Circular Plastic Connector Sealing Accessories

Sealing Caps
for Receptacles only

Sealing caps are used to protect exposed contacts of unmated receptacles.

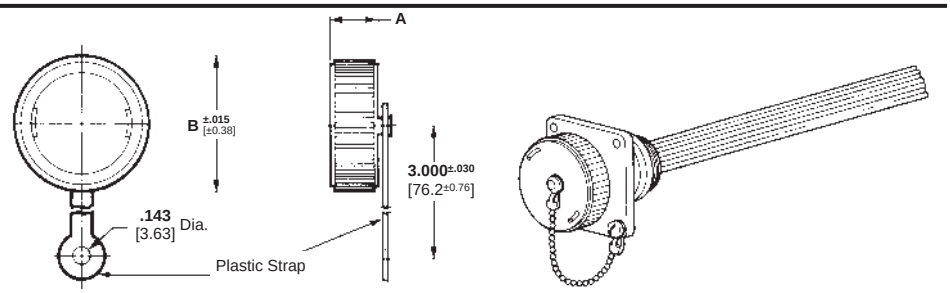
Material and Finish

Cap—Thermoplastic, heat stabilized, fire resistant, self-extinguishing, 94V-1 rated, black

Sealing Gasket—Neoprene, black

Bead Chain—Steel, nickel plated

Bead Chain Coupling—Brass, plated nickel



Shell Size	Series	Dimensions A	Dimensions B	Plastic Strap Part No.	Metal Bead Chain Part No.
11	1 & 2	**.360** 9.14	**.927** 23.55	206903-1	208800-1
13	1	**.360** 9.14	**1.055** 26.80	211870-1	213485-1
17	1,2,& 3	**.360** 9.14	**1.295** 32.89	207445-1	208652-1
23	1, 3, & 4	**.460** 11.68	**1.728** 43.89	207446-1	208680-1
	2			207446-2	208680-2

Cable Entry Seals
Heat Shrinkable Sealing Boots

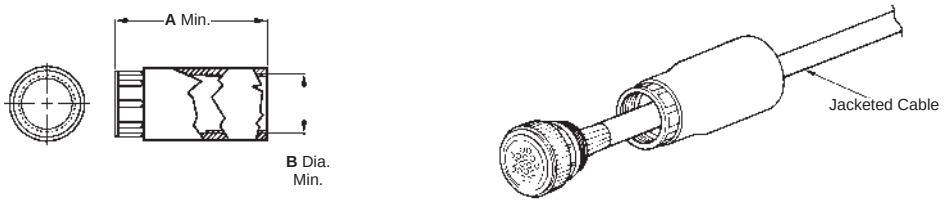
Cable entry seals are used with jacketed cable to provide an environmentally sealed wire-to-connector system. They can be used with either plugs or receptacles.

Thick Wall Boots

Material

Internal Sleeve—Nylon

Outer Tubing—Polyolefin, black



Shell Size	Dimensions A	Dimensions B	Expanded Wall Thickness	Sealing Range (Dia.)	Max. Recovered Inside Diameter	Part No.
11	**2.500** 63.50	**.625** 15.88	**.050** 1.27 Ref.	**.250 - .600** 6.35 - 15.24	**.160** 4.06	54010-4
					.250 6.35	54010-1
13	**2.500** 63.50	**.775** 19.68	**.060** 1.52 Ref.	**.250 - .375** 6.35 - 9.53	**.220** 5.59	54123-2
				.375 - .725 9.53- 18.42	**.300** 7.62	54123-1
17	**2.500** 63.50	**.975** 24.76	**.060** 1.52 Ref.	**.400 - .875** 10.16 - 22.22	**.375** 9.52	54011-1
	3.000 76.20					54011-3
23	**3.000** 76.20	**1.250** 31.75	**.070** 1.78 Ref.	**.550 - 1.250** 13.97 - 31.75	**.500** 12.70	54012-1

Thin Wall Boot

Material

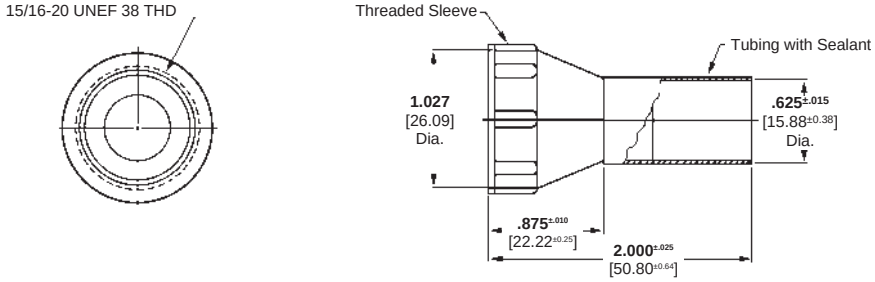
Inter Sleeve—Nylon

Outer Tubing—Polyolefin

Expanded Wall Thickness—.020 [0.51]

Max. Recovered Wall Thickness—.040 [10.16]

Sealing Range—.250 [6.35]-.500 [12.70] Dia.



Shell Size 17
Part No. 213933-1

CPC Sealing Accessories

Catalog 82021
Revised 7-06

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UK: 44-208-420-8341

Circular Plastic Connector Sealing Accesories (Continued)

Jacketed Cable Seals (for Shell Size 23)

A jacketed cable seal kit provides an environmentally sealed connection for jacketed cable.

Material

Peripheral Seal—Grey elastomer

Collar—Aluminum

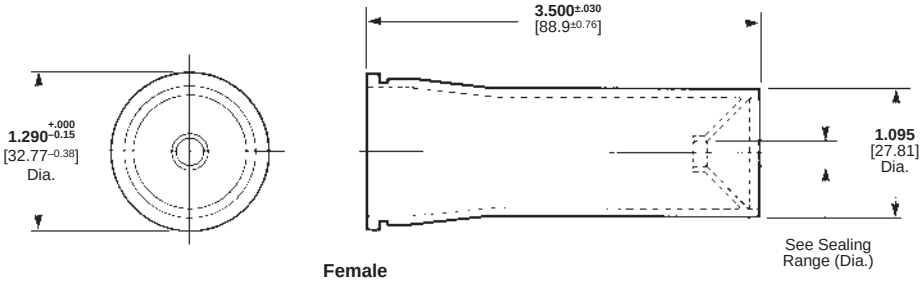
Jacketed Cable Seal—Black rubber

Back-Shell Extender—Black glass-filled thermoplastic

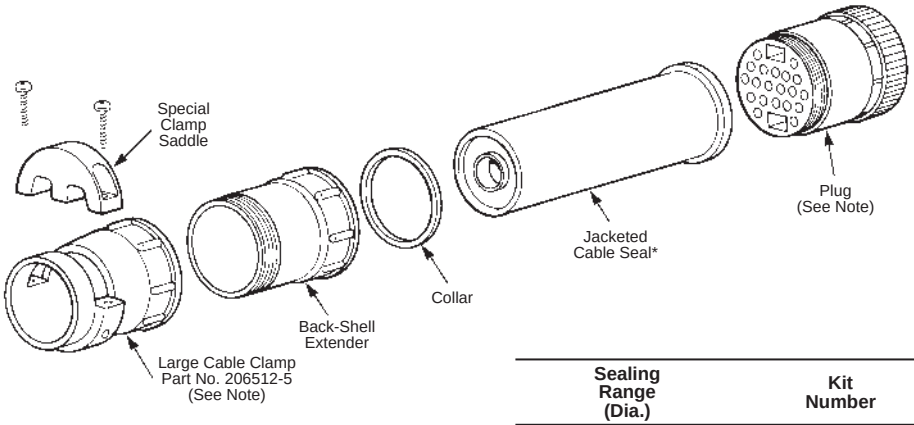
Special Clamp Saddle—Black thermoplastic

Note: Jacketed cable seals must be used with large cable clamps and can be used on plugs or receptacles. Large cable clamps are to be ordered separately (see page 37). Each jacketed cable seal kit includes:

- Peripheral Seal—to be discarded if kit is used on plug. Additional seals may be purchased (see page 50)
- Collar—provides bearing surface for back-shell extender
- Jacketed Cable Seal
- Back-Shell Extender
- Special Clamp Saddle—to be used in lieu of clamping insert supplied with large cable clamp



Female



*Jacketed cable seal is pressed flush against rear connector face when back-shell extender is threaded onto rear of connector.

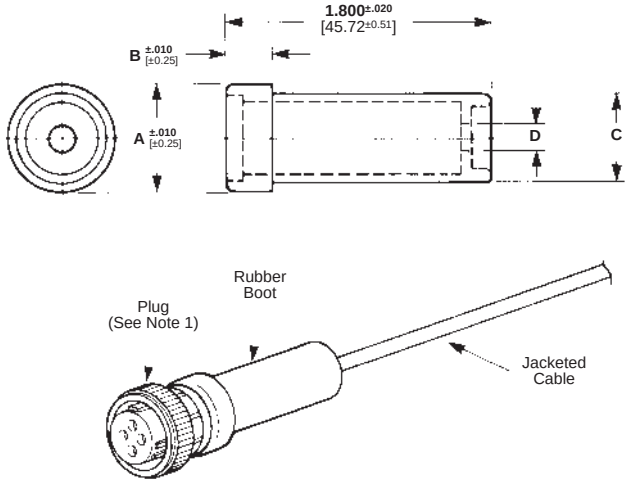
Sealing Range (Dia.)	Kit Number
.300-.450 7.62-11.43	207052-1
.450-.600 11.43-15.24	207052-2
.600-.875 15.24-22.22	207052-3

Rubber Boot

Rubber boots are used with jacketed cable to provide splash-proof connections for Series 1 and Series 3 connectors. (Not for Metal Shell Connectors.)

Material

Black neoprene



Shell Size	Cable Dia. Sealing Range	Dimensions A	B	C	D	Part No.
11	**.219-.438** 5.56-11.13	**.750** 19.05	**.300** 7.62	**.600** 15.24	**.170** 4.32	206304-1

Notes: 1. Rubber boots are recommended for use with jacketed cable and can be used on plugs or receptacles, except Series 2 connectors.
2. For detailed performance data on rubber boots, refer to Product Specification No. 108-10024.

Circular Plastic Connector Sealing Accesories (Continued)

Flexible Cable Protection System

Product Facts

- **For cables that require better protection**
- **Fittings allow more reliable connections to be made**
- **Sealed fittings enhance reliability of machinery operating under many extreme environmental conditions encountered in manufacturing and construction industries**
- **High-quality, complete systems are available combining innovative technology with rapid in-stock availability**
- **Conforms with the latest industry standards**
- **Recognized under the Component Program of Underwriters Laboratories Inc. on applied products as marked.**
- **Certified by Canadian Standards Association on applied products as marked.**
- **Certified by VDE on applied products as marked.**

Related Product Data

Catalog 1654227
Identification Products

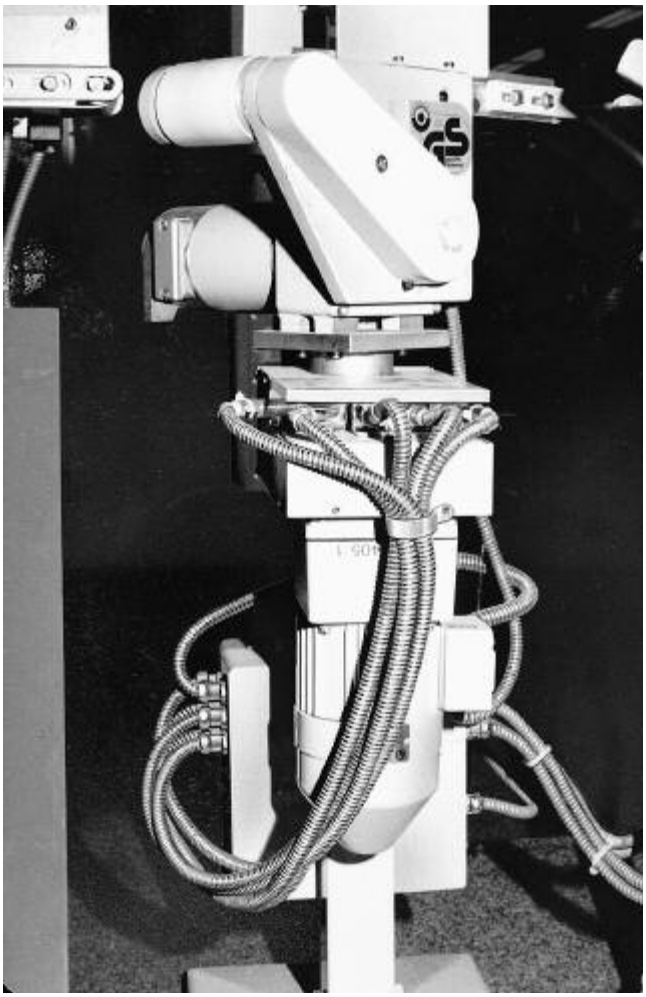
Technical Documents

Product Specifications

108-1696 FLEXAgraff Metal Conduits
108-1696-1 ROHRflex Plastic Tubing
108-1696-2 AIRflex Plastic Conduits

Application Specifications

114-18274 FLEXAgraff**-AS**, **-PU-AS**, **-ME-ASF** Metal Conduits
114-18275 FLEXAgraff**-CU** Metal Conduits
114-18276 AIRflex**-KUW-PU** Plastic Conduits
114-18277 ROHRflex**-PA 6**, ROHRflex**-PA 6 S**, ROHRflex**-PA 12** Plastic Tubing



Typical Industrial Application








Circular Plastic Connectors (CPC) / FLEXAquick-System Selection Aid

CPC Shell Size	Female ROHRflex quick Connector	ROHRflex-PA 6 Plastic Tubing	Male ROHRflex quick Connector	Male ROHRflex quick Elbow Connector	Counternut	Flat Sealing Washer
11	1-969807-2	969789-2	969803-2	969817-2	796260-2	796257-2
13	1-969809-3	969789-3	969803-3	969817-3	796260-3	796257-7
17	1-969811-4	969789-4	969803-4	969817-4	796260-5	796257-8
23	2-969813-5	969789-5	969803-5	969817-5	796260-6	796257-9

NOTE:
Request Flexible Cable Protection System Catalog 1307244.

Catalog 82021
Revised 7-06

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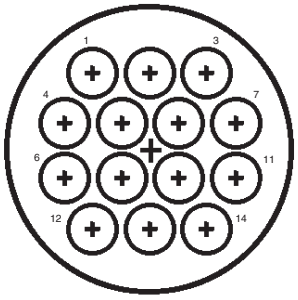
Japan: 81-44-844-8013
UK: 44-208-420-8341

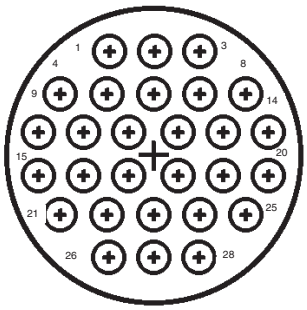
Note: All part numbers are RoHS Compliant.

Connector Series and Types



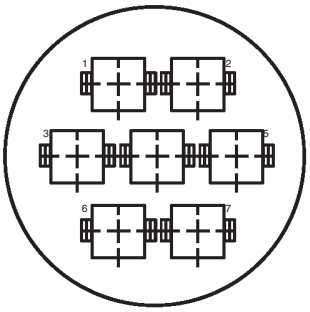
Series 1—Size 16 Contacts

Series 1 connectors permit the use of multiple combinations of signal and coaxial circuits in the same housing by accepting durable Multimate contacts. These pin and socket contacts include Type III+ and subminiature coaxial contacts, interchangeable in the same Multimate contact cavity. Type III+ contacts (.062 [1.57] pin diameter) are capable of carrying a maximum of 13 amperes when crimped in wire. Type III solder contacts and posted contacts for pc board applications are also available. Many connector arrangements offer both standard and reverse sex contact loading—**from 4 thru 37 positions.**



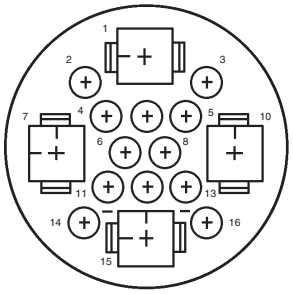
Series 2—Size 20 Contacts

Series 2 connectors accept Size 20 DF (precision formed) and Size 20 DM (screw-machined) pin and socket contacts with a .040 [1.02] pin diameter, Size 20 DF contacts are available in crimp and solder versions, as well as a posted version for wrap-type and pc board applications. Maximum current carrying capability is 7.5 amperes. Many connector arrangements offer both standard and reverse sex contact loading—**from 8 thru 63 positions.**



Series 3—Power Contacts

Series 3 connectors accept Type XII power contacts which can carry up to 25 amps per contact. These contacts will accommodate a wire size range of 16 to 10 AWG [1.4 to 5 mm^2]. Two connector sizes are available in both standard and reverse sex connector arrangements **3 and 7 positions.**



Series 4—Combination Size 16 and Power Contacts

Series 4 connectors accept Size 16 Multimate and Type XII power contacts, combining the signal and coaxial circuit capabilities of Series 1 connectors with the power circuit capabilities of Series 3 connectors. Available in two connector sizes offering power mixing combinations totaling **16 and 22 positions.**

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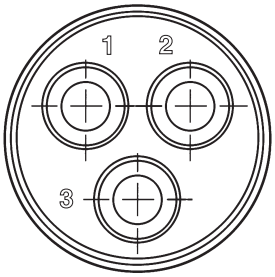
Connector Series and Types (Continued)

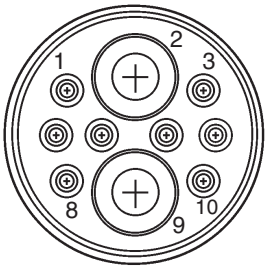


Series 5—Power Contacts .125 POWERBAND

Series 5 connectors combine the revolutionary performance of the new AMP POWERBAND Contact, high current contact in configurations similar to the Series 3 connectors. AMP POWERBAND contacts offer the electrical performance of the best Mil Spec Size 8 screw-machined contacts with the economy and productivity of strip-fed, precision formed contacts.

Series 5 connectors are environmentally sealable to meet IEC IP 65 and IP 67 specifications.

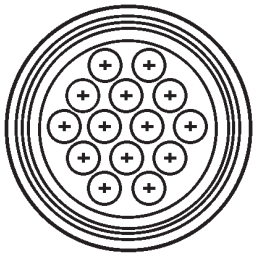
Rated at 600 VAC or VDC, 45 amperes maximum in a single contact, the connectors are available in free-hanging and panel-mount applications—**one connector configuration containing three .125 POWERBAND contacts.**



Series 6—Combination, Size 16 and .125 POWERBAND Contacts

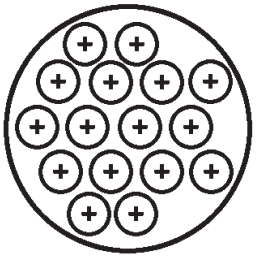
Series 6 combines the high current and environmental sealing capability of Series 5, POWERBAND contacts, and the reliability of signal carrying, low current Type III+ contacts.

This combination of power and signal contacts is offered in **one connector configuration containing two .125 POWERBAND contacts and eight Type III+ signal pin and socket contacts.**



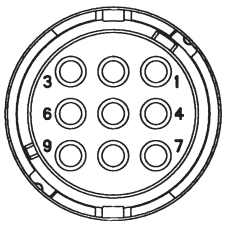
MIL-C-5015 Style—Size 16 Contacts

This new addition to the AMP Circular Plastic Connector Line is specifically designed to be **intermateable with Metal-Shell size 20-14 and 18-10, MIL-C-5015 Style connector systems.** The high impact resistant plastic housing offers the advantages of light weight and lower cost than existing metal-shell connectors. In addition the connector design prevents mismating when used with other insert arrangements. As part of the AMP Multimate family of connectors, the MIL-C-5015 style connector offers the economies of crimp Type III+ pin and socket contacts in reel-mounted, strip-form for high volume automatic machine termination, as well as in loose piece-form for low volume, prototype or maintenance and repair.



Metal-Shell, Circular Plastic Connectors

Metal-Shell CPC connectors consist of a black thermoplastic insert in a nickel-plated, zinc alloy shell. These connectors are currently available in **shell sizes 14, 22 and 28, and in two basic configurations consisting of plugs and square flange receptacles.**



Miniature CPC Connectors

These compact connectors accept existing Mini-Universal MATE-N-LOK pin and socket contacts, 30-18 AWG [.05-.8 mm^2].

Two shell sizes (8 or 11) are available, accommodating **from 1 to 4 and 5 to 9 positions**.

Featuring high contact density and IP67 sealing, these durable connectors are well suited for many wire-to-wire, wire-to-board, and wire-to-panel applications.

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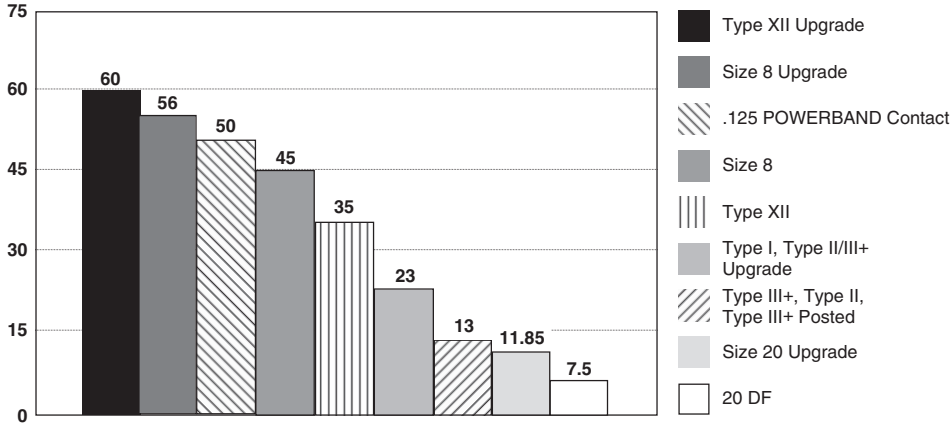
Current Carrying Capabilities

The total current capacity of each contact in a given connector is dependent upon the heat rise resulting from the combination of electrical loads of the contacts in the connector arrangement and the maximum ambient temperature in which the connector will be operating. Caution must be taken so that this combination of conditions does not cause the internal temperature of the connector to exceed the maximum operating temperature of the housing material. Several variables which must be considered when determining this maximum current capability for your application are:

CONTACT CURRENT GUIDE Maximum Current (Amperes) for Largest Wire Size



- **Wire Size**—Larger wire will carry more current since it has less internal resistance to current flow and generates less heat. The wire also conducts heat away from the connector.
- **Connector Size**—In general, with more circuits in a connector, less current per contact can be carried.
- **Current Load Distribution**—Spreading those lines with greater current loads throughout the connector, particularly around the outer perimeter, will enhance heat dissipation.
- **Ambient Temperature**—With higher ambient temperatures, less current can be carried.

Current Rating Verification Can a contact rated at 10 amps carry 10 amps?

Maybe yes, but probably not. The reason lies in the test conditions used to rate the contact. If these conditions do not adequately reflect the application conditions, the actual allowable current levels may be lower than specified levels. For example, many manufacturers, including Tyco Electronics, test a single contact in air. This gives an accurate measure of the basic current-carrying capacity of the contact. Use the contact alone in air and it can certainly carry 10 ampere. Use it in a multi-position connector surrounded by other current-carrying contacts or in high ambient temperatures, and the contact should carry less current.

Similarly, as the contact ages and stress relaxation, environmental cycling, and other degradation factors take their toll, the contact's current-carrying capacity decreases. A prudent design must set current levels for such end-of-design-life (EODL) conditions. Practical current-carrying capacity is not an absolute, but an application-dependent condition.

New Method Simplifies Ratings

To help the designer set the appropriate current level, Tyco Electronics has developed a method of specifying current-carrying capacity. This method takes into account the various application factors that influence current rating.

The method can be summarized as follows:

- The contact is aged to EODL conditions by durability cycling, thermal cycling, and environmental exposure.
- The contact's resistance stability is verified.
- The current necessary to produce the specified temperature rise is measured. This T-rise is usually 30°C.
- A rating factor is determined to allow derating of multiple contacts in the same housing and for different conductor sizes.

Temperature

One other factor influencing current levels is the maximum operating temperature, for example, 105°C. If the application has a high ambient temperature (over 75°C) the contact's T-rise is limited by the maximum operating temperature. For example, an application temperature of 90°C limits the contact T-rise to 15°C. Since current produces heat (the I^2R law), the current must be lowered to limit the T-rise.

A contact's T-rise depends not only on its I^2R Joule heating, but also on its ability to dissipate the heat. Consider a contact in a multi-contact housing. Joule heating in multiple contacts will raise the local ambient temperature. Since the contact will not be able to dissipate its own heat as well by convection, the maximum T-rise will be realized at a lower current level. Consequently, the allowable current level must be lower to maintain an acceptable T-rise.

For a given connector, the current level will be set by the loading density. A connector containing 50% current-carrying contacts will permit higher currents (per contact) than a connector will at 75% loading. The loading percentage assumes an even distribution of contacts within the housing. If all 10 contacts are grouped together in one section of a 20-position connector, the loading density may approach 100%.

The Importance of EODL

As stated, T-rise in a contact depends on both resistance and current. As it ages, a contact's resistance will increase. The contact designer will specify a maximum resistance for the contact, this level is the end-of-design-life resistance. Before the contact is tested for current, Tyco Electronics subjects it to a sequence of tests that exercises the major failure mechanisms and thereby simulates EODL conditions. Conditioning includes mating cycling, industrial mixed-flowing gases, humidity and temperature cycling, and vibration to sequentially introduce wear, corrosion, stress relaxation, and mechanical disturbance.

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Presentation — An Example*

Current Rating

The presentation of current-carrying capacity in AMP product specifications includes two parts:

- First, a base curve showing current levels versus T-rise for a single circuit and the largest wire size (See figure 1). This represents the maximum current capacity of the contact. The curve is usually flat up to 75°C ambient and then drops off. Up to 75°C, the 30°C T-rise limits the amount of current, and above 75°C the current must be reduced to keep the combination of ambient temperature and T-rise from exceeding the maximum operating temperature of 105°C.
- Next are rating factors, a table of multipliers to account for connector loading and for smaller wire sizes (See figure 2). The designer first determines the base current for the ambient conditions of the application; then multiplies this base current by the rating factors to find the current level for the application's loading factor and wire size.

Practical Values

The current-rating method gives designers practical values applicable to their applications. While the specified current levels for a contact may be lower than for other testing methods, they are more practical and simplify the system design process.

"Spec-manship" is replaced by a realistic assessment of the current-carrying capacity of a contact under varying conditions of temperature, connector loading, and wire size.

Specific current-carrying data based on EOL and % loading is available from Tyco Electronics. Please contact your local Tyco Electronics Sales Engineer or call Tyco Electronics.

Connector/Contact Acceptability

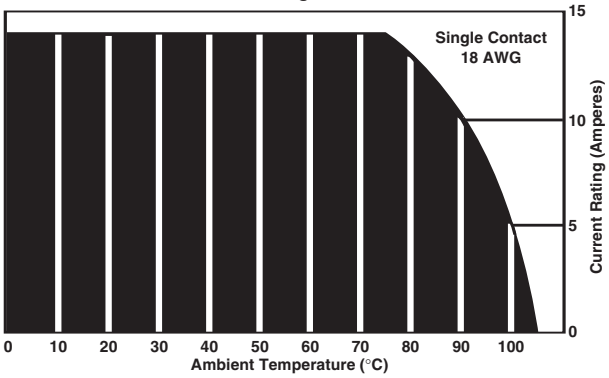
As previously stated, choosing the correct connector/contact combination is fundamental to the successful function of all connectors. The Selector Chart shown at right, is designed to simplify your choice of connectors and their acceptable contacts. Once you have selected the wire size, current-carrying capacity need, number of positions required, and the type of contacts needed in your choice of connector, refer to this matrix for a quick look at exactly what is acceptable in a given connector type.

***Note:** Data is *not* typical of a specific CPC connector configuration. For specific current rating information based on % connector loading, contact Tyco Electronics.

To demonstrate the method of specifying current, consider the following application conditions; an ambient temperature of 65°C, a 50% loading of contacts in the housing, and 20 AWG [0.6mm²] wire.

- From Figure 1, the base current rating is 14 ampere with 18 AWG [0.8mm²] wire.
- Figure 2, the rating factor for 50% loading and 20 AWG [0.6mm²] wire is 0.68.
- The specific rating for this application is the product of the base rating and the rating factor:
  14 x 0.68 = 9.5 ampere
- Each of the contacts can carry 9.5 ampere.
- However, if the ambient temperature is 80°C the allowable T-rise becomes 25°C. The base current must be lowered to 12.8 ampere so that the 105°C maximum operating temperature is not exceeded. The current rating then becomes:
  12.8 x 0.68 = 8.7 ampere.

Figure 1



Graph shows the relationship between base current, ambient temperature, and contact T-rise.

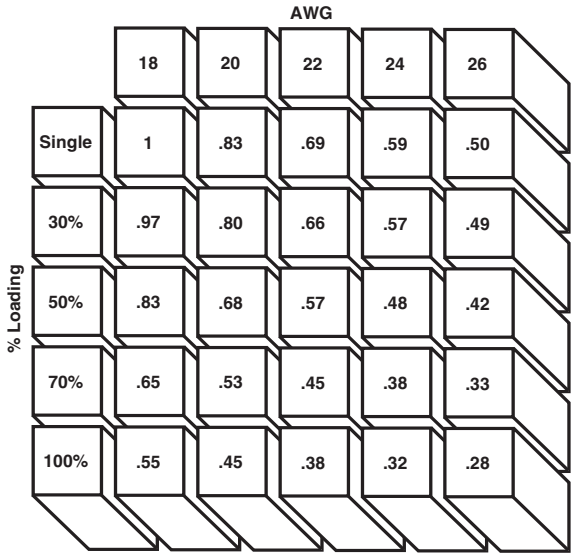


Figure 2

Rating factors allow the base current to be adjusted for various connector loading and wire sizes.

Contact Selector Chart

Connector Type	20 DF	Type I	Type II	Type III+	Posted Type III+	Type XII	Sub-Mini Coax	POWERBAND Contacts
CPC Series 1			✔	✔	✔		✔	
CPC Series 2	✔							
CPC Series 3						✔		
CPC Series 4			✔	✔		✔	✔	
CPC Series 5								✔
CPC Series 6		✔	✔	✔				✔
CPC 5015				✔				
CMC Series 1			✔	✔	✔		✔	
CMC Series 2	✔							
CMC Series 3						✔		
CMC Series 4			✔	✔		✔	✔	

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Dimensions are in inches and millimeters unless otherwise specified. Values in brackets are metric equivalents.

Dimensions are shown for reference purposes only. Specifications subject to change.

USA: 1-800-522-6752
Canada: 1-905-470-4425
Mexico: 52-55-1106-0800
C. America: 57-1-254-4444

South America: 55-11-2103-6000
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