

THERMOCOUPLE CONNECTORS

- *Quick connect/disconnect design*
- *For single or multiple thermocouple applications*
- *Continuous and accurate monitoring of hostile environments where extreme surface or ambient temperatures, gases or liquids must be controlled*



LEUIS00029

The Quality Choice

Thermocouple Connectors

Series S-B

Thermocouples convert thermal energy directly into electrical energy and hence allow for temperature measurement. A thermocouple consists of two wires of different materials which are welded together at one end. Heating the welded junction (measuring point) creates a thermoelectric voltage the magnitude of which is a function of the difference in temperature between the welded junction itself and the free wire legs which are at ambient temperature (reference point). This voltage can be read on a millivoltmeter.

Because of heat conduction and radiation the free wire legs of a thermocouple are mostly at a somewhat higher than ambient temperature. Therefore they have to be lengthened with compensation leads until an appropriate reference point is reached. To avoid additional thermoelectric voltages in the circuit these leads have to be thermoelectrically equivalent to the thermocouple wires.

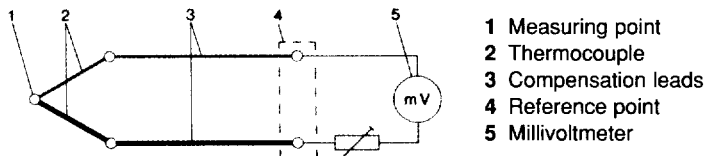
Basic Thermocouple Circuit

A connector joins the compensation lead to the thermocouple.

All pairs of different metals demonstrate the thermoelectric effect. In practice, only certain combinations are used because of their specific characteristics – 1) stability and reproductibility; 2) resistance to corrosion; 3) sensitivity: the potential difference created by a temperature difference of 1°C must be high; 4) cover a wide temperature range. The types of thermocouples most used are the E, J, K, T, R and S types according to ANSI-MC-96-1 (1975) (American National Standard Instrument).

Temperature can be measured with a resistance thermometer as well. It operates on the principle of change in electrical resistance of a metal or semiconductor (thermistor) as a function of temperature. The table lists a resistance material of this kind under the heading L.

Type	Thermocouple Material	Environmental Conditions and Remarks
E	Chromel EP (+) Constantan EN (-)	In vacuum and in inert or oxidizing environment up to 870°C (1600°F) in a protective sheath. Not affected by corrosion when exposed to temperature lower than 0°C (32°F).
J	Iron (magnetic) JP (+) Constantan JN (-)	In vacuum, in inert, oxidizing or reducing environment. Can be used from 0°C to 760°C (32°F to 1400°F) with wires having an OD >3.25 mm in a closed conventional protective sheath. Not to be used at high temperature in hydrogen-containing atmosphere.
K	Chromel KP (+) Alumel KN (-)	For temperatures higher than those which can be measured with an iron-constantan thermocouple. From 0°C to 1260°C (32°F to 2300°F). In oxidizing environment, low resistance in reducing environment.
T	Copper TP (+) Constantan TN (-)	In vacuum and in inert oxidizing or reducing environment. Mostly used for measurement of temperatures lower than 0°C (32°F). From -184°C to 370°C (-300°F to 700°F). Higher resistance to corrosion in moist environment and at lower temperature than type J.
L	Brass (gold-plated) LP Bronze (gold-plated) LN	Temperature measurement with electrical resistance thermometers. From 0°C to 260°C (32°F to 500°F). In inert or oxidizing environment or in hydrogen-containing atmosphere.
R	Copper RP (+) Copper Alloy RN (-)	From 0°C to 1480°C (32°F to 2700°F) with wires having an OD >0.51 mm in a conventional closed protective sheath.
S	Copper RP (+) Copper Alloy RN (-)	Same characteristics as R type.



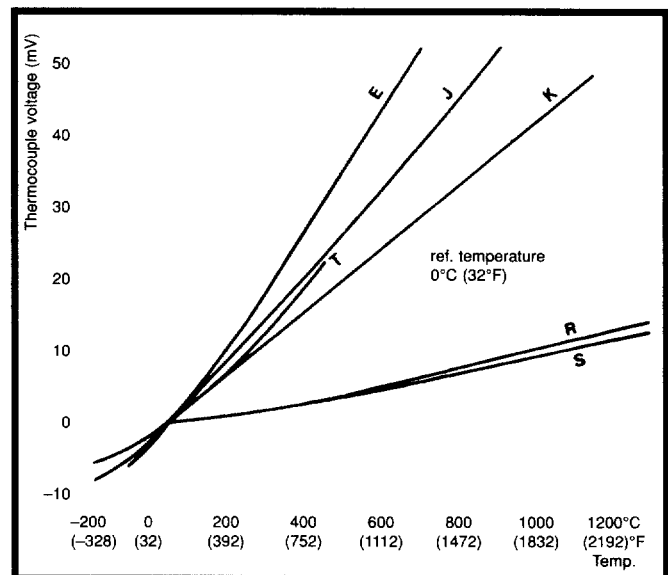
Conductor Diameters According to ANSI-ASTM 586-76

Single Thermocouple

Sheath Ø	Conductor	
	Ø	AWG
0.51	0.10	38
0.81	0.16	34
1.02	0.18	33
1.57	0.32	28
3.17	0.51/0.64	24/22
4.77	0.91	19
6.35	1.29	16
7.90	1.29	16
9.53	1.45	15

Double Thermocouple

Sheath Ø	Conductor	
	Ø	AWG
1.60	0.28	29
3.17	0.57	23
4.77	0.81	20
6.35	0.91	19
7.90	1.02	18



Technical Characteristics

Material and Treatment

Components		Material (Standard)	Surface treatment (µm)			
			Cu	Ni	Cr	Au
Outer shell and collet nut		Brass (ASTM C 385)	0.5	3	0.3	
		Stainless Steel (AISI 303)	no treatment			
Earthing crown		Brass (ASTM C 385)	0.5	3		
		Bronze (ASTM C 544)	0.5	3		
Latching sleeve		Special Brass	0.5	3		
		Stainless Steel (AISI 416)	no treatment			
Locking washer		Bronze (ASTM C 521)	0.5	3		
Hexagonal nut		Brass (ASTM C 385)	0.5	3		
		Stainless Steel (AISI 303)	no treatment			
Insulator		PEEK (MIL-P-46183)				
		PBT (MIL-M-24519)				
Contacts	Type E male and female	Chromel/Constantan	no treatment			
	Type J male and female	Iron/Constantan	no treatment			
	Type K male and female	Chromel/Alumel	no treatment			
	Type T male and female	Copper/Constantan	no treatment			
	Type L male	Brass (ASTM C 385)	0.5	3		1.5
	Type L female	Bronze (ASTM C 544)	0.5	3		2.0

The surface treatment standards are as follows:

– Nickel FS-QQ-N-290A

– Chrome FS-QQ-C-320B

– Gold MIL-G-45204C type I, class 1

Mechanical and Climatical

Characteristics	Value	Standard	Method
Contact retention force	>60N	MIL-STD-1344A	2007.1
Cable retention force ¹⁾	>100N	MIL-STD-1344A	2009.1
Endurance	>1000 cycles	MIL-STD-1344A	2016
Operat. temperature	–55°C + 260°C (–67°F + 500°F)		

1) For models fitted with collet only. Measured with a mineral insulated cable.

1N = 0.102 kg

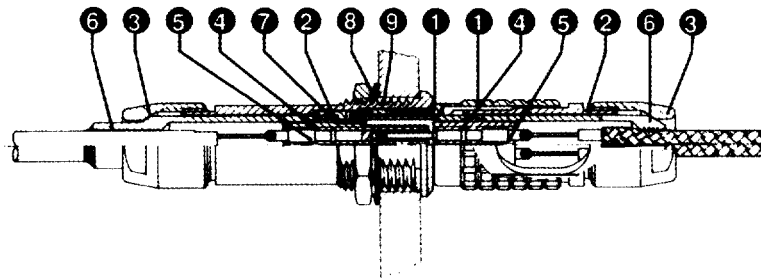
Electrical

Characteristics	Material (Standard)	Value
Contact resistance (IEC 130-1)	Chromel	<33 mΩ
	Alumel	<15 mΩ
	Constantan	<15 mΩ
	Iron	<7.5 mΩ
	Copper	<1.5 mΩ
	Brass (ASTM C 385)	<5 mΩ
Insulation resistance (MIL-STD-1344A/3003.1)	Bronze (ASTM C 544)	<5 mΩ
	PEEK (MIL-P-46175)	>10 ¹² Ω

Part Section Showing Internal Components

Fixed Socket

- ① shell
- ② earthing crown
- ③ collet nut
- ④ insulator
- ⑤ female contact
- ⑥ brazing collet
- ⑦ retaining ring
- ⑧ hexagonal nut
- ⑨ locking washer



Straight Plug

- ① outer shell
- ② latch sleeve
- ③ collet nut
- ④ insulator
- ⑤ male contact
- ⑥ collet

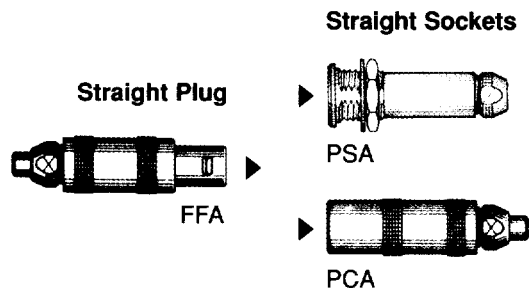
Part Number Example

Model: page 4	Series: page 4	Type: page 5	Housing: C = chrome plated brass S = stainless steel	Collet: page 6	Cable fixing type: page 6	Contact type: page 5	Insulator: L = PEEK N = PBT
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FGG.0B.302.CLEN16 Straight plug with key (G) and cable collet, series 0B, with two type E thermocouple contacts, chrome plated brass housing, PEEK insulator, brazing collet for a mineral insulated cable having a max OD of 1.55 mm.

Series S

Interconnections

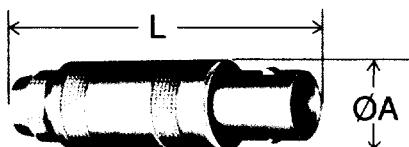


Model Description

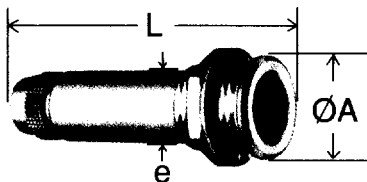
- FFA** Straight plug with cable collet
PCA Free socket with cable collet
PSA Fixed socket, nut fixing, with cable collet

Models

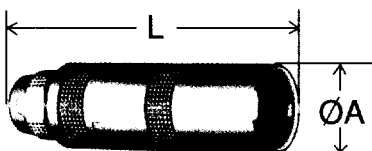
FFA



PSA



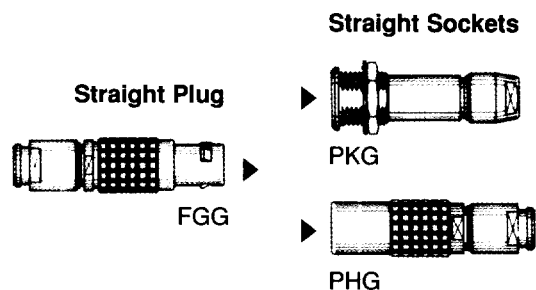
PCA



Model	Dim.	Series		
		0S	1S	2S
FFA	A	9.0	12.0	14.8
	L	34.5	42.5	52.0
PSA	A	10.0	14.0	18.0
	e	M9×0.6	M12×1	M15×1
PCA	L	33.5	40.5	50.0
	A	8.9	11.9	14.8
	L	33.5	40.5	50.0

Series B

Interconnections

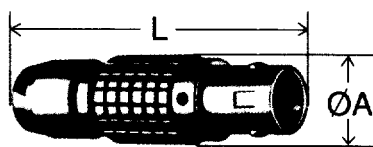


Model Description

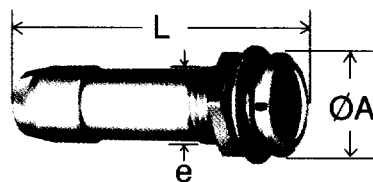
- FGG** Straight plug with key (G) and cable collet
PHG Free socket with key (G) and cable collet
PKG Fixed socket, nut fixing, with key (G) and cable collet

Models

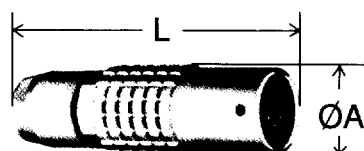
FGG



PKG



PHG



Model	Dim.	Series			
		00	0B	1B	2B
FGG	A	6.4	9.5	12.0	15.0
	L	28.5	40.5	50.0	58.0
PKG	A	8.0	10.0	14.0	18.0
	e	M7×0.5	M9×0.6	M12×1	M15×1
PHG	L	35.5	40.5	47.5	56.0
	A	6.4	9.5	12.5	16.5
	L	27.0	40.5	45.0	51.5

Note: All dimensions are in millimeters.

Types (Series S)



Reference	Series	No. of Pairs	No. of Contacts	Contact Ø	Contact Position	Thermocouple Composition				
						E	J	K	T	L
302	0S	1	2	0.9	1 2	EN EP	JN JP	KN KP	TN TP	LN LP
303		1	3	0.7	1 2 3	EN EN L	JP JN L	KP KN L	TP TN L	LP LN L
902		2	4	0.7	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
302	1S	1	2	1.3	1 2	EN EP	JN JP	KN KP	TN TP	LN LP
303		1	3	0.9	1 2 3	EP EN L	JP JN L	KP KN L	TP TN L	LP LN L
902		2	4	0.9	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
903	2S	3	6	0.7	1-3-5 2-4-6	EP EN	JP JN	KP KN	TP TN	LP LN
302		1	2	1.6	1 2	EN EP	JN JP	KN KP	TN TP	LN LP
303		1	3	1.3	1 2 3	EP EN L	JP JN L	KP KN L	TP TN L	LP LN L
902	2S	2	4	1.3	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
903		3	6	1.3	1-3-5 2-4-6	EP EN	JP JN	KP KN	TP TN	LP LN

For types 303 and 903 the third contact is used to guarantee the ground conductivity and for earthing of parasite currents.

Note: All dimensions are in millimeters.

Types (Series B)



Reference	Series	No. of Pairs	No. of Contacts	Contact Ø	Contact Position	Thermocouple Composition				
						E	J	K	T	L
302	00	1	2	0.5	1 2	—	—	KP KN	—	LP LN
303		1	3	0.5	1 2 3	—	—	KP KN L	—	LP LN L
902		2	4	0.7	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
302	0B	1	2	0.9	1 2	EP EN	JP JN	KP KN	TP TN	LP LN
303		1	3	0.9	1 2 3	EP EN L	JP JN L	KP KN L	TP TN L	LP LN L
902		2	4	0.7	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
302	1B	1	2	1.3	1 2	EP EN	JP JN	KP KN	TP TN	LP LN
303		1	3	1.3	1 2 3	EP EN L	JP JN L	KP KN L	TP TN L	LP LN L
902		2	4	0.9	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
903	2B	3	6	0.7	1-3-5 2-4-6	EP EN	JP JN	KP KN	TP TN	LP LN
302		1	2	2.0	1 2	EP EN	JP JN	KP KN	TP TN	LP LN
303		1	3	1.6	1 2 3	EP EN L	JP JN L	KP KN L	TP TN L	LP LN L
902	2B	2	4	1.3	1-3 2-4	EP EN	JP JN	KP KN	TP TN	LP LN
903		3	6	1.3	1-3-5 2-4-6	EP EN	JP JN	KP KN	TP TN	LP LN

Housing

Ref.	Material (Standard)	Note
C	Brass (ASTM C 385)	●
S	St. Steel (AISI 303 or 316L)	○

Insulator

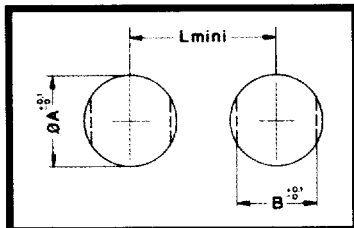
Ref.	Material (Standard)	Note
L	PEEK (MIL-P-46183)	●
N	PBT	●

Contacts

Ref.	Material	Polarity	Note
E	Chromel	EP (+)	○
	Constantan	EN (-)	
J	Iron	JP (+)	○
	Constantan	JN (-)	
K	Chromel	KP (+)	○
	Alumel	KN (-)	
T	Copper	TP (+)	○
	Constantan	TN (-)	
L	Brass	LP	●
	Bronze	LN	
R	Copper	RP (+)	○
	Copper Alloy	RN (-)	

Cut-out and Mounting Nut Torque

Panel Cut-out



Series S

Series	Dimensions			Torque (in-lbs)
	Ø A	B	L	
0S	9.1	8.3	13.5	25
1S	12.1	10.6	17.0	40
2S	15.1	13.6	21.5	60

Series B

Series	Dimensions			Torque (in-lbs)
	Ø A	B	L	
00	7.1	6.5	14.5	18
0B	9.1	8.3	13.5	25
1B	12.1	10.6	17.0	40
2B	15.1	13.6	21.5	60

● Available
○ On request

Note: Longer contact is positive polarity P (+)

1N = 0.102 kg



Collets (Series S)



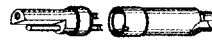
Reference Type	Ø	Series	Cable OD	
			max.	min.
C	17	0S	1.6	1.3
C	22		2.1	1.7
C	27		2.6	2.2
C	32		3.1	2.7
C	37		3.6	3.0
C	42		4.1	3.3
C	44		4.3	3.5
K	47		4.6	3.8
K	52		5.1	4.3
K	57		5.6	4.8
K	62		6.1	5.3
K	66	1S	6.5	5.9
K	68		6.7	6.0
C	17		1.6	1.3
C	22		2.1	1.7
C	27		2.6	2.2
C	32		3.1	2.6
C	37		3.6	2.7
C	42		4.1	3.3
C	47		4.6	3.8
C	52		5.1	4.3
C	57	2S	5.6	4.8
C	62		6.1	5.3
C	66		6.5	5.9
C	68		6.7	6.0
K	72		7.0	6.1
K	77		7.5	7.1
K	82		8.0	7.6
K	87		8.5	8.1
C	17		1.5	1.3
C	27		2.5	1.7
C	32	2S	3.0	2.5
C	42		4.0	3.1
C	52		5.0	4.1
C	62		6.0	5.1
C	72		7.0	6.1
C	77		7.5	7.1
C	82		8.0	7.6
C	87		8.5	8.1
K	92		9.0	8.1
K	97		9.5	9.1
K	10		10.0	9.6
K	11		10.5	10.1



Reference Type	Ø	Series	Cable OD	
			max.	min.
G	03	0S	0.27	0.15
	07		0.60	0.30
	12		1.10	0.70
	17		1.60	1.20
	22		2.10	1.50
	27		2.50	2.00
G	34	1S	3.30	2.50
	42		4.10	3.10
	52		5.00	4.10
	61		6.00	5.20
	22	2S	2.10	1.50
	27		2.50	2.00
G	34		3.30	2.50
	42		4.10	3.10
	52		5.00	4.10
	67		6.50	5.60



Reference Type	Ø	Series	Cable OD
			max.
N	03	0S	0.25
	07		0.65
	12		1.15
	17		1.65
	22		2.15
	27		2.65
N	34	1S	3.35
	42		4.15
	52		5.15
	61		6.05
	22	2S	2.15
	27		2.65
N	34		3.35
	42		4.15
	52		5.15
	67		6.65



Reference Type	Ø	Series	Cable OD
			max.
P	03	0S	0.25
	07		0.65
	12		1.15
	17		1.65
	22		2.15
	27		2.65
P	34	1S	3.35
	42		4.15
	52		5.15
	61		6.05
	22	2S	2.15
	27		2.65
P	34		3.35
	42		4.15
	52		5.15
	67		6.65



Reference Type	Ø	Series	Cable OD
			max.
R	03	0S	0.25
	07		0.65
	12		1.15
	17		1.65
	22		2.15
	27		2.65
R	34	1S	3.35
	42		4.15
	52		5.15
	61		6.05
	22	2S	2.15
	27		2.65
	34		3.35

Collets (Series B)



Reference Type	Ø	Series	Cable OD	
			max.	min.
D	17	00	1.7	1.1
D	22		2.2	1.6
D	27		2.7	2.1
D	30		3.0	2.5
D	35		3.5	2.9
D	21	0B	2.0	1.5
D	25		2.5	2.1
D	31		3.0	2.1
D	35		3.5	3.0
D	42		4.0	3.1
D	52	1B	5.0	4.1
D	56		5.5	5.1
M	27		2.5	2.0
M	31		3.0	2.1
D	42		4.0	3.1
D	52	2B	5.0	4.1
D	62		6.0	5.1
D	72		7.0	6.1
D	76		7.5	7.1
M	21		2.0	1.5
M	31		3.0	2.1
M	42		4.0	3.1
D	52		5.0	4.1
D	62		6.0	5.1
D	72		7.0	6.1
D	82		8.0	7.1
D	92		9.0	8.1
D	99		9.7	9.1



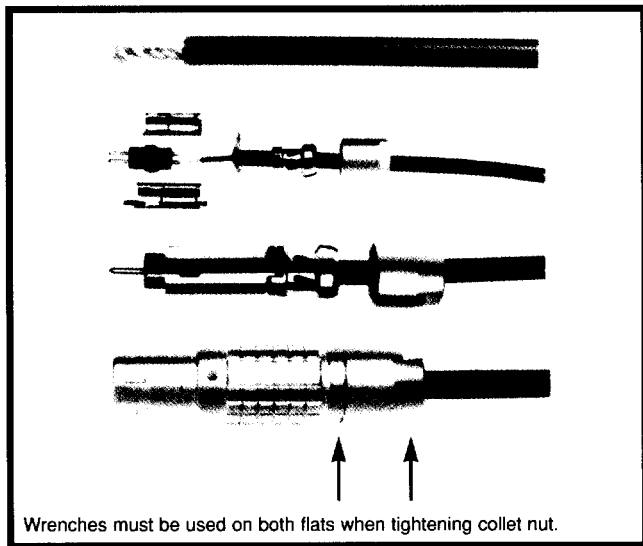
Reference Type	Ø	Series	Cable OD	
			max.	min.
F	21	0B	2.1	1.5
	31		3.0	2.1
	42		4.0	3.1
	52		5.0	4.1
F	27	1B	2.5	2.0
	31		3.0	2.1
	42		4.0	3.1
	52		5.0	4.1
F	62	2B	6.0	5.1
	31		3.0	2.1
	52		5.0	4.1
	72		7.0	6.1
	82		8.0	7.1



Reference Type	Ø	Series	Cable OD
			max.
N	06	0B	0.55
	12		1.15
	16		1.55
	21		2.05
	26		2.55
	33		3.25
N	49	1B	4.85
	21		2.05
	26		2.55
	33		3.25
	49		4.85
	66		6.55
N	33	2B	3.25
	49		4.85
	66		6.55
	81		8.05

Note: Types N, P, and R are for brazing onto mineral insulated cables.

Assembly Instructions

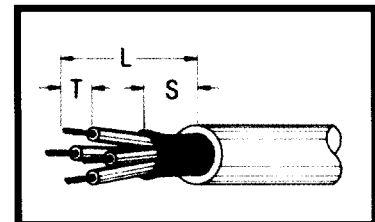


Connector Assembly – B Series

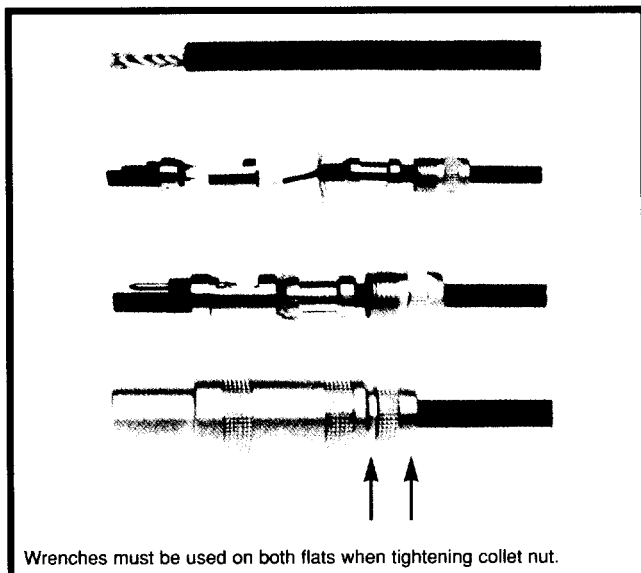
1. Strip cable jacket as shown.
2. Slide collet nut and collet onto cable. If connector shell is to be grounded, fray shielding as shown.
3. Strip conductor insulation to dimension as shown below.
4. Terminate contacts using solder or crimp methods. If solder use lead free solder (Kester® 285). Recommended flux is RMA fluxes. Clean solder joints using isopropyl anhydrous alcohol.
5. Position midpieces on insert as shown making sure that insert key appears through midpiece window.
6. Position collet as shown.
7. Fold and trim shielding over collet flange making sure to keep collet keying slot clear.
8. Install outershell and tighten collet nut to specified torque value, using two wrenches, one to hold the shell and the other to tighten collet nut (see page 8). The use of a removable threadlocker is recommended.

Cable Stripping for Connectors with Solder Contacts

Series	Type	Contact Ø (mm)	Stripping for FGG, PKG, PHG			Collet Nut Torque
			L (mm)	S (mm)	T (mm)	
00	302/303	0.5	7.0	3.8	2.0	2 in-lbs
0B	302/303	0.9	13.0	7.0	3.0	7 in-lbs
	902	0.7	13.0	7.0	3.0	
1B	302/303	1.3	15.0	8.0	3.5	9 in-lbs
	902	0.9	14.0	8.0	3.0	
	903	0.7	14.0	8.0	3.0	
2B	302	2.0	17.0	9.0	4.0	11 in-lbs
	303	1.6	17.0	9.0	3.5	
	902/903	1.3	17.0	9.0	3.5	



S Series – Assembly Instructions



1. Strip cable jacket as shown.
2. Slide collet nut and collet onto cable. If connector shell is to be grounded, fray shielding as shown.
3. Strip conductor insulation to dimension as shown on page 8.
4. Position midpiece on insert as shown. (If split midpieces are used, terminate contacts before positioning midpieces.)
5. Terminate contacts using solder method.
6. Position collet as shown.
7. Fold and trim shielding over collet flange.
8. Install outershell and tighten collet nut to specified torque value.

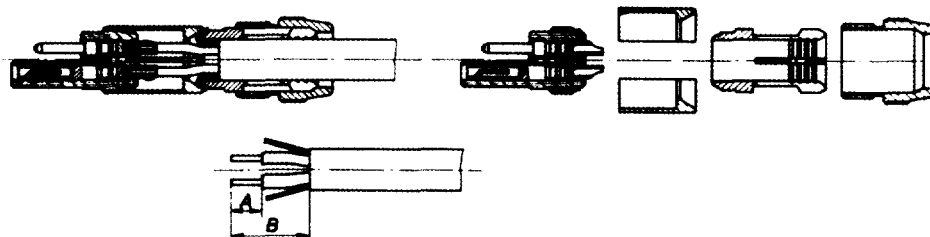
Note: All dimensions are in millimeters.

Cable and Conductor Stripping Dimensions

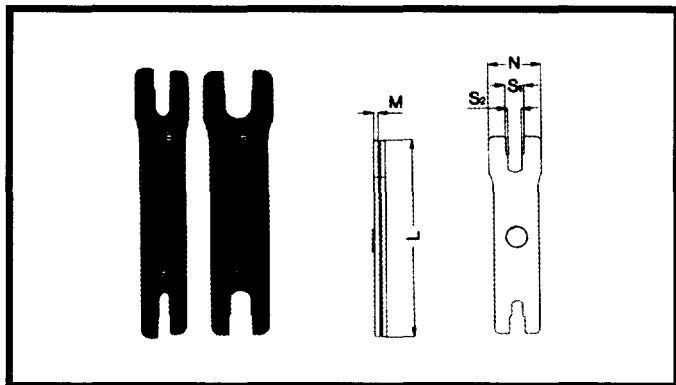
S Series

Multicontact (Shielded Cable)

Size	Dimensions (mm)		
	0S	1S	2S
A	4	4	4
B	9	12	17
Collet	4	7	11
Nut Torque	in-lbs	in-lbs	in-lbs



Accessories

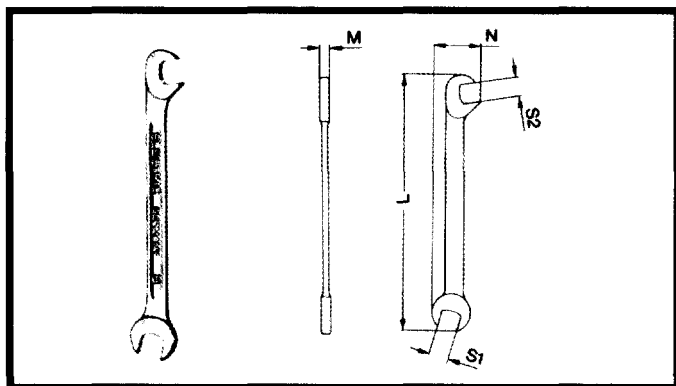


DCP

Wrenches for Tightening Collet Nuts

Part Number	Series	Dimensions (mm)				
		L	M	N	S1	S2
DCP.91.001.TN	0B	95	2.5	21	8.1	7.1
DCP.91.001.TN	1B	95	2.5	25	10.1	9.1
DCP.91.023.TN	2B	115	3.0	30	13.1	12.1

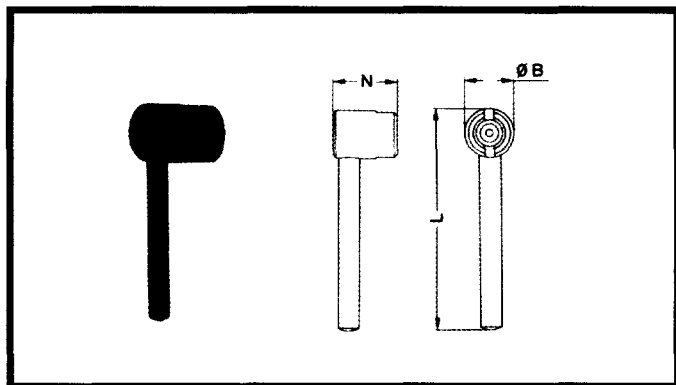
Material: steel blackened



DCP

Wrench for Collet Nuts

Part Number	Series	Dimensions (mm)				
		L	M	N	S1	S2
DCP.99.000.TN	00	68	2.4	10.5	5	5



DCL

Wrench which secures Straight Plug with 2 Latching Tabs while tightening Collet Nut

Part Number	Series	Dimensions (mm)		
		B	L	N
DCL.91.127.0TK	0S	12	47	17
DCL.91.149.0TK	1S	14	52	19

DCN

Wrench which secures Straight Plug with 3 Latching Tabs while tightening Collet Nut

Part Number	Series	Dimensions (mm)		
		B	L	N
DCN.91.171.2TK	2S	17	62.5	20