Non-confidential attachment of PFAS public consultations

PP-SFP-IPD-Aero
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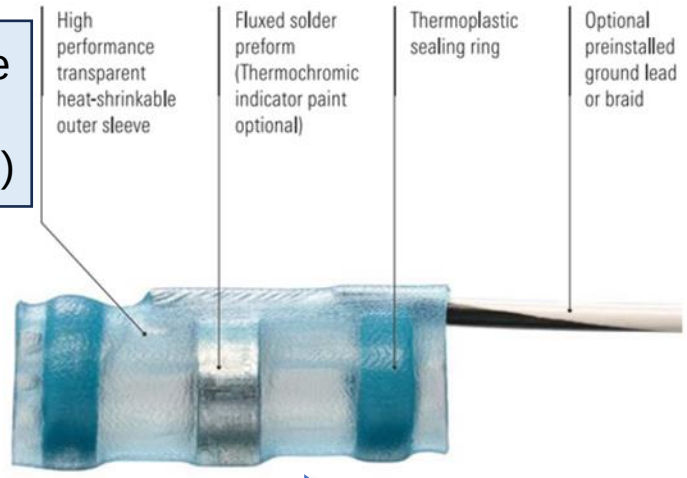
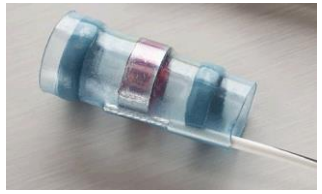
Irradiated Products Division
Sumitomo Electric Fine Polymer, Inc.

Application of “Solder sleeve” (heat-shrinkable tubing with solder inside) for Aircraft harnesses

This tint blue sleeve is PFAS(PVDF)

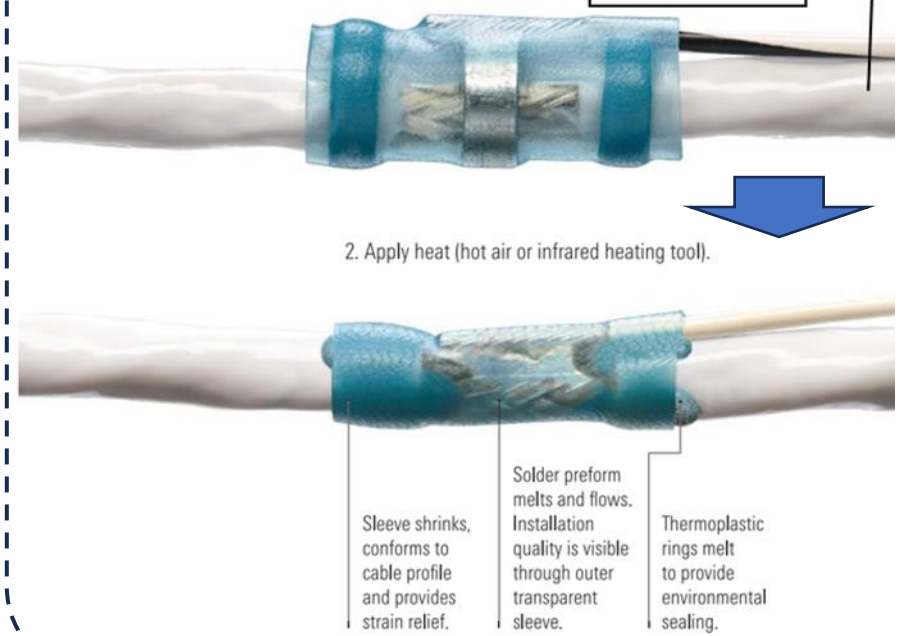


Solder sleeve



installation

Coaxial Cables



before shrink

after shrink

Comparison table of general characteristic of PFAS(PVDF) and its alternatives

Materials	PVDF		EPDM	Silicone	PEEK	Mica	Polyvinyl chloride	Polyethylene	Ceramic Based
Flexibility	Semi rigid		Flexible	Flexible	Rigid	Rigid	Flexible～ Semi rigid	Flexible～ Semi rigid	Rigid
Continuous use temperature(℃)	180		90	180	260	＞ 500(Mica)	100	120	＞500
Tensile strength(MPa)	45		5～20	3～12	90		15～50	10～30	
Tensile elongation(%)	200		100～800	100～500	50	≒0	500～100	500～1000	≒0
Flexural Modulus(MPa)	800		5~10	5~10	4000	＞10000	20～3000	20～2000	＞10000
Oil resistance	Excellent		Poor	Poor	Excellent	Excellent	Poor	Good	Excellent
Abrasion resistance	Excellent		Poor	Poor	Excellent	Excellent	Good	Good	Excellent
Transparency	Excellent		Poor	Poor	Excellent	Poor	Good	Good	Poor
Heat Shrinkable Tubing (Shrink ratio)	Possible (67%)		Possible (50%)	Possible (50%)	Possible (40%)	Impossible	Possible (min.50%)	Possible (min.50%)	Impossible

Comparison between PVDF, one of PFAS, and other alternative candidates.
Gray shaded cells mean it has an issue, inferior than PVDF.
As PVDF is 175℃ temp rating, the same or higher materials are silicone, PEEK, mica and ceramic.
Mica and ceramic are inorganic material and cannot be processed into sleeve.
Silicone and PEEK would be candidates of alternative, but they have following issues.

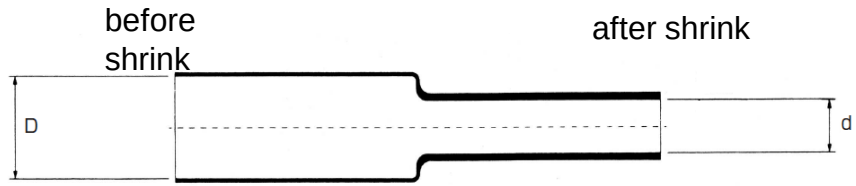
- Silicone : not transparent, thus cannot see the soldering status underneath
- PEEK : can be heat shrink tube, but the shrink ratio is up to 40% (solder sleeve requires min 67%)

Therefore, they cannot be alternatives.

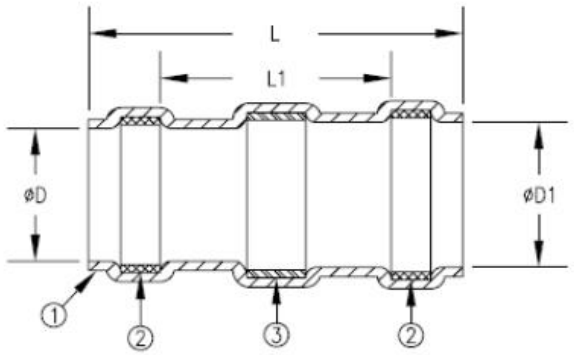
Shrink ratio:
$(D-d)/D \times 100$ (%)

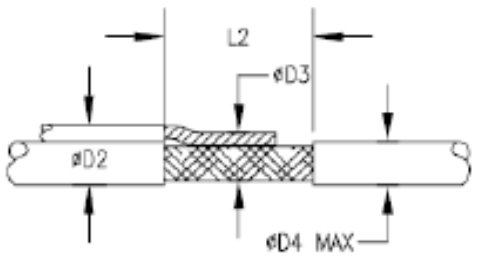
where as D: Inside diameter before shrink
d: Inside diameter after shrink

Shrink ratio
50% = 2:1 shrink
67% = 3:1 shrink



Why “solder sleeve” requires 67% shrink ratio?





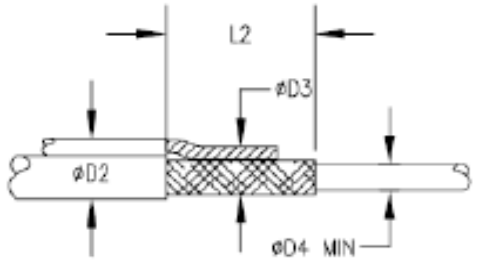


TABLE I: PRODUCT DETAILS

SAE AS83519/1 PART NUMBER	MARKING CODE *CLASS II NO "SO" PREFIX	PART NUMBER *CLASS II ADD -C2 SUFFIX	L ± .070	L1 MINIMUM	øD MINIMUM
AS83519/1-1	SO101S	H-M-1	.650	.325	.075
AS83519/1-2	SO102S	H-M-2	.650	.325	.105
AS83519/1-3	SO103S	H-M-3	.650	.325	.170
AS83519/1-4	SO104S	H-M-4	.750	.325	.235
AS83519/1-5	SO105S	H-M-5	.750	.325	.275

TABLE II: CABLE PREPARATION MEASUREMENTS

PART NUMBER *CLASS II ADD -C2 SUFFIX	øD2 MAXIMUM	øD3 MINIMUM	øD4 MAXIMUM	øD4 MINIMUM	L2 RANGE
H-M-1	.105	.035	.075	.020	.250-.325
H-M-2	.145	.055	.105	.030	.250-.325
H-M-3	.200	.085	.170	.050	.250-.325
H-M-4	.255	.130	.235	.070	.250-.325
H-M-5	.300	.170	.275	.100	.250-.325

Here is our specification of solder sleeve in line with SAE AS83519.
This spec tells why heat-shrink tube for solder sleeve requires high shrink ratio.
It is because covered available wire size ranges (outside diameters).

In case H-M-3, maximum Inside Diameter (ID) is φD, 0.17 inch in Table 1.
And the minimum ID of H-M-3 is φD4, the minimum diameter of wire, 0.05 inch. This means the sleeve should shrink from 0.17 to 0.05, 70% shrink ratio.
PEEK shrink tube cannot be used as its max ratio is only 40%.