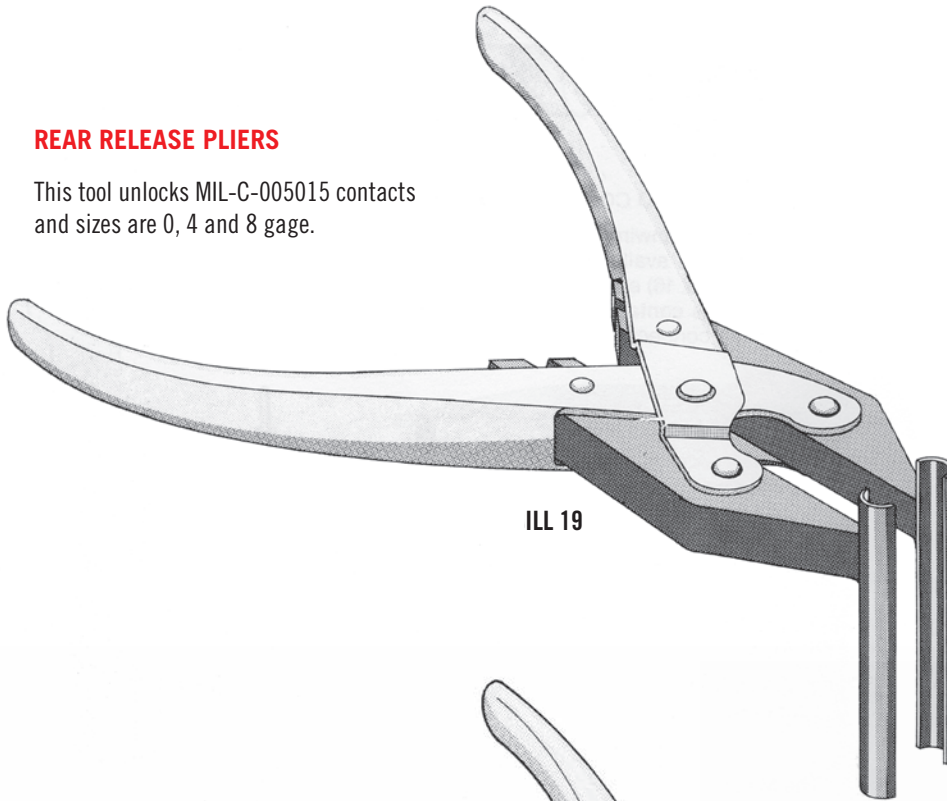


ILL 18



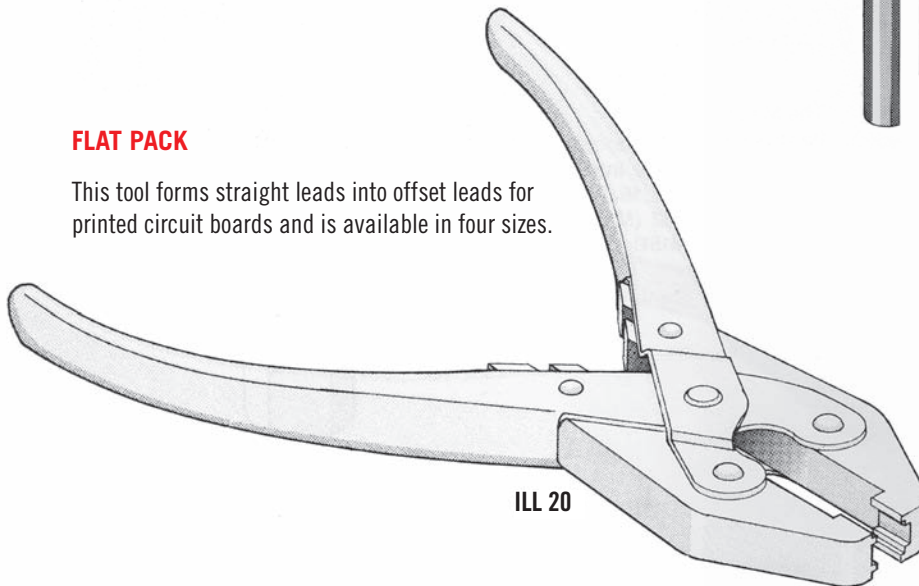
REAR RELEASE PLIERS

This tool unlocks MIL-C-005015 contacts and sizes are 0, 4 and 8 gage.



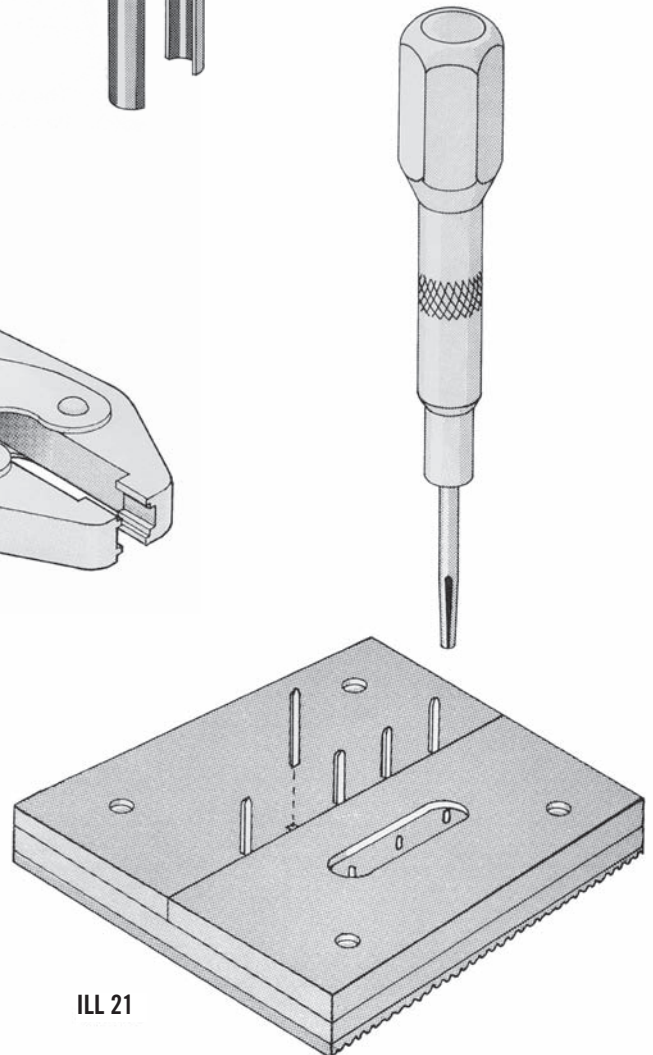
FLAT PACK

This tool forms straight leads into offset leads for printed circuit boards and is available in four sizes.



TRANSFER KITS

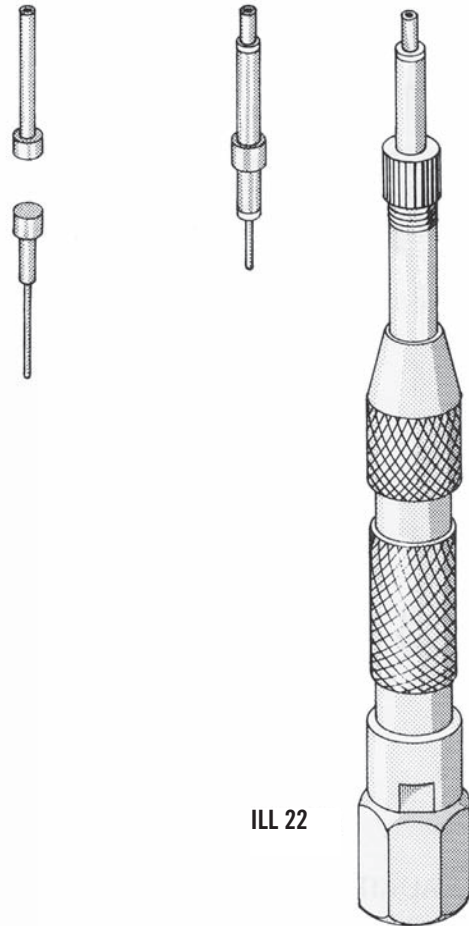
This tool is designed to move the wired clips from one pin to another with ease. Two sizes are available; .025 square and .058 x .028 pins kits.



Insertion & Removal Tool Illustrations

IMPACT TOOLS

Tool is used mainly on Cannon's "Ring-Lok" contacts. The contacts are "snapped" out by the impact tool. Sizes are coax to 20 gage and remove both pin and socket contacts. The probes are replaceable and handles are color coded.

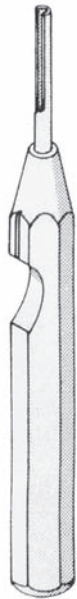


ILL 22

INSERTION AND REMOVAL TOOLS

This tool uses 3/8" hex aluminum handle and is used in the smaller gage sizes. Tips are normally straight, from 1" to 4" long.

Delrin handles with 20° offset tips work well when inserting 16 to 22M contacts in the MIL-C-38999 connectors.



ILL 23



ILL 24

TIPS

Replacement tips come in many shapes and sizes.

Lockheed (figure A)

Bendix (figure B)

Burndy (figure C)

ILL 25



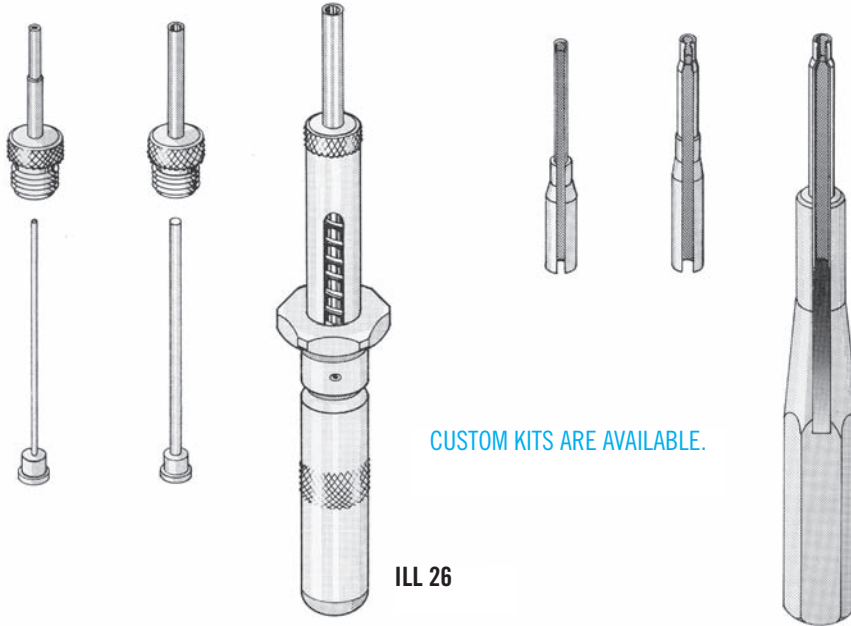
FIG C



FIG A



FIG B



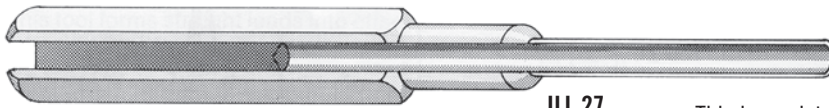
CUSTOM KITS ARE AVAILABLE.

INTERCHANGEABLE PROBE REMOVAL KIT

Common handle and 3 tips for sizes 12, 16 and 20 gage contacts, with shedders for MIL-C-26482, 26500 and 26636 connectors.

INTERCHANGEABLE PROBE INSERTION KIT

Common handle and 3 tips for sizes 12, 16 and 20 gage contacts for MIL-C-26482, 26500 and 26636 connectors.



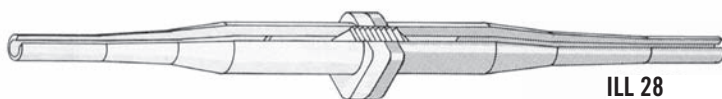
ILL 27

This long-slot tool illustrates the standard for MIL-C-005015 insertion tools. Modified versions are available on request.

PLASTIC TOOLS vs. ASTRO METAL TOOLS

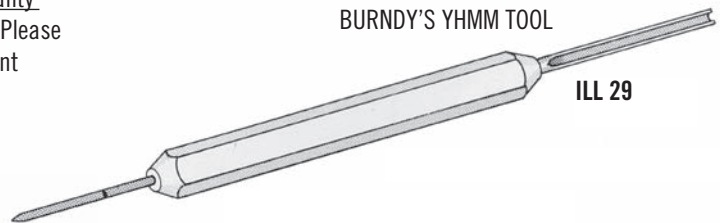
Plastic tools are used throughout the industry. Astro Tool Corp's policy is to give our customers the greatest savings for the best quality tools we can manufacture. Metal tools, although initially more costly, offer a quality product and a lower tooling cost in servicing electrical connectors. Please refer to our cross-reference lists for any plastic to metal replacement equivalents you may need.

The tools are available in two basic lengths with a metal or plastic insertion foot.

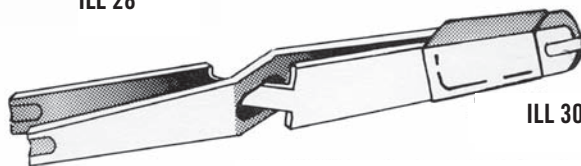


ILL 28

BURNDY'S YHMM TOOL



ILL 29



COLLIN'S RADIO FILTER PIN INSERTION TOOL

ILL 30

APPENDIX



ASTRO TOOL CORP.
CONNECTOR ASSEMBLY TOOLING



Terms & Conditions of Sale

(a) **APPLICABLE TERMS AND CONDITIONS:** These Terms and Conditions exclusively control any sale between ATC and purchaser. If purchaser fails to object in writing to ATC's Terms and Conditions within ten (10) days of receipt of these Terms and Conditions, then Purchaser's acceptance of the goods will be deemed an acceptance of the terms and conditions set forth herein. ATC expressly rejects any pre-printed terms and conditions set forth in any of purchaser's forms. Any proposed terms and conditions proposed by purchaser not contained in a pre-printed form shall not be binding upon ATC unless such terms and conditions are expressly agreed upon by ATC in writing.

(b) **CHANGES:** If the purchaser at any time changes within the general scope of any order and if any such changes cause an increase or decrease in the cost of, or the time required for the performance of any purchase order or any other order affected by such change, an equitable adjustment in the price, the delivery schedule or both shall be made and such order shall be modified accordingly.

(c) **SHIPMENT:** Shipment generally will be accomplished FOB ATC's plant. Notwithstanding this, if ATC prepays the transportation charges purchaser will be obligated to reimburse ATC upon receipt of invoice for the prepaid transportation charges. Any Special or abnormal packaging required will be included in the unit price of the item to be delivered or as a separate line item.

(d) **DELIVERY:** Delivery will be accomplished within the time specified on the face of the acknowledgment or if no time is specified within the normal lead time necessary for ATC to deliver its products in question. Anything to the contrary notwithstanding, ATC shall not be liable to any reasonable delay in production or delivery. In the event a delay in production or delivery occurs beyond a reasonable period of time, which delay is occasioned by fire, strikes, civil or military authority, war, hostility, riots, government action, energy crises, parental leave, or by other causes beyond the control of ATC or without its fault or negligence, the failure of date or dates of delivery of the products ordered hereunder shall be extended for a period of time lost by reason of any such delay.

(e) **PAYMENTS:** In the event any payments of purchaser under any order are not made in a timely manner ATC may either: (1) declare purchaser's performance in breach and terminate any other order for default, (2) withhold future shipments under any order until delinquent payments are made, (3) deliver future shipments under any order on a C.O.D. or cash in advance basis even after the delinquency is cured, (4) charge interest on the delinquency at a rate of 2% per month or the maximum rate permitted by law, if lower, for each month or part thereof of the delinquency in payment plus applicable storage charges or inventory carrying charges, if any, or (5) combine any of the above rights and remedies as a practicable and permitted by law. Nothing herein shall waive any other rights or remedies of ATC permitted by law or set forth in this or any other order between purchaser and ATC and all rights and remedies set forth herein shall be considered cumulative with all other available rights and remedies.

(f) **MATERIAL SHORTAGES AND ALLOCATIONS:** In the event ATC is unable to obtain in a timely manner material sufficient to fulfill all of its orders on hand, ATC shall have the right as a result of said material shortages to equitably allocate lesser quantities of the products to be delivered to all purchasers on the proportionate basis. Unless specifically agreed in writing to the contrary, purchaser agrees to accept partial shipments.

(g) **INSPECTIONS:** The purchaser shall inspect and accept any products delivered immediately after purchaser takes custody of such products. In the event the products do not meet the drawings, designs, and/or specifications, the purchaser shall notify ATC of such noncompliance in writing and give ATC a reasonable opportunity to correct any such noncompliance. The purchaser shall be deemed to have accepted any products delivered and to have waived any such noncompliance in the event a written notification that the products delivered do not comply with the drawings, design, and/or specifications, is not received by ATC within 15 days after the purchaser takes custody of the products delivered.

(h) **INSOLVENCY:** ATC may cancel the whole or any part of any order in the event of the suspension of purchaser's business, insolvency of purchaser, the institution, by the purchaser or others, of bankruptcy reorganization, arrangement of liquidation proceedings involving or affecting the purchaser or any assignment for the benefit of creditors of purchaser or receivership that purchaser places itself in or may be placed in. Such cancellation shall be deemed a cancellation for default of purchaser.

(i) **RIGHT TO COMMUNICATE:** If purchaser is a reseller of ATC products, ATC shall have the absolute right to freely communicate with purchaser's customers concerning the reasons for delay or non-delivery of ATC product. If purchaser is on credit hold for any reason, ATC shall have the absolute right to furnish ATC product directly to purchaser's customer. Purchaser waives all right to claim that such communications and actions are slanderous, libelous, defamatory or constitute interference with a business arrangement.

(j) **SPECIAL TOOLING:** Title to dies, tools, jigs, fixtures, patterns or any other type of special tooling shall remain vested in ATC, whether or not paid for or amortized over the products manufactured under any other purchaser.

(k) **TAXES:** Unless otherwise specifically stated in writing by ATC, prices quoted by ATC do not include sums necessary to cover any taxes or duties including but not limited to Federal, State, Municipal excise, sales or use taxes or import duties upon the production, sale, distribution, or delivery of equipment or furnishing of service hereunder. Any taxes or duties that are due and owing shall be paid by the purchaser. Accordingly, ATC reserves the right to revise any contract between itself and others to include any and all taxes or duties that may become due and ATC may involve purchaser for said additional amount. This cause shall survive the acceptance and complete performance of any order.



(l) **SET-OFF:** All moneys owed under any order shall be due and payable at Beaverton, Oregon and the purchaser is prohibited from setting off said sums due ATC under this order form sums, whether liquidated or not, that are or may be due the purchaser which arise out of a different transaction with ATC, its divisions, subsidiaries or affiliates.

(m) **VENUE:** Washington County, Oregon shall be the proper venue for any actions arising out of or because of the breach of any agreement entered into with ATC.

(n) **ATTORNEYS' FEES AND SUIT COSTS:** Should ATC have to initiate legal action to collect any moneys owed arising out of any contract, or should ATC be sued by a customer under any contract, then if ATC prevails in whole or in part, customer agrees to pay ATC's attorneys' fees, witness fees, and court costs.

(o) **TITLE:** Title to the goods shall pass to the purchaser on identification of the goods to the contract. Purchaser grants ATC a security interest in the goods identified on this document, to secure payment of the purchase price, including all amounts that come due under the Sale Document.

(p) **NON-WAIVER:** No course of dealing or failure of ATC to strictly enforce any term, right or condition of any contract shall be construed as a waiver of such term, right or condition.

(q) **CHOICE OF LAW:** The construction, interpretation and performance of any agreements entered into and all transactions under such agreements shall be governed by the laws of the State of Oregon.

(r) **CANCELLATION COSTS:** In the event of cancellation of any order by purchaser, purchaser shall be liable for reasonable cancellation costs which shall not exceed the contract price for the items canceled.

(s) **RISK OF LOSS:** Purchaser shall be liable for any loss which occurs after goods leave their F.O.B. point which shall be Factory, Beaverton, Oregon, unless otherwise stated on the reverse side of this document.

(t) **ERRORS SUBJECT TO CORRECTION:** All typographical, stenographic and arithmetical errors are subject to correction.

(u) **LIABILITY FOR PATENT INFRINGEMENT:** If goods are made to purchaser's specifications or design, purchaser assumes liability for patent and copyright infringement and agrees to hold ATC harmless from any actions arising out of any alleged infringement.

(v) **RESPONSIBILITY FOR SAFETY TRAINING:** Purchaser and end users stipulate and agree that tampering with, or the improper or unsafe operation of ATC products, especially power actuated products, can cause severe bodily injury or death. Purchaser and end users agree to assume complete and sole responsibility for fully training and continually supervising each of their operators in the proper use and safe operation of all products from ATC.



Limited Warranty and Limitations of Liability

(w) **LIMITED WARRANTY:** ATC warrants each new product sold by it to be free from defects in material and workmanship under normal use and service. ATC's obligation under this warranty is limited to the free correction or, at ATC's option, the refund of the purchase price of any such product which proves defective in normal service within ninety (90) days after delivery to the first user, provided that the product is returned to ATC with all transportation charges prepaid and which shall appear to ATC's satisfaction, after ATC's inspection, to have been defective in material or workmanship, it being understood that ATC products are not consumer products. This warranty shall not cover any damage to any product which, in the opinion of ATC, was caused by normal wear, misuse, improper operation, tampering, neglect, or accident. This warranty is in lieu of all other warranties express or implied.

No warranty, express or implied, is made or authorized to be made or assumed with respect to products of Astro Tool Corporation other than those herein set forth.

(x) **LIMITATION OF LIABILITY:** ATC IS NOT LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY NATURE OR KIND RESULTING FROM THE USE, OR MISUSE OF ANY OF ITS PRODUCTS. OWNERS AND USERS OF ATC PRODUCTS ASSUME FULL RESPONSIBILITY FOR INSTRUCTING THEIR EMPLOYEES IN THE PROPER AND SAFE USE OF SUCH PRODUCTS.

(y) **SEVERABILITY:** If any provision herein is held to be in violation of any Federal, State or Local statute or regulation of illegal or unenforceable for any reason, said provision shall be self-deleting without affecting the validity of the remaining provisions.

(z) **TOOLING OR TOOLING COMBINATIONS SUGGESTED BY ATC** may or may not cover a user's specific contract manufacturing requirements. It is the user's responsibility to conduct sufficient testing to validate the suitability of the ATC product(s) selected for the specific requirements of each particular application. ATC DISCLAIMS ANY LIABILITY DIRECT OR CONSEQUENTIAL ARISING FROM USER'S FAILURE TO CARRY OUT SUCH VALIDATION TESTING.

Certificate of Conformance

Astro Tool Corporation certifies that documentary evidence in the form of test reports and inspection records on this material and/or associated processes indicating conformance to applicable specifications are on file and available for review, by appointment, at its home office. The parts so submitted meet dimensional, functional and quality requirements as covered by the applicable purchase order, part numbers and/or specifications.

CERTIFICATES OF CONFORMANCE: A standard Certificate of Conformance is printed on the back of invoices and packing lists. There will be an additional charge for additional and/or non-standard Certificates of Conformance.

Certificate of Calibration/Inspection

The parts so submitted by Astro Tool Corporation meet dimensional, functional and quality requirements as covered by the applicable purchase order, part numbers and/or specifications. The quality system meets ISO9001/AS9000. ATC's metrology system is maintained according to ANSI/NCSL Z540-1-1994 and uses test equipment and material traceable to N.I.S.T.



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