

i NOTE

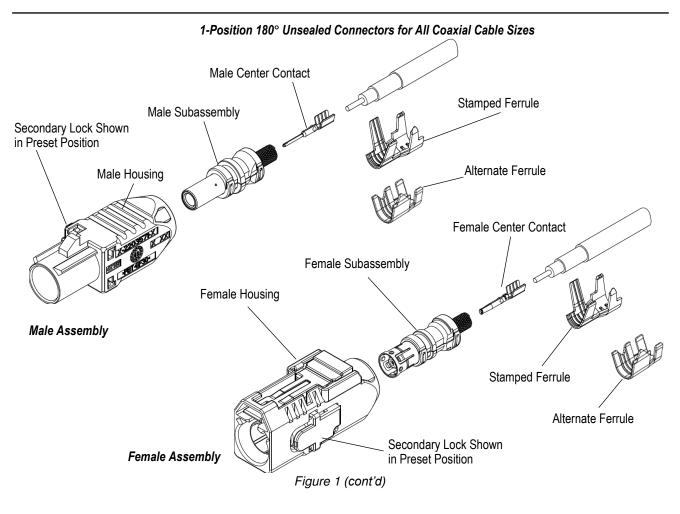
All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters. Unless otherwise specified, dimensions have a tolerance of ± 0.13 and angles have a tolerance of $\pm 2^{\circ}$. Dimensions shown in parenthesis are for reference only. Figures and illustrations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

1. INTRODUCTION

This specification covers the requirements for application of FAKRA Automated In-Line connector system. This connector system is designed for use on automotive RF applications including AM/FM radio, navigation systems, SDARS, video, and other applications. The system accommodates a variety of coax cables, including 1.5D, DACAR 462, RG-58, RG-58 LL (low loss), RG-174, RG-174 LL, RG-316, RTK031, RTK044 and 2DS-PPFW(TA). The connector system consists of a male assembly and a female assembly; available in 1-position, 2-position, and 2-position hybrid FAKRA/power.

Each connector consists of a housing and secondary lock, subassembly, ferrule, and pin contact (for the male assembly) and socket contact (for the female assembly). Each component is available separately or as part of a kit. When assembled, the secondary lock secures the primary lock of the housing. Each connector has a locking feature (male locking tab and female locking latch) to ensure full mating. The female assembly has integral keys, and the male assembly has integral keying ribs. Keying is used for inadvertent mating of similar connector assemblies. These connectors are terminated using hand or automatic machine crimping tools.

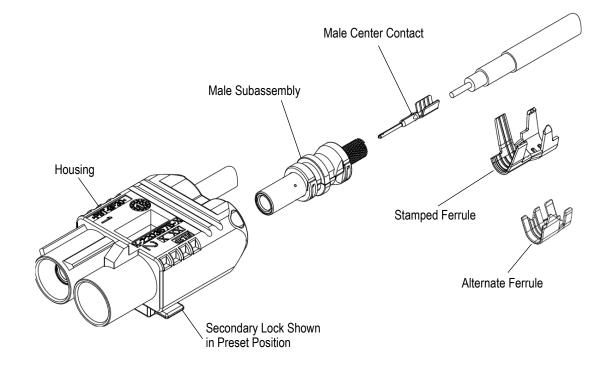
When corresponding with TE Connectivity personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.



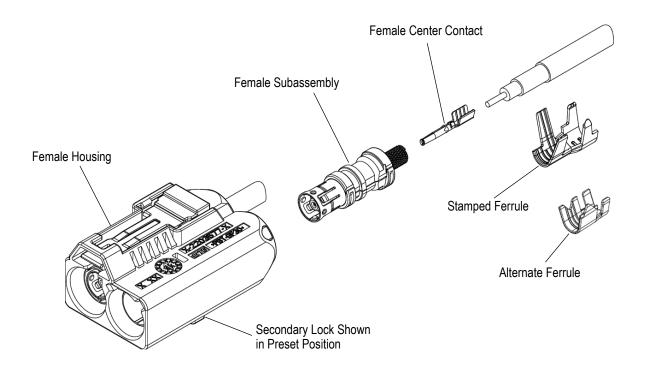
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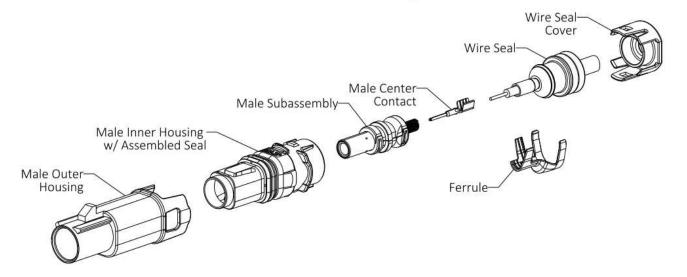


2-Position 180° Unsealed Female Connectors for All Coaxial Cable Sizes

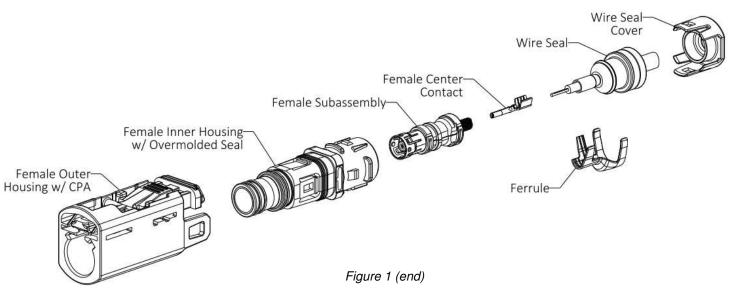








1-Position 180° Sealed Female Connector for All Coaxial Cable Sizes





2. REFERENCE MATERIAL

2.1. Revision Summary

Revision P: Revised Figures 6 and 7.

2.2. Customer Assistance

Reference product base part numbers 2203265, 2203275, 2344360, 2344361, 2439016, 2439018, 2272518, 2272519, 2410913, 2410915, 2272865, 2272870, 2304240, and 2304242 and product code W766 are representative of the FAKRA Automated In-Line connector system. Use of these numbers will identify the product line and help you to obtain product and tooling information when visiting www.te.com or calling the PRODUCT INFORMATION number at the bottom of page 1.

2.3. Customer Drawings

Customer drawings for product part numbers are available from www.te.com. Information contained in the customer drawing takes priority if there is a conflict with this specification or any other technical document provided by TE.

2.4. Specifications

These connectors are compatible with SAE/USCAR-17 (Rev 5) and SAE/USCAR-18 (Rev 4).

2.5. Instructional Material

Instruction sheets (408-series) provide product assembly instructions or tooling setup and operation procedures and customer manuals (409-series) provide machine setup and operating procedures. Documents available that pertain to this product are:

408-7424Checking Terminal Crimp Height or Gaging the Die Closure408-10389Ocean Side-Feed Applicators409-10047AMP 3K* Terminating Machine 1725950-[] and AMP 5K* Terminating Machine 1725900-[]409-10204AMP 3K/40* CE Terminating Machines 2161400-[] and AMP 5K/40* CE Terminating Machines 2161500-[]409-32035AMP-O-LECTRIC* Model G II Terminator 2217000-[]412-108000H-2 Terminator 2014000-[]

3. REQUIREMENTS

3.1. Safety

Do not stack product shipping containers so high that the containers buckle or deform.

3.2. Limitations

NOTE

The connectors are designed to operate in a temperature range of -40 to 125°C [-40 to 257°F].



Temperature rating of the coaxial cable must be considered when determining operating temperature of the connector and cable assembly.

3.3. Storage

A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the product material.

B. Reeled Contacts

When using tape-mounted reeled contacts, care must be taken to prevent stretching, sagging, or other distortion that would prevent smooth feeding of the reeled product through automatic machine feed mechanisms. Store coil wound reels horizontally and traverse wound reels vertically.



C. Shelf Life

The product should remain in the shipping containers until ready for use to prevent deformation to components. The product should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

D. Chemical Exposure

Do not store product near any chemical listed below as they may cause stress corrosion cracking in the material.

Alkalis	Ammonia	Citrates	Phosphates Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur Nitrites	Tartrates

3.4. Cable Preparation

A. Stripping

Proper strip length is necessary to properly apply the cable to the contact. See Figure 2. Center conductor and dielectric strip lengths must be chosen such that the finished product requirements for center conductor extension (a.k.a. "wire brush") and braid strand length are met. See Figures 3 and 5.

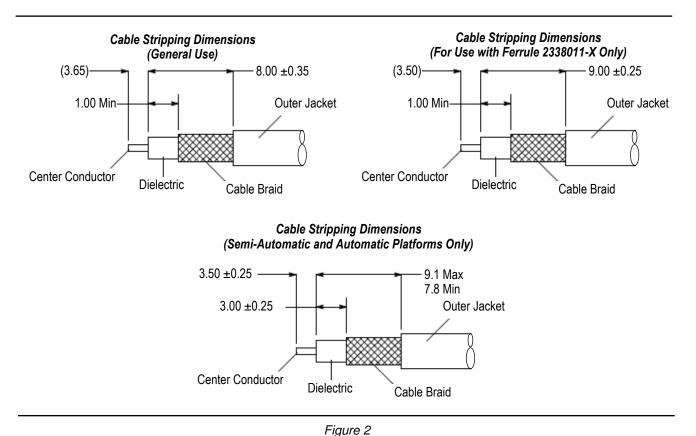


CAUTION

Reasonable care must be taken not to nick, scrape, or cut any strands during the stripping operation.

B. Flaring

The cable braid and foil (where applicable) must be flared.



The general use cable stripping dimensions are intended for all processes where a human operator presents the cable to the equipment for stripping, crimping, etc. Some automated lead-making platforms handle cable braid and foil differently, leading to differences in finished dimensions of terminated cable. In these applications, the semi-automatic/automatic cable stripping dimensions are to be used. Consult product engineering if there are questions regarding the correct stripping dimensions.

NOTE



3.5. Crimped Contact

Crimp the contact onto center conductor of cable (see Figure 3). Refer to instructions packaged with crimp tooling for appropriate procedures.

A. Wire Barrel Crimp

The crimp applied to the wire barrel is the most compressed area and is most critical in ensuring optimum electrical and mechanical performance of the crimped contact. The <u>contact wire barrel crimp height</u> must be within the dimension provided in Figure 3.

B. Effective Crimp Length

For optimum crimp effectiveness, the crimp must be within the area shown in Figure 3. Effective crimp length shall be defined as that portion of the wire barrel, excluding bell-mouth(s), fully formed by the crimping tool. Instructions for adjusting, repairing, and inspecting tools are packaged with the tools.

C. Bell-mouths

Front and rear bell-mouths shall conform to the dimensions given in Figure 3.

D. Cutoff Tab

The cutoff tab shall be cut to the dimensions shown in Figure 3.

E. Burr

The cutoff burr shall not exceed the dimensions shown in Figure 3.

F. Wire Barrel Flash

The wire barrel flash shall not exceed the dimensions shown in Figure 3.

G. Conductor Extension

The conductor must extend beyond the wire barrel, but less than the maximum shown in Figure 3.

H. Wire Barrel Seam

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

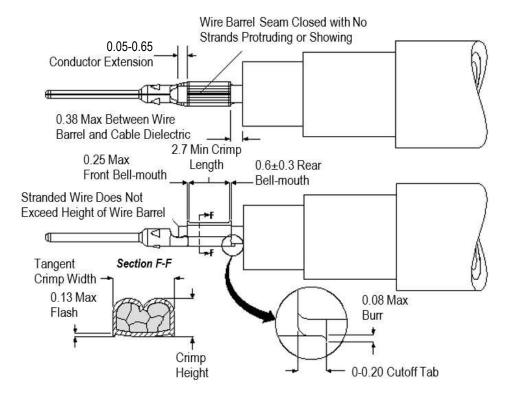
I. Twist and Roll

There shall be no twist, roll, deformation, or other damage to the mating portion of the crimped contact that will impair usage of the contact.

J. Crimp Retention

Crimp retention must meet the MIN Tensile values specified in Figure 3.





			CABLE SIZE		CONTACT WIRE BARREL ("F" CRIMP)		
MALE CENTER CONTACT PART NO.	PRIMARY FEMALE CENTER CONTACT PART NO.	ALTERNATE FEMALE CENTER CONTACT PART NO.		APPLICATOR	CRIMP HEIGHT	TANGET CRIMP WIDTH (Ref)	MIN TENSILE (N)
		2-2203270-3	1.5DS- QFB(TA)	2266046-[]	0.73±0.03	(1.067)	27
			RG-174		0.72±0.03		
2203260-4	2203270-4		RG-174 LL Dacar 108		0.69±0.03		
			RG-316		0.72±0.03		
			DACAR 462	2836529-[]	0.71±0.02		
	2203270-8	2-2203270-6	2DS- PPFW(TA)	2266048-[]	0.84±0.03	(1.270)	50
			GG RTK044		0.92 ±0.03		
2203260-8			RTK031		0.84±0.03		
			RTK031 G&G		0.84±0.03		
			DACAR 302 DACAR 302-4		0.84±0.03		
1-2203260-7	1-2203270-7	-	DACAR 037	2266040 []	1.04±0.03	(4.007)	90
1-2203260-9	1-2203270-9	3-2203270-2	RG-58 LL	2266049-[]	0.96±0.03	(1.397)	90



K. Straightness

The force applied during crimping may cause some bending between the crimped wire barrel and the mating portion of the contact or between the crimped wire barrel and the cable dielectric. Such deformation is acceptable within the limits provided in Figure 4.

1. The side-to-side bend of the contact may not exceed the limits provided.

2. The up and down bend of the crimped contact, including cutoff tab and burr, shall not be bent above or below the datum line more than the amount given.

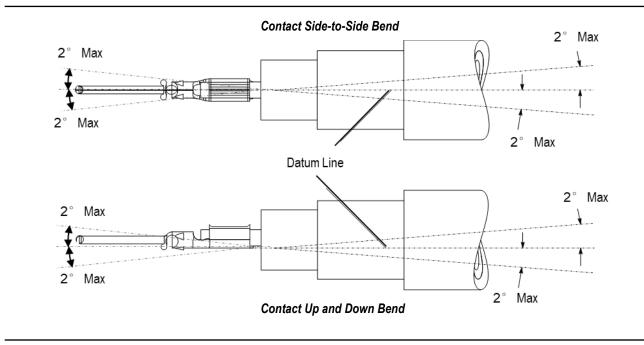


Figure 4



NOTE

Periodic inspections must be made to ensure crimped contact formation is consistent, and statistical analysis is strongly recommended.



NOTE

All connector-level qualification testing has been completed with the specific cables listed in the appendix (Figure 13). The use of other cables may need to be qualified independently.



NOTE

Tangent crimp widths are reference because they are controlled by the applicator.



NOTE

All features listed in this section (3.5 Crimped Contact) are considered critical and must be reviewed before the release of a process and/or crimp tool. Periodic inspections (on attributes) and statistical analysis (when applicable) must also be made.



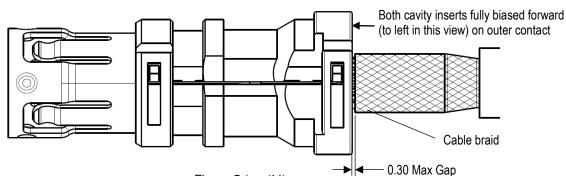
3.6. Contact Assembled to Connector Subassembly

After the contact is crimped onto the cable center conductor, the cable braid must be flared outward away from the coaxial cable dielectric. The contact must be pushed into the cable end of the connector subassembly. The contact must be inserted over the dielectric detent feature. For manual processes, the braid strip must fall within the dimension in Figure 5 when the cavity inserts are located completely forward on the outer contact.



NOTE

When the cable incorporates a foil wrap, it must ideally be flared outward and crimped with the braid, however, it can be trimmed to jacket strip length if necessary.





NOTE

Figure 5 (cont'd)

When assembling female socket into connector subassembly, visually inspect the mating end of the subassembly to ensure that both beams are visible but neither socket beam is within a 0.1 mm diameter centered on the dielectric opening. Visual representations of beam locations are shown in Figure 5.



NOTE: Excessive contact bending during female center contact crimping (see Section 3.5.K) can cause only one beam to be visible and/or one beam to interfere with the 0.1 mm diameter free zone. In this case, the crimped cable may be recovered by correcting this condition in a manual process after rotating the subassembly while holding the cable steady until both beams become visible (prior to ferrule crimping).

NOTE: Section 3.6 is considered critical. 100% EOL inspection on all features specified in Figure 5 must be made.

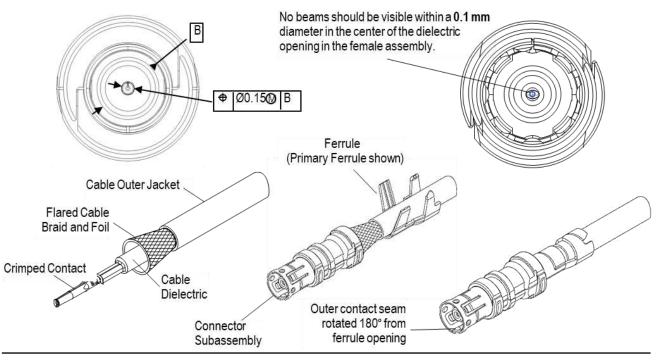


Figure 5 (end)



3.7. Crimped Ferrule

The ferrule must be crimped to the cable braid and connector subassembly according to the instructions packaged with the applicable tooling. The crimped ferrule must meet the following requirements, as well as Workmanship Standard 101-32103 and 101-160042 (Sealed Only).

A. Braid Distribution

The braid and foil must be evenly distributed over the tail end of the subassembly.

B. Ferrule Position

The ferrule must be positioned over the braid and bottomed against the shoulder of the subassembly. Apply a gentle forward force to the cable assembly during crimping to keep the subassembly and center contact in the correct position during the crimping operation. A gap is allowed between the ferrule and shell not exceeding the dimension given in Figure 6, Detail A.

C. Crimp Height

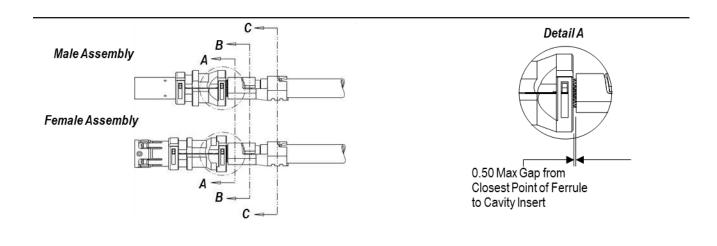
The ferrule crimp is critical to optimum performance of the terminated connector. The spring-back of the ferrule, braid, and outer contact prevents an accurate direct measurement of the crimp height; however, crimping a piece of solder wire (50Sn/50Pb) with a diameter slightly larger than the ferrule inside diameter can verify proper termination. The recommended solder size is dependent upon the applicator and is specified in Figures 6 and 7. The crimped solder height can be checked with a crimp height micrometer or comparator per instruction sheet 408-7424. The measurements must be within the dimensions in Figures 6 and 7 and made in the area of the solder that correlates with the correct section (A, B, or C).

D. Outer Contact Seam

The seam of the outer contact must be rotated 180° (±15°) from the opening of the ferrule.

E. Crimp Retention

Ferrule crimp must withstand an axial pull-out force of 110N MIN (all cable types).





								FERRULE	CRIMP			
PRIMARY	PRIMARY		ALTERNATE		BRAID					JACKET		
FERRULE APPLICATO PART NO. R PART NO.	FERRULE PART NO. (See Note)	APPLICATOR PART NO.	CABLE SIZE	SOLDER	SECTI	ON A	SECT	ION B	SOLDER	SECTI	ON C	
		(See Note)		DIA. (Ref.)	HEIGHT (±0.03)	WIDTH (Ref.)	HEIGHT (Ref.)	WIDTH (Ref.)	DIA. (Ref.)	HEIGHT (±0.05)	WIDTH (Ref.)	
		2272584-9		1.5DS-QFB(TA)	FB(TA)			(3.00)			3.76	
				DACAR 462		2.75		(2.90)			3.46	(3.56)
				RG-174		2.75		(2.90)		(4.76)	3.46	
2203259-2		2266170-[] 1-2272584-1 2836180-[] RG-174 LL Dacar 108 (3.18) 2.75 RG-174 Antenna 2.87	2836180-[]	-	(3.18)	2.75	(2.79)		(2.92)		3.46	
				(3.04)			3.60					
				RG-316	2.75	2.75		(2.90)			3.46	
	2338011-2/ 2837713-[]	3-[] 2272584-8	3 2836181-[]	RTK031	(4.76) 3.93 3.90	2.02				4.30		
2338011-2/				GG CoSpeed 5031		5.95	(4.20)	N/A	N/A	(4.76)	4.50	(4.45)
2338011-5*	2001110[]	22120010	2000101 []	DACAR 302 DACAR 302-4		3.90	(1.20)				4.27	(1.10)
2338011-1/ 2338011-4*	2837927-[]	N/A	N/A	Shikoku 2DS-PPFW(TA) G&G 2DS-PPFW (TA)	(6.35)	4.53	(4.80)	N/A	N/A	(6.35)	4.90	(5.30)
2338011-3/ 2338011-6*	2837908-[]	N/A	N/A	GG RTK044	(5.10)	4.30	(4.55)	N/A	N/A	(5.45)	5.03	(4.80)
2338011-1	2837325_[1	1837325-[] N/A N/A	N/A	RG-58 LL or DACAR 037 Male		4.93	- (5.30) N	N/A	N/A N/A	(6.35) -	5.83	(6.47)
2338011-4*	2338011-4*		RG-58 LL 0	RG-58 LL or DACAR 037 Female	(0.33)	(6.35) 5.02		IN/A			5.92	(0.47)

Figure 6 – Unsealed Applications (* ferrule P/N is with 20mm pitch, P/N without * is with 30mm pitch)

			FERRULE CRIMP							
					SEAL					
FERRULE PART NO.	APPLICATOR PART NO.	CABLE SIZE	SOLDER SECTION A		ION A	DN A SECTION B		SECTION C		
			DIA. (Ref.)	HEIGHT (±0.03)	WIDTH (Ref.)	HEIGHT (Ref.)	WIDTH (Ref.)	DIAMETER (REF)		
	2272633-2 2836525-[]	DACAR 462	(3.18)	2.70	(2.79)	(2.85)	(2.92)			
2222633.2		RG-174		2.70		(2.85)				
2212033-2		RG-174 LL / Dacar 108		2.70		(2.85)				
		RG-316		2.65		(2.80)		6.85		
2272633-3	2026526 [1	RTK031	(4.76)	3.36	(3.61)	(3.36)	(3.61)	0.05		
2212033-3	2272633-3 2836526-[]	DACAR 302		3.36		(3.36)				
2272633-4	2026527 []	DACAR 037	(4.70)	4.25	(4.40)	(4.25)	(4.40)			
2272633-4 2836537-[]		RG-58 LL	(4.76)	4.25	(4.40)	(4.25)	(4.40)			

Figure 7 – Sealed Applications



NOTE

Alternate ferrules and applicators have not been validated. Crimp height and width may vary.



NOTE

NOTE

All connector-level qualification testing has been completed with the specific cables listed in the appendix (Figure 13). The use of other cables may need to be qualified independently.



Using ferrules of different pitch size (per Figure 6) may require minor setup adjustments in the crimp applicator (Terminal Feeding).

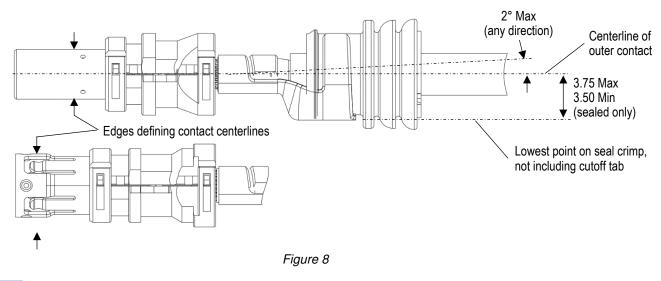
F. Straightness

The crimping process may cause some bending in the ferrule between the subassembly components, braid crimp, and seal crimp (sealed connectors) or insulation crimp sections (unsealed connectors).

- 1. The bend of the male or female subassembly must not exceed the angle provided in Figure 8.
- 2. The offset between braid crimp and seal crimp must not exceed the limits provided in Figure 8 (sealed connectors only).

i NOTE

All features listed in Section 3.7 (Ferrule Crimp) are considered critical and must be reviewed before the release of a process and/or crimp tool. Periodic inspections (on attributes) and statistical analysis (when applicable) must also be made.





NOTE

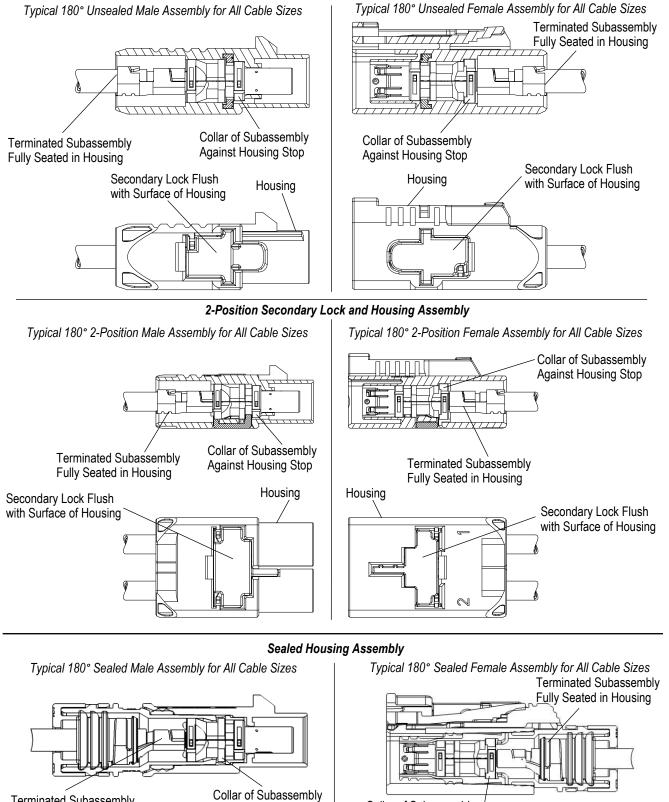
Periodic inspections must be made to ensure crimped contact formation is consistent.

3.8. Secondary Lock and Housing Assembly

The terminated connector subassembly must be installed into the housing, and the secondary lock must be seated into the housing. The assembled connector must meet the following requirements. See Figure 9.

- The terminated subassembly must be fully seated in the housing.
- The primary lock of the housing must produce an audible click upon full insertion of the terminated subassembly.
- The collar of the subassembly must bottom on the stop in the housing.
- The connector housing must cover the crimped ferrule 2203259-[] or 2272584-[] when the terminated subassembly is fully inserted. The connector housing may not completely cover the crimped ferrule 2338011-[] when the terminated subassembly is fully inserted.
- For dual connectors, it is recommended to load both positions and insert the lock in one assembly
 process.





Unsealed 1-Position Secondary Lock and Housing Assembly

Collar of Subassembly Against Housing Stop



Against Housing Stop

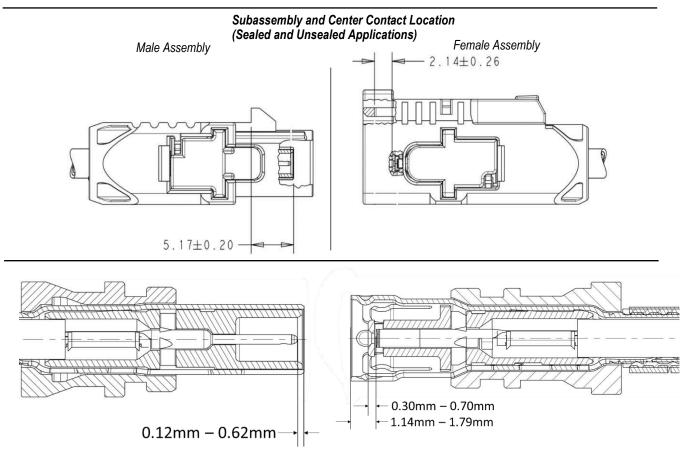
Terminated Subassembly

Fully Seated in Housing



3.9. Subassembly and Center Contact Location

Once the terminated subassemblies have been installed into the housing assembly the subassembly and center contact location must meet the following criteria. Socket/ Pin depth is considered a critical characteristic.





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NOTE

Two depth dimensions are provided in Figure 10 for the Female connector for informational purposes only, so one of them can be selected based in the gage design (to tip of the shell OR tip of the dielectric). Both provide the exact same function-related boundaries for socket contact depth.

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L	-	

NOTE

Contact depth on female connectors in Figure 10 is shown to the tip of the tulip in the socket contact, and the dielectric design with a front wall may make the tip inaccessible for gaging, leading to a slightly deeper first-touch point inside the tulip section. An additional +0.10mm can be added to either specification for gage design and/or setup purposes.



NOTE

100% Contact depth in-process inspections are strongly recommended.

3.10. Keying

Keying prevents inadvertent mating of similar assemblies. The keying rib position (male assembly) must be compatible with the key position (female assembly). The quantity and position of the keying combinations varies. Keying information is defined on the customer drawing for the specific connector.



3.11. Mating Connectors

After mating, the female assembly locking latch must be latched and fully seated on the male assembly locking tab.

3.12. Cable Routing and Strain Relief

When bending or forming cable, the cable bundle must be held at least 6.35 mm beyond the back of the housing before bending in any direction. If the installation is to be subject to bending forces, strain relief should be provided on the cable bundle approximately 25.4 mm from the back of the housing. If harness tape is applied to the cable, it should be kept at least 65mm from the back of the housing.



CAUTION

Unsupported cable must NOT be bent as this may cause strain on the contact inside the subassembly.



CAUTION

To ensure optimum performance, routing of cable and/or the strain relief must not bias or reduce the float of the subassembly inside the housing.

3.13. Repair and Replacement

These connector components are not repairable. Any damaged components must be replaced. Terminated contacts, ferrules, or subassemblies must NOT be re-used by removing the cable. Housings and retainers already assembled must NOT be reused.

4. QUALIFICATION

FAKRA Automated In-Line connectors are not required to be agency evaluated and tested.

5. TOOLING

The center contacts and ferrules can be terminated to the cable using semi-automatic or automatic crimping tools. Recommended tooling is provided in Figure 9.



NOTE

Machines for a variety of application requirements are available. For assistance in setting up prototype and production line equipment, contact your local TE Representative or call the PRODUCT INFORMATION number at the bottom of page 1.

5.1. Applicator

Applicators are designed for the full cable size range of strip-fed, precision formed contacts, and provide for high volume, heavy duty, and production requirements. The applicators can be used in bench or floor model power units.



NOTE

Some changes may have to be made to the applicators to run in all related power units. Contact the PRODUCT INFORMATION number at the bottom of page 1 for specific changes.



5.2. Power Unit

A power unit is an automatic or semi-automatic device used to assist in the application of a product. The power unit includes the source used to supply the force or power to an applicator.

		APPLICATO			
CABLE SIZE	CENTER CONTACT	PRIMARY FERRULE (UNSEALED)	ALTERNATE FERRULE (UNSEALED)	SEALED FERRULE	POWER UNIT (DOCUMENT)
1.5DS, DACAR 462, RG-316, RG-174, RG-174 LL, Dacar 108	2266046-[]	2266170-[]	2836180-[]	2836525-[]	1725900-[] (409-10047)
RTK031	2266049 [1	2837927-[]	2836181-[]	2836526-[]	1725950-[] (409-10047) 2014000-[] (412-108000)
2DS-PPFW(TA)	2266048-[]		2836182-[]		2161400-[] (409-10204)
G&G RTK044 2266048-[]		2837908-[]			2161500-[] (409-10204) 2217000-[] (409-32035)
RG-58, RG-58 LL	2266049-[]	2837325-[]		2836537-[]	

Figure 11 (cont'd)



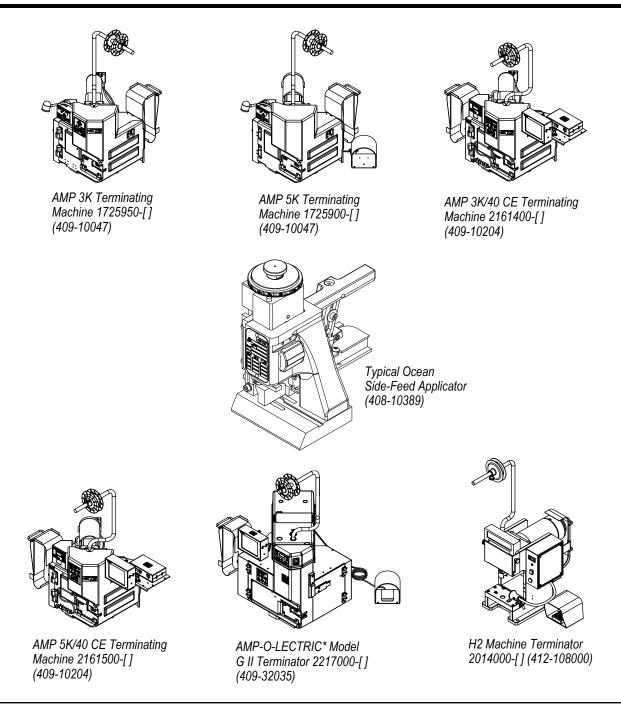


Figure 11 (end)



6. VISUAL AID

The illustration below shows a typical application of this product. This illustration should be used by production personnel to ensure a correctly applied product. Applications which do not appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

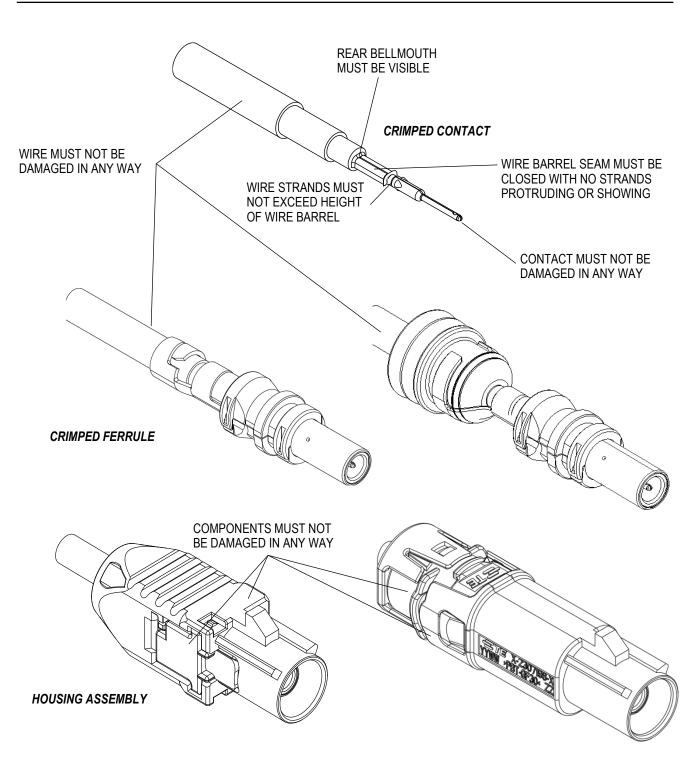


Figure 12 (cont'd)



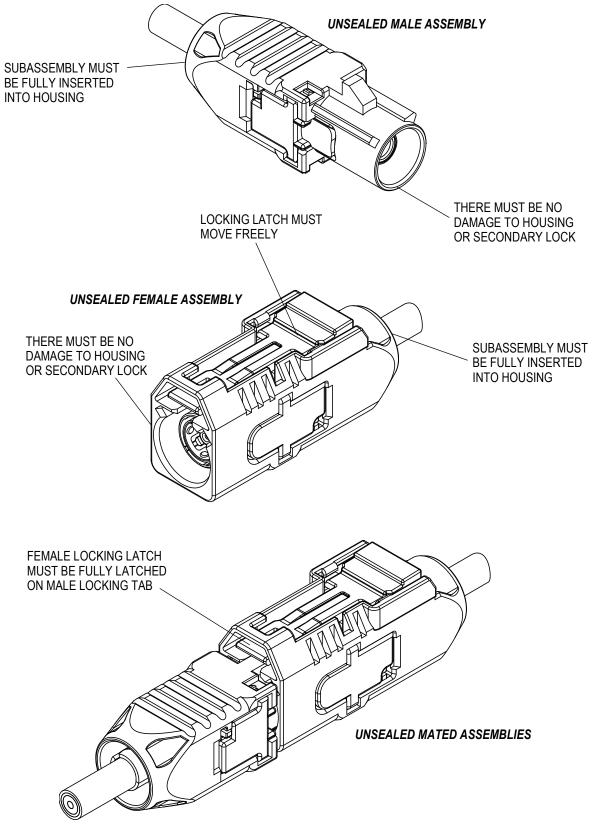


Figure 12 (cont'd)



SUBASSEMBLY MUST-BE FULLY INSERTED CALENCE AND INTO INNER HOUSING in 1 INNER HOUSING MUST-BE FULLY INSERTED INTO OUTER HOUSING SEALED FEMALE ASSEMBLY CPA MUST BE IN PRESET POSITION LOCKING LATCH-MUST MOVE FREELY THE S B б -SUBASSEMBLY MUST BE FULLY INSERTED INTO INNER HOUSING -INNER HOUSING MUST BE FULLY INSERTED INTO OUTER HOUSING -CPA MUST BE FULLY SEATED SEALED MATED ASSEMBLY FEMALE LOCKING LATCH-MUST BE FULLY LATCHED ON MALE LOCKING TAB ß C In the set Figure 12 (cont'd)

SEALED MALE ASSEMBLY



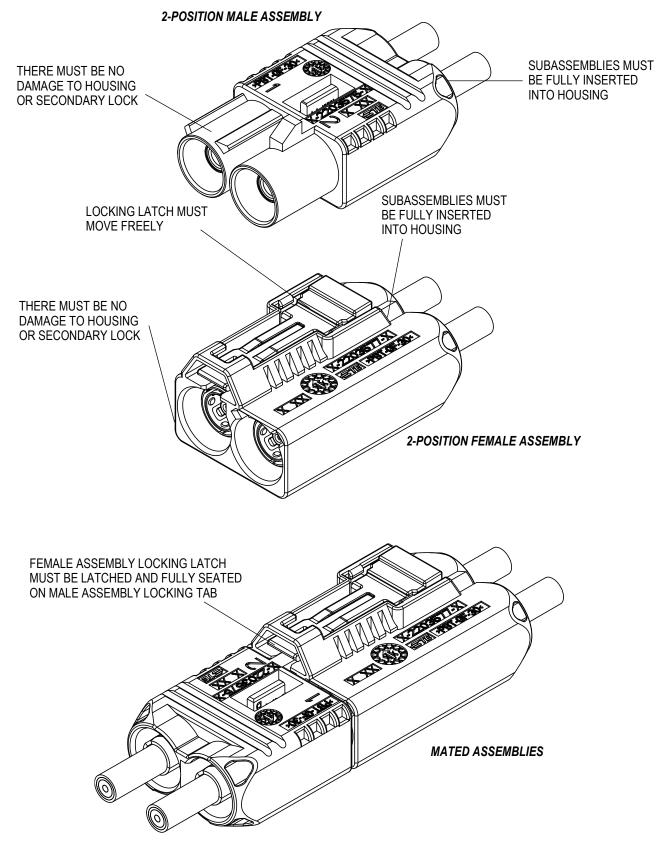


Figure 12 (cont'd)



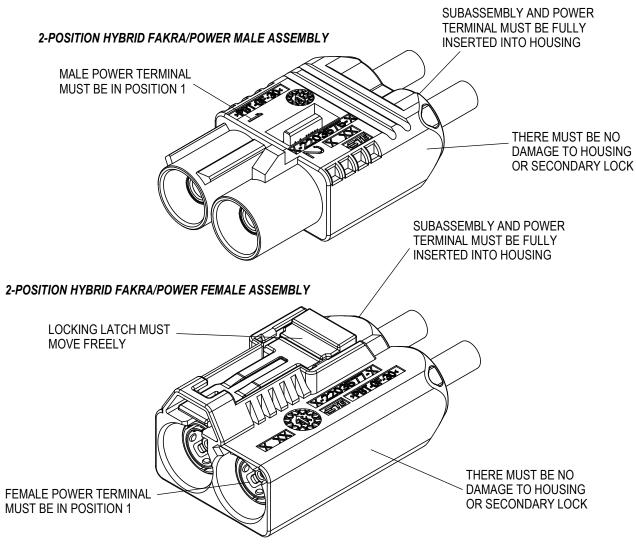


Figure 12 (end)



7. APPENDIX

GENERIC CABLE DESCRIPTION	MANUFACTURER	MANUFACTURER PN OR SPECIFICATION	TE PN
1.5DS-QFB(TA)	Shikoku	E10112601C	1832844-1
RG-174	Condumex	800323-49	1557491-1
RG-174 LL	Condumex	800289-49	1557475-1
Dacar 108	Leoni	85D00066	2477622-1
RG-174 Antenna	Condumex	800320-49	2319470-1
RG-316	Harbour Industries	M17/113-RG316	
DACAR 462	LEONI	850000E	
2DS-PPFW(TA)	Shikoku	E13120501A	1557701-2
RTK031	Condumex	FL09YHBCYW KX-50	
DACAR 302	LEONI	85120380D	
DACAR 302-4	LEONI	85120420H	956339-4
DACAR 037	LEONI	85120030D	
RG-58 LL	Belden	AG50847	
RG-58 LL	Condumex	800315-49	1557489-1
2DS-PPFW(TA)	G&G	150773	1557701-3
RTK044	G&G	157270	2371807-1
RTK044	G&G	172768	
RTK044	G&G	173465	2446356-1
RTK031	G&G	CoSpeed 5031 (PN: 140262)	956339-1

Figure 13

8. REVISION HISTORY

REVISION LEVEL	CHANGE DESCRIPTION						
V	CORRECTING TENSILE THRESHOLD FOR RTK031 CENTER CONTACTS / ADDING RTK044						
	VERSIONS WITH 0.87MM CONDUCTOR IN APPENDIX 7 / WELD CONTACTS & NEW LATCH						
	HOUSINGS ADDED TO SECTION 2.2 / ADDING CABLE TYPES TO 180° UNSEALED PORTION:						
	DACAR 302-4 & GG RTK031						
W	- FOIL TRIMMING ALLOWANCE ADDED IN SECTION 3.6						
	- SEAL CRIMP (SECTION C) MADE REF IN FIGURE 7						
	- UPGRADING NOTES IN SECTION 3.5						
	- UPGRADING FIGURE 10						
Y	- Dacar 108 added						
	- Figure 7 updated for RTK031 cables						