



Tyco Electronics Corporation  
300 Constitution Drive  
Menlo Park, CA 94025 U.S.A.

**Raychem Devices**

No: **RCPS-200-09**

Rev: C

Date: April 8, 2011

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## **Installation Procedure For Standard Solder Sleeve Wire-Splice Sleeves**

### **1.0 Scope**

This standard covers the installation procedure and inspection requirements for making in-line lap splices and stub splices in wires rated at 125°C minimum using Tyco Electronics/Raychem standard Soldersleeve wire-splice sleeves, series D-110 and D-144. Either hot air or infrared heating can be used to install the parts covered in this document.

### **2.0 References**

#### **2.1 Tyco Electronics/Raychem Instructions:**

- 1) AA-400 Superheater Instructions
- 2) CV-4504 Shop Air Heater Instructions
- 3) CV-5300 Mini-Gun Instructions
- 4) CV-5600 Mini-Gun 2 Instructions
- 5) CV-5700 Mini-Gun 3 Instructions
- 6) TG-500A Heating Tool Instructions
- 7) IR-500 Heating Tool Instructions
- 8) IR-550 Heating Tool Instructions
- 9) AD-1319 Holding Fixture

#### **2.2 Tyco Electronics/Raychem Specification Control Drawings:**

D-110-35	D-110-0181
D-110-41	D-144-12/-15
D-110-54	D-144-29/-32
D-110-55	

#### **WARNING**

Follow installation instructions carefully. Use adequate ventilation and avoid charring or burning during installation. Charring or burning the product will produce fumes that may cause eye, skin, nose and throat irritation. Consult Material Safety Data Sheets **RAY5104** for further information.



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## Installation Procedure For Standard Solder Sleeve Wire-Splice Sleeves

### 3.0 Recommended Tyco Electronics/Raychem Application Equipment

#### 3.1 Fixtures

- 1) AD-1319 Holding Fixture.

#### 3.2 Manual Heating Tools

- |                            |                           |
|----------------------------|---------------------------|
| 1) AA-400 Superheater      | 5) CV-5700 Mini-Gun 3     |
| 2) CV-4504 Shop Air Heater | 6) TG-500A Thermogun      |
| 3) CV-5300 Mini-Gun        | 7) IR-500 Infrared Heater |
| 4) CV-5600 Mini-Gun 2      | 8) IR-550 Infrared Heater |

### 4.0 Splicing Procedure

#### 4.1 General

The following paragraphs give detailed procedures and requirements for splicing two, three, or four wires (total), AWG 30 through 12, stranded or solid, using Soldersleeve wire-splice sleeves.

- If more than two wires enter either end of an immersion-resistant splice sleeve, moisture sealing cannot be assured.
- Conductors are to be pre-tinned as directed in this standard.
- All of the parts listed in this standard can be used to make both inline and stub lap splices. Procedures will differ where noted.

#### 4.2 Size and Type Selection

- 1) Use Table 1 to determine the total CMA (circular mil area) of all the wires to be spliced together in one splice sleeve.

Table 1: Conversion of AWG Size to Circular Mil Area (CMA) and Diameter

AWG	Solid Conductor		7-Strand		19-Strand		37-Strand	
	Diameter mm (inch)	CMA	Diameter mm (inch)	CMA	Diameter mm (inch)	CMA	Diameter mm (inch)	CMA
30	0.25 (0.010)	100	0.30 (0.012)	112	--	--	--	--
28	0.32 (0.0126)	159	0.38 (0.015)	175	--	--	--	--
26	0.40 (0.0159)	253	0.48 (0.019)	278	0.53 (0.021)	304	--	--
24	0.51 (0.020)	404	0.61 (0.024)	448	0.66 (0.026)	475	--	--
22	0.64 (0.025)	640	0.76 (0.030)	700	0.81 (0.032)	754	--	--
20	0.81 (0.032)	1024	0.96 (0.038)	1111	1.04 (0.041)	1216	--	--
18	1.02 (0.040)	1624	1.22 (0.048)	1770	1.53 (0.051)	1900	--	--
16	1.30 (0.051)	2581	1.52 (0.060)	2828	1.45 (0.057)	2426	--	--
14	1.63 (0.064)	4109	1.93 (0.076)	4481	1.83 (0.072)	3831	--	--
12	2.03 (0.080)	6448	--	--	2.31 (0.091)	6088	2.26 (0.089)	5874

Unless otherwise specified dimensions are in millimeters. Inches dimensions are in between brackets.

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### Installation Procedure For Standard SolderSleeve Wire-Splice Sleeves

2) Use Table 2 or 3 to select the proper wire-splice sleeve for the application.

\* These selection tables are based on the amount of solder required to splice the conductors of a certain total cross-sectional area. Unusually thick wire insulation may restrict the choice of sleeves.

Table 2: Selection of Immersion-Resistant Wire-Splice Sleeves

Total CMA of Wires in Splice		Soldersleeve Part Number	
CMA Range for 2 Wires	CMA Range for 3 or 4 Wires	Tin or Silver Plated Wire	Nickel Plated Wire
350 - 2,000	900 - 1,400	D-144-15	D-144-29
2,000 - 4,000	1,400 - 2,800	D-144-12	D-144-30
4,000 - 10,000	2,800 - 9,200	D-144-13	D-144-31
10,000 - 13,000	9,200 - 18,000	D-144-14	D-144-32

\* Immersion resistance not assured if three or more wires exit either end of the sleeve.

Table 3: Selection of Unsealed Wire-Splice Sleeves

Total CMA of Wires in Splice CMA Range, 2 Wires Only	Soldersleeve Part Number Tin or Silver Plated Wire Only
200 - 1,600	D-110-35
1,600 - 4,800	D-110-41
4,800 - 9,000	D-110-54
9,000 - 13,000	D-110-55
3600 - 6000	D-110-0181

#### 4.3 Wire Preparation

1) Strip the wires to the dimensions given in Table 4.

Table 4: Wire Strip Lengths for Solder Sleeve Wire-Splice Sleeves

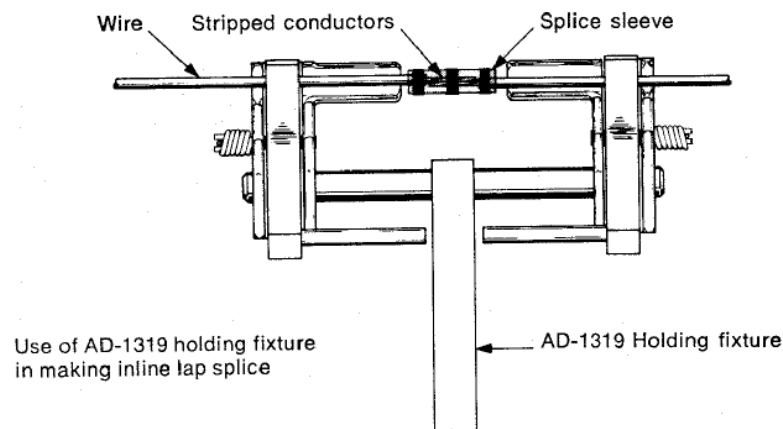
Soldersleeve Part Number	Wire Strip Lengths
D-144 Series	12.70 – 14.22 (0.500 - 0.560)
D-110-35, D-110-41	17.27 – 19.05 (0.680 - 0.750)
D-110-54, D-110-55	22.10 – 25.40 (0.870 - 1.000)
D-110-0181	19.0 – 25.40 (0.750 – 1.000)

### Installation Procedure For Standard Solder Sleeve Wire-Splice Sleeves

- 2) Make sure that the stripped conductors are straight and that stranded conductors are not splayed.
- 3) Tin the stripped conductors to within one wire diameter of the insulation with Sn63 solder.

#### 4.4 Assembly

- 1) Inline splices only: Slip the selected splice sleeve back over the wire(s) coming from one direction.
- 2) Fixture the wires to prevent them from moving while they are heated.
  - Use a holding fixture, such as the Tyco Electronics/Raychem AD-1319.
  - Conductors must be parallel and overlapping each other as shown.
- 3) Make sure that there are no splayed wire strands on the ends of the conductors, which could puncture the heat-shrinkable sleeve during heating.
- 4) Center the sleeve over the area where the conductors overlap.





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#### 4.5 Heating

- 1) Refer to Table 5 to determine the correct heating tool/reflector combination for the splice sleeve being used.

Table 5: Recommended Heating Tools and Reflectors for  
 Soldersleeve Wire-Splice Sleeves

Soldersleeve Part Number	Tool(s)	and	Reflector(s)
	AA-400	+	Solder Sleeve (979646) or Mini Solder Sleeve (979663)
D-110-35	CV-4504	+	Solder Sleeve (991180)
D-110-41	CV-5300	+	MG-1
D-144-12	CV-5600	+	MG-1
D-144-15	CV-5700	+	MG-7
D-144-29	TG-500A	+	TG-14
D-144-30	IR-500	+	RG-2
	IR-550	+	RG-4

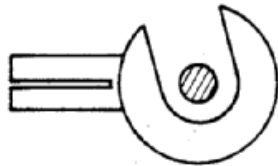
Soldersleeve Part Number	Tool(s)	and	Reflector(s)
D-110-54	CV-5300	+	MG-1
D-110-55	CV-5600	+	MG-1
D-144-13	CV-5700	+	MG-7
D-144-31	TG-500A	+	TG-14
D-110-0181	IR-500	+	RG-2
	IR-550	+	RG-4
D-144-14	TG-500A	+	TG-14A
D-144-32	IR-500	+	RG-2
	IR-550	+	RG-4

### Installation Procedure For Standard Solder Sleeve Wire-Splice Sleeves

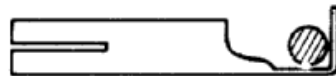
(2) Hold the assembly horizontal so that the sleeve does not slip out of place, and position it within the heating tool reflector according to the diagrams below, and centered laterally.

- Hot-air tools (AA-400 Superheater, CV-5300 Mini-Gun, CV-5600 Mini-Gun 2, CV-5700 Mini-Gun 3, CV-4504 Shop Air Heater, or TG-500A Thermogun) should be allowed to warm up to operating temperature before assembly is inserted. Infrared heaters, such as the IR-500, are turned on only after the product to be heated is in place within the reflector.

AA-400 Superheater



Solder Sleeve reflector

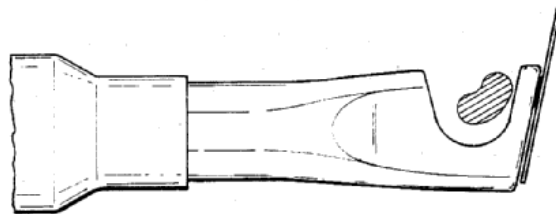


Mini Solder Sleeve reflector

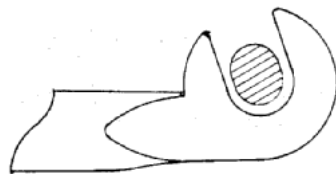
IR-500/IR-550 Infrared Heaters



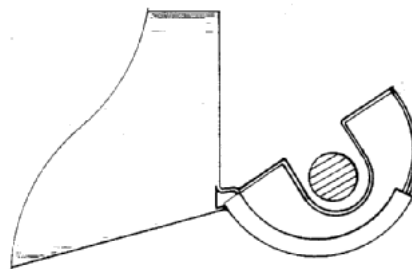
Mini-Guns



CV-4504 Shop Air Heater



Thermogun



## **Installation Procedure For Standard Solder Sleeve Wire-Splice Sleeves**

- 3) Heat the ends of the sleeve to shrink them onto the wire insulation.
- 4) Heat the center of the sleeve until it shrinks and the solder preform melts and flows, forming a fillet between the conductors.
  - The collapse of the solder ring does not indicate solder flow. Continue to apply heat until the solder brightens and flows, forming a solder fillet.
  - It is usually not necessary to rotate the splice assembly within the heating tool reflector.
- 5) Immersion-resistant sleeves only: Reheat the ends of the sleeve until the sealing inserts completely melt and some of the melted material is squeezed out the ends of the sleeve.

### **5.0 Inspection**

#### **5.1 Assembly Inspection**

- 1A) Immersion-resistant wire-splice sleeves only: The sleeve must overlap the wire insulation to a minimum of two wire diameters.
- 1B) Unsealed wire-splice sleeves only: The sleeve must completely cover the stripped conductors, and must overlap the wire insulation so that no uninsulated conductor is visible.

#### **5.2 Heating Inspection**

- 1) The solder preform must be completely melted and flowed, so that its original shape is no longer visible.
  - If the solder preform retains some of its original shape, the splice is underheated.
- 2) The solder must be wetted to the conductors.
- 3) A solder fillet must be visible between the spliced conductors.
- 4) The sleeve must not be discolored to the point where it prevents visual inspection of the solder joint (overheated condition). However, moderate discoloration is not cause for rejection.
- 5) Immersion-resistant sleeves only: The sealing inserts must have melted and flowed around the wire insulation.



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### 5.3 Damage Inspection

- 1) The sleeve must not be cut or split.
- 2) There must be no conductor strands poking through the sleeve.
- 3) The wire must not show any signs of mechanical damage or overheating outside the sleeve (cuts, tears, melting, charring).

## **6.0 Repair**

### 6.1 Repair of Underheated Splices

Reheat underheated splices to obtain proper solder flow (paragraph 4.5).

### 6.2 Repair of Overheated or Damaged Splices

If the wire insulation is not damaged, remove the sleeve as directed in paragraph 6.3, and install a new wire-splice sleeve according to the procedures in Section 4.

- **Stub splices only:** If the solder joint is good according to the inspection criteria in Section 5, and only the insulating sleeve requires replacement, it may be desirable to install a sleeve with the solder preform removed. To remove the solder from a Soldersleeve wire-splice sleeve, squeeze it between two fingers to crush the solder preform.

If the wire insulation is damaged, cut off the damaged portion before installing a new wire-splice sleeve.

### 6.3 Removal Procedure

- 1) Score the sleeve full length with a sharp blade.
  - It is not necessary to cut completely through the wall of the sleeve.
  - Be careful not to cut the wire insulation.
- 2) Heat the sleeve to soften it, and strip off the warm sleeve with pliers or tweezers.
  - Use the same heating tool as for installation.
  - For sleeve removal, it is not necessary to melt the solder.
- 3) If the splice is to be disassembled, heat as directed in paragraph 4.5 to melt the solder.