



**WHA YU INDUSTRIAL CO., LTD. (HEAD OFFICE)**

**TAI HWA ELECTRONIC CO., LTD.(CHINA)**

**SHANGHAI HUA YU ELECTRONIC CO., LTD.(CHINA)**


**SPECIFICATION FOR APPROVAL**

**CUSTOMER:** 中磊科技股份有限公司

**PART NAME:** RF Cable Assembly

**PART NO:** **REVISION:**

**W. Y. P / NO.:** C147-510027-A **REV.:** X1

|                          | <b>MANUFACTURER<br/>SIGNATURE</b>   | <b>CUSTOMER<br/>SIGNATURE</b> |
|--------------------------|---|-------------------------------|
| <b>APPROVED<br/>BY :</b> |  |                               |
| <b>DATE :</b>            | 2003.9.9  |                               |

**WHA YU GROUP**

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# RF Cable Assembly

## Specification

### 1. Electrical Properties :

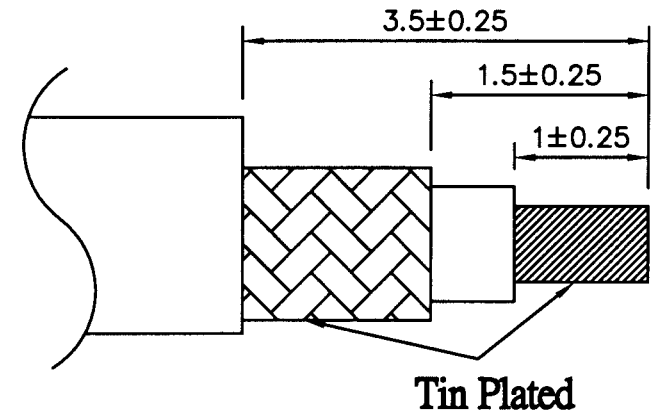
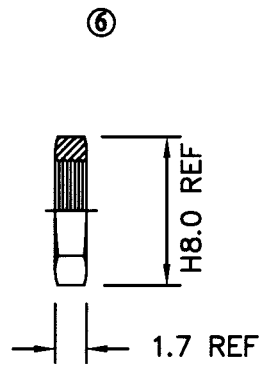
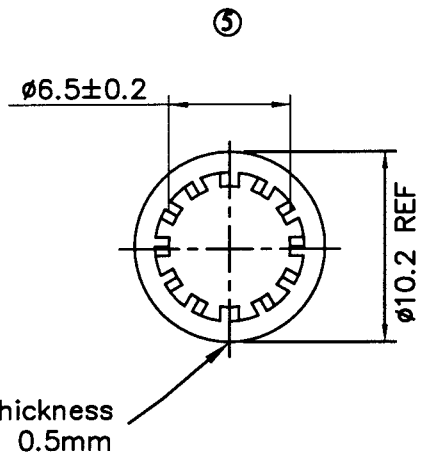
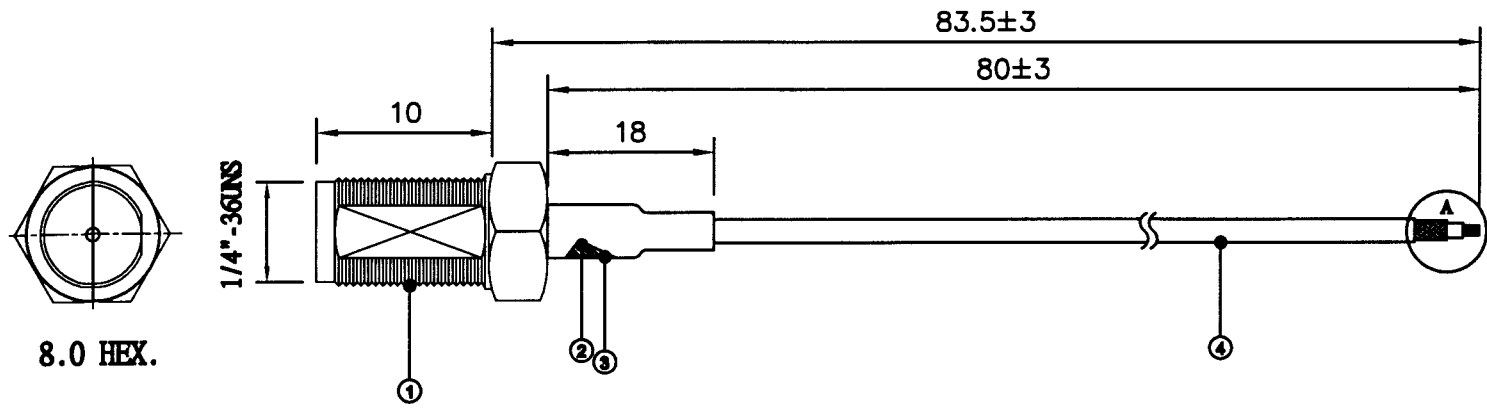
- 1.1 Frequency Rang..... 2.4GHz ~ 2.5GHz
- 1.2 Impedance ..... 50 $\Omega$  Nominal
- 1.3 Insertion Loss..... <1.5 dB

### 2. Physical Properties :

- 2.1 Cable..... RG-178 Coaxial Cable
- 2.2 Operating Temp. .... -20 $^{\circ}$ C ~ +65 $^{\circ}$ C
- 2.3 Storage Temp. .... -30 $^{\circ}$ C ~ +75 $^{\circ}$ C
- 2.4 Connector..... SMA Jack Reverse

CG-xx

| REV | DATE       | DESCRIPTION                |
|-----|------------|----------------------------|
| X1  | 08/13-2003 | New Issue                  |
| X2  | 09/09-2003 | Added Heat Shrink Tube DIM |



| NO | DESCRIPTION | QTY | REMARK                    |
|----|-------------|-----|---------------------------|
| 6  | Nut         | 1   | Brass ; Gold Plated       |
| 5  | Washer      | 1   | Brass ; Gold Plated       |
| 4  | Cable       | 1   | RG-178 Cable              |
| 3  | Tube        | 1   | Heat Shrink Tube          |
| 2  | Crimp Tube  | 1   | Brass ; Gold Plated       |
| 1  | Connector   | 1   | SMA Straight Jack/Reverse |

CUSTOMER'S SIGNATURE

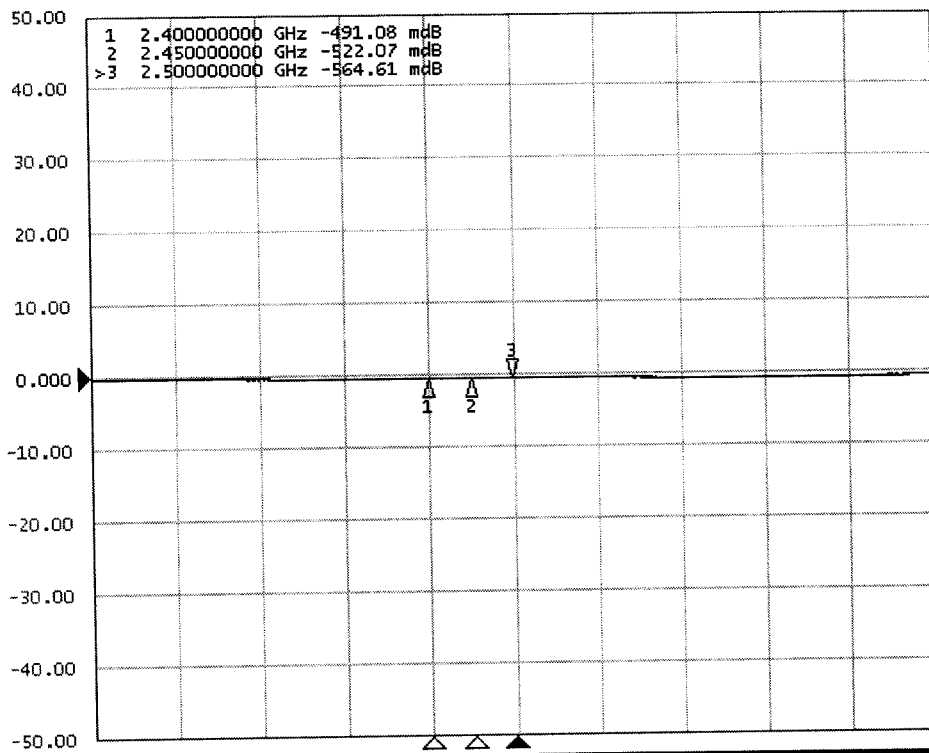
APPROVED  
 Smith 9/9/03  
 CHECKED  
 DRAWING  
 090903

CUSTOMER: 中磊科技股份有限公司  
 PART NO :  
 PARTNAME: RF Cable Assembly  
 W.Y PNO : C147-510027-A  
 REV UNIT FILE : SSR-2015  
 X2 mm SHEET : 1/1

**Wha Yu INDUSTRIAL CO.,LTD.**  
 譚裕實業股份有限公司  
 THIS DRAWING, AND ITS INHERANT DESIGN CONCEPTS, ARE THE PROPERTY OF WHA YU AND AS SUCH MAY NOT BE COPIED, REPRODUCED, OR GIVEN TO THIRD PARTIES WITHOUT THE WRITTEN CONSENT OF WHA YU.

1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State

▶Tr1 S21 Log Mag 10.00dB/ Ref 0.000dB [F2]



1 Start 2 GHz

IFBW 70 kHz

Stop 3 GHz

REF

Calibration

Correction ON

Calibrate

ECal

Property OFF

Cal Kit ZV-Z32

Modify Cal Kit

Properties

Velocity Factor 1.0000

Return

NOA

Ready

2003-08-13 14:21

# Cable Specification

**Cable : Mil-C-17 Coaxial Cable RG-178**

## 1. Construction :

- 1 Conductor..... 30AWG 7/38 SCCS
- 2 Dielectric..... PTFE OD : 0.033"±0.002"
- 3 Shielded.....38AWG SPC OD : 0.051" Nominal
- 4 Jacket.....FEP OD : 0.071"±0.004"

## 2. Physical Properties :

- 1 Weight per 1000ft..... 6.3 lbs Maximum
- 2 Bend Radius.....0.35" Minimum
- 3 Operating Temperature Range -55°C ~ 200°C

## 3. Electrical Properties:

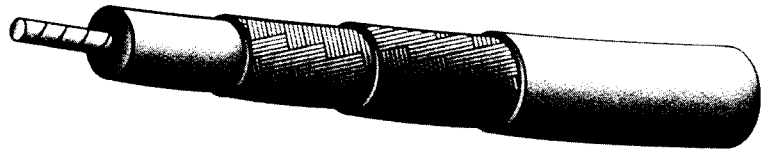
- 1 Impedance..... 50±2 ohms
- 2 Capacitance..... 32 pF/ft Maximum
- 3 Cut off Frequency..... 116 GHz
- 4 Attenuation.....45.0 dB/100ft @ 1GHz  
64.4 dB/100ft @ 2GHz  
79.7 dB/100ft @ 3GHz  
92.7 dB/100ft @ 4GHz  
104.3 dB/100ft @ 5GHz  
115.0 dB/100ft @ 6GHz

# Mil-C-17 Coaxial Cable QPL Approved

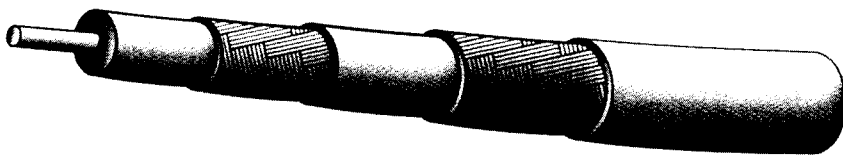
*Single braid*



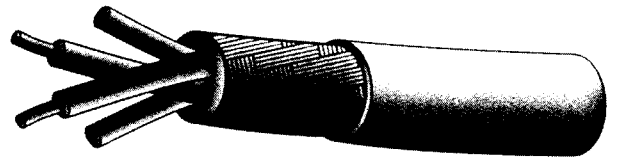
*Double braid*



*Triax*



*Twinax*



Harbour supplies a complete line of high temperature, high performance QPL approved MIL-C-17 coax cables for the military, commercial and industrial applications. The specific M17 constructions referenced are manufactured in accordance with the most recent revision of the MIL-C-17 specification. The MIL-C-17 specification defines complete physical and electrical characteristics for each M17 part number, including dimensional parameters, dielectric materials, shield construction, maximum attenuation, and VSWR levels.

## ***VSWR Sweep Testing***

When selecting a 50 ohm coaxial cable, constructions with VSWR requirements are recommended. Manufacturing and sweep testing cables with concern for VSWR ensures a quality cable free of spikes over the referenced frequency range. (Note the test frequencies specified in the electrical characteristics section.)

## ***Precision PTFE Dielectrics***

All of the high temperature, high performance coax cables listed have PTFE dielectrics with high dielectric strength and low capacitance in proportion to the dielectric constant. All PTFE dielectrics are manufactured with tolerances tighter than the MIL-C-17 specification to ensure uniformity of electrical characteristics, especially impedance, attenuation and VSWR.

## ***Tape wrapped PTFE Constructions***

Harbour also manufactures PTFE tape wrapped cables to a previous revision of the MIL-C-17 specification. These constructions can withstand operating temperatures up to 250° C. versus 200° C. for FEP jacketed cables. Also, PTFE tape wrapped cables are generally more flexible than their FEP jacketed counterparts.

## ***UL Approvals***

All of Harbour's M17 part numbers manufactured to the MIL-C-17 specification may be ordered with UL and FT4 approvals.

# Mil-C-17 Coaxial Cables

## Physical Characteristics:

| M17 Number                               | Center Conductor       | PTFE Dielectric Diameter | Shield | Jacket | Overall Diameter | Minimum Recommended Bend Radius | Operating Temperature | Weight | Notes                            |
|--|------------------------|--------------------------|--------|--------|------------------|---------------------------------|-----------------------|--------|----------------------------------|
| M17/60-RG142                             | .037" SCCS             | .116"                    | SPC(2) | FEP    | .195"            | 1.0"                            | -55 +200              | 43.0   |                                  |
| M17/93-RG178                             | .0120"(7/.004")SCCS    | .033"                    | SPC    | FEP    | .071"            | 0.4"                            | -55 +200              | 6.3    |                                  |
| M17/93-00001                             | .0120"(7/.004")SCCS    | .033"                    | SPC    | PFA    | .071"            | 0.4"                            | -55 +230              | 6.3    | M17/93-RG178 w/extended temp. ra |
| M17/94-RG179                             | .0120"(7/.004")SCCS    | .063"                    | SPC    | FEP    | .100"            | 0.4"                            | -55 +200              | 10.8   |                                  |
| M17/95-RG180                             | .0120"(7/.004")SCCS    | .102"                    | SPC    | FEP    | .141"            | 0.7"                            | -55 +200              | 19.8   |                                  |
| M17/110-RG302                            | .0253"SCCS             | .146"                    | SPC    | FEP    | .202"            | 1.0"                            | -55 +200              | 40.0   |                                  |
| M17/111-RG303                            | .037"SCCS              | .116"                    | SPC    | FEP    | .170"            | 0.9"                            | -55 +200              | 31.0   |                                  |
| M17/112-RG304                            | .059" SCCS             | .185"                    | SPC(2) | FEP    | .280"            | 1.4"                            | -55 +200              | 94.0   |                                  |
| M17/113-RG316                            | .0201"(7/.0067")SCCS   | .060"                    | SPC    | FEP    | .098"            | 0.5"                            | -55 +200              | 12.2   |                                  |
| M17/127-RG393                            | .094"(7/.0312")SC      | .285"                    | SPC(2) | FEP    | .390"            | 2.0"                            | -55 +200              | 165.0  |                                  |
| M17/128-RG400                            | .0384"(19/.008")SC     | .116"                    | SPC(2) | FEP    | .195"            | 1.0"                            | -55 +200              | 50.0   |                                  |
| M17/131-RG403                            | .0120"(7/.004")SCCS    | .033"                    | SPC(2) | FEP(2) | .116"            | 0.6"                            | -55 +200              | 15.0   | Triaxial M17/93-RG               |
| M17/152-00001                            | .0201"(7/.0067")SCCS   | .060"                    | SPC(2) | FEP    | .114"            | 0.6"                            | -55 +200              | 18.5   | Double shielded M17/113-RG316    |
| M17/158-00001                            | .037"SCCS              | .116"                    | SPC(2) | FEP    | .195"            | 1.0"                            | -55 +200              | 56.0   | Unsweped M17/60-RG               |
| M17/169-00001                            | .0120"(7/.004")SCCS    | .033"                    | SPC    | FEP    | .071"            | 0.4"                            | -55 +200              | 6.3    | Unsweped M17/93-RG               |
| M17/170-00001                            | .037"(SCCS)            | .116"                    | SPC    | FEP    | .170"            | 0.9"                            | -55 +200              | 39.0   | Unsweped M17/111-RG              |
| M17/172-00001                            | .0201"(7/.0067")SCCS   | .060"                    | SPC    | FEP    | .098"            | 0.5"                            | -55 +200              | 11.5   | Unsweped M17/113-RG              |
| M17/174-00001                            | .094"(7/.0312")SCCS    | .285"                    | SPC(2) | FEP    | .390"            | 2.0"                            | -55 +200              | 175.0  | Unsweped M17/127-RG              |
| M17/175-00001                            | .0384"(19/.008")SC     | .116"                    | SPC(2) | FEP    | .195"            | 1.0"                            | -55 +200              | 50.0   | Unsweped M17/128-RG              |
| M17/176-00002                            | .0235"(19/.005")SPA(2) | .042"                    | SPA    | PFA    | .129"            | 0.6"                            | -55 +230              | 18.0   | Controlled impedar twinax        |
| <b>PTFE Tape Wrap Jacketed RG Cables</b> |                        |                          |        |        |                  |                                 |                       |        |                                  |
| RG 187 A/U                               | .0120"(7/.004)SCCS     | .063                     | SPC    | PTFE   | .100"            | 0.5"                            | -55 +250              | 10.0   | Flexible, 250° C. rat            |
| RG 188 A/U                               | .0201"(7/.0067)SCCS    | .060                     | SPC    | PTFE   | .100"            | 0.5"                            | -55 +250              | 11.0   | Flexible, 250° C. rat            |
| RG 195 A/U                               | .0120"(7/.004)SCCS     | .102                     | SPC    | PTFE   | .141"            | 0.7"                            | -55 +250              | 18.0   | Flexible, 250° C. rat            |
| RG 196 A/U                               | .0120"(7/.004)SCCS     | .034                     | SPC    | PTFE   | .067"            | 0.4"                            | -55 +250              | 6.0    | Flexible, 250° C. rat            |

## Electrical Characteristics:

| M17 Number                               | Impedance (ohms) | Capacitance (pF/ft) | Max. Operating Voltage (RMS) | Maximum attenuation (dB) |         |       |         |         |       |         |
|--|------------------|---------------------|------------------------------|--------------------------|---------|-------|---------|---------|-------|---------|
|  |                  |                     |                              | 100 MHz                  | 400 MHz | 1 GHz | 100 MHz | 400 MHz | 1 GHz | 100 MHz |
| M17/60-RG142                             | 50 +/- 2         | 29.4                | 1900                         | 5.5                      | 11.7    | 19.0  | 35.0    | 48.0    | -     | 17.4    |
| M17/93-RG178                             | 50 +/- 2         | 29.4                | 1000                         | 16.0                     | 33.0    | 52.0  | 94.0    | -       | -     | 3.0     |
| M17/93-00001                             | 50 +/- 2         | 29.4                | 1000                         | 16.0                     | 33.0    | 52.0  | 94.0    | -       | -     | 3.0     |
| M17/94-RG179                             | 75 +/- 3         | 19.4                | 1200                         | -                        | 21.0    | -     | -       | -       | -     | -       |
| M17/95-RG180                             | 95 +/- 5         | 16.4                | 1500                         | -                        | 17.0    | -     | -       | -       | -     | -       |
| M17/110-RG302                            | 75 +/- 3         | 19.4                | 2300                         | -                        | 8.0     | -     | 26.0    | -       | -     | -       |
| M17/111-RG303                            | 50 +/- 2         | 29.4                | 1900                         | 3.9                      | 8.0     | 15.0  | 28.0    | -       | -     | -       |
| M17/112-RG304                            | 50 +/- 3         | 29.4                | 3000                         | 2.7                      | 6.4     | 11.1  | 22.0    | 30.0    | -     | 8.0     |
| M17/113-RG316                            | 50 +/- 2         | 29.4                | 1200                         | 11.0                     | 21.0    | 38.0  | 58.0    | -       | -     | 3.0     |
| M17/127-RG393                            | 50 +/- 2         | 29.4                | 2500                         | 2.4                      | 5.0     | 8.8   | 18.0    | 24.6    | 37.0  | 11.0    |
| M17/128-RG400                            | 50 +/- 2         | 29.4                | 1900                         | 4.5                      | 10.5    | 17.0  | 38.0    | 50.0    | 78.0  | 12.4    |
| M17/131-RG403                            | 50 +/- 2         | 29.4                | 1000                         | -                        | 37.0    | -     | -       | -       | -     | 10.0    |
| M17/152-00001                            | 50 +/- 2         | 29.4                | 1200                         | 11.5                     | 24.0    | 40.0  | 75.0    | 110.0   | 170.0 | 12.4    |
| M17/158-00001                            | 50 +/- 2         | 29.4                | 1900                         | -                        | 9.5     | -     | -       | -       | -     | -       |
| M17/169-00001                            | 50 +/- 2         | 29.4                | 1000                         | -                        | 29.0    | -     | -       | -       | -     | -       |
| M17/170-00001                            | 50 +/- 2         | 29.4                | 1900                         | -                        | 8.6     | -     | -       | -       | -     | -       |
| M17/172-00001                            | 50 +/- 2         | 29.4                | 1200                         | -                        | 21.0    | -     | -       | -       | -     | -       |
| M17/174-00001                            | 50 +/- 2         | 29.4                | 2500                         | -                        | 5.0     | -     | -       | -       | -     | -       |
| M17/175-00001                            | 50 +/- 2         | 29.4                | 1900                         | -                        | 10.5    | -     | -       | -       | -     | -       |
| M17/176-00001                            | 77 +/- 7         | 19.0                | 1000                         | -                        | -       | -     | -       | -       | -     | -       |
| <b>PTFE Tape Wrap Jacketed RG Cables</b> |                  |                     |                              |                          |         |       |         |         |       |         |
| RG 187 A/U                               | 75 +/- 3         | 19.4                | 1200                         | -                        | 21.0    | -     | -       | -       | -     | 3       |
| RG 188 A/U                               | 50 +/- 2         | 29.4                | 1200                         | 11.0                     | 21.0    | 38.0  | 58.0    | -       | -     | 3       |
| RG 195 A/U                               | 95 +/- 5         | 15.4                | 1500                         | -                        | 17.0    | -     | -       | -       | -     | 3       |
| RG 196 A/U                               | 50 +/- 2         | 29.4                | 1000                         | -                        | 29.0    | -     | -       | -       | -     | -       |

"Maximum frequencies" are those as referenced on individual slant sheets of the MIL-C-17 specification. No values are given for unswept constructions as the specification recommends these cables should not be used above 400 MHz. (All figures referenced above are nominal unless otherwise specified.)



# RF SMA Connector

## Specification

### 1. Electrical Properties :

- 1.1 Frequency Rang.....0 ~ 6GHz
- 1.2 Impedance ..... 50 $\Omega$  Nominal
- 1.3 VSWR ..... 1.5 Max.
- 1.4 Voltage rating ..... AC 500V
- 1.5 Withstanding Voltage .....AC 1000V one minute
- 1.6 Insulation Resistance ..... 5000M $\Omega$

### 2. Mechanical Properties :

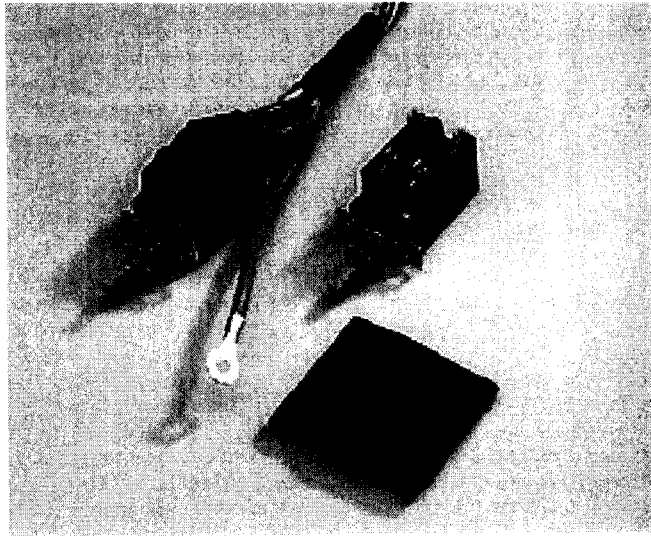
- 2.1 Mating / unmating force .. 2 inch-lb
- 2.2 Mating Torque ..... 7~10 inch-lb
- 2.3 Contact Retention ..... 4 lbs min. axial force
- 2.4 Cable Retention ..... 15lb for RG316 ; 9lb for RG178
- 2.5 Durability ..... 500 cycles Minimum

### 3. Environment Properties :

- 3.1 Temperature Range..... -40 $^{\circ}$ C ~ +85 $^{\circ}$ C
- 3.2 Thermal Shock.....MIL-STD-202, Method 107, Condition B
- 3.3 Shock.....MIL-STD-202, Method 213, Condition I
- 3.2 Vibration ..... MIL-std-202 Method 204, Test Condition D

# Versafit V2

Highly flame-retardant, very flexible, low-shrink-temperature polyolefin tubing



Fax-on-Demand: (800) 260-9099  
(650) 361-6523

**FAX ID Description**

2222 Data sheet  
2221 RT-1136

**Before ordering check with factory for most current data.**

### Applications

Cost-effective choice for many commercial and military applications; electrically insulates and protects in-line components, disconnect terminals, and splices. Bundles wires for very flexible light-duty harnesses. Strain-relieves electrical wire connections for commercial applications. Identifies or color-codes wires, cables, terminals, and components.

### Operating Temperature Range

-55°C to 125°C

### Features/Benefits

- 2:1 shrink ratio.
- Low shrink temperature reduces installation time and the risk of damage to temperature-sensitive components.
- Very flexible; doesn't easily wrinkle when bent.
- Hot stamps extremely well.
- Free of polybrominated biphenyls (PBBs) and polybrominated biphenyl oxides and ethers (PBBOs and PBBEs), which are classified as environmentally hazardous substances.
- Higher temperature rating, better thermal stability, and higher resistance to physical abuse than noncrosslinked materials.

### Installation

Minimum shrink temperature: 70°C

Minimum full recovery temperature: 90°C

### Specifications/Approvals



| Series   | UL                          | CSA                         | Raychem |
|----------|-----------------------------|-----------------------------|---------|
| Versafit | E35586 VW-1<br>600 V, 125°C | LR31929 OFT<br>600 V, 125°C | RW-3023 |

### Product Dimensions (mm)

| Size | As supplied     |                          | After shrinkage        |                        |
|------|-----------------|--------------------------|------------------------|------------------------|
|      | Inside diameter | Wall thickness (nominal) | Inside diameter (max.) | Wall thickness* (min.) |
| 1.0  | 1.6 ±0.2        | 0.2                      | 0.5                    | 0.33                   |
| 1.5  | 2.1 ±0.2        | 0.2                      | 0.75                   | 0.35                   |
| 2.0  | 2.6 ±0.2        | 0.25                     | 1.0                    | 0.43                   |
| 2.5  | 3.1 ±0.2        | 0.25                     | 1.25                   | 0.43                   |
| 3.0  | 3.6 ±0.2        | 0.25                     | 1.5                    | 0.43                   |
| 3.5  | 4.1 ±0.3        | 0.25                     | 1.75                   | 0.43                   |
| 4.0  | 4.6 ±0.3        | 0.25                     | 2.0                    | 0.43                   |
| 5.0  | 5.6 ±0.3        | 0.3                      | 2.5                    | 0.56                   |
| 6.0  | 6.6 ±0.3        | 0.3                      | 3.0                    | 0.56                   |
| 7.0  | 7.6 ±0.3        | 0.3                      | 3.5                    | 0.56                   |
| 8.0  | 8.6 ±0.3        | 0.3                      | 4.0                    | 0.56                   |
| 9.0  | 9.6 ±0.3        | 0.3                      | 4.5                    | 0.56                   |
| 10.0 | 10.4 ±0.3       | 0.3                      | 5.0                    | 0.56                   |

| Size | As supplied     |                          | After shrinkage        |                        |
|------|-----------------|--------------------------|------------------------|------------------------|
|      | Inside diameter | Wall thickness (nominal) | Inside diameter (max.) | Wall thickness* (min.) |
| 11.0 | 11.4 ±0.3       | 0.3                      | 5.5                    | 0.56                   |
| 12.0 | 12.7 ±0.3       | 0.3                      | 6.0                    | 0.56                   |
| 13.0 | 13.5 ±0.3       | 0.35                     | 6.5                    | 0.66                   |
| 14.0 | 14.4 ±0.4       | 0.35                     | 7.0                    | 0.68                   |
| 15.0 | 15.7 ±0.4       | 0.35                     | 7.5                    | 0.68                   |
| 16.0 | 16.9 ±0.4       | 0.35                     | 8.0                    | 0.68                   |
| 18.0 | 19.0 ±0.4       | 0.4                      | 9.0                    | 0.76                   |
| 20.0 | 21.4 ±0.4       | 0.4                      | 10.0                   | 0.76                   |
| 22.0 | 23.2 ±0.4       | 0.45                     | 11.0                   | 0.89                   |
| 25.0 | 26.8 ±0.4       | 0.45                     | 12.5                   | 0.89                   |
| 27.0 | 28.2 ±0.5       | 0.45                     | 12.5                   | 0.89                   |
| 28.0 | 30.0 ±0.5       | 0.45                     | 14.0                   | 0.89                   |
| 30.0 | 32.1 ±0.5       | 0.45                     | 15.0                   | 0.89                   |

\*Wall thickness will be less if tubing recovery is restricted during shrinkage.

### Ordering Information

|                      |  |
|----------------------|--|
| Color                | Standard Black (-0), white (-9), red (-2), blue (-6), yellow (-4), green (-5)<br>Nonstandard Orange (-3), violet (-7), brown (-1), gray (-8) |
| Size selection       | Always order the largest size that will shrink snugly over the component to be covered.<br>Special order sizes are available upon request.   |
| Standard packaging   | On spools.   |
| Marking              | Marked with UL/CSA/F- legends.   |
| Ordering description | Specify product name, size, and color (for example, Versafit V2-3.0-0).  |

Versafit is a trademark of Raychem Corporation.

3-50 Tubing **Raychem**

Users should independently evaluate the suitability of the product for their application.