

Kapton insulated wires for UHV use

Allectra offers a wide variety of Kapton wires for the use in High- and Ultra-High-Vacuum applications. Here is an overview about the single wires including technical details. In addition, Twisted Pair versions and Ribbon Cables are available.

Type	Construction	AWG ¹	Conductor Diam. mm	Overall Diam max. mm	Max. Voltage in vacuum ² V DC	Max. Current ³ A	Conductor area mm ²	Resistivity ⁴ Ohm/km	Usage example
311-KAP-010	Plain copper wire, dipped	38	0,1	0,13	2.000	0,1	0,01	2270	STM / AFM, radiation environment
311-KAP-012	Plain copper wire, dipped	36	0,12	0,16	2.000	0,15	0,01	1580	Fine instrumentation, radiation environment
311-KAP-014	Plain copper wire, dipped	35	0,14	0,18	2.000	0,2	0,02	1160	Fine instrumentation, radiation environment
311-KAP-025	Plain copper wire, dipped	30	0,25	0,3	2.000	1	0,05	360	Standard instrumentation, radiation environment
311-KAP-040	Plain copper wire, dipped	26	0,4	0,47	2.000	2	0,13	138	Standard medium current, radiation environment
311-KAP-060	Plain copper wire, dipped	22	0,64	0,71	2.000	5	0,31	58	Standard medium current, radiation environment
311-KAP-100	Plain copper wire, dipped	18	1	1,1	10.000	10	0,8	23	High current and high voltage applications, radiation environment
311-KAP-102	Plain copper wire, dipped	18	1,02	1,1	2.000	10	0,8	23	Like 311-KAP-100 but lower voltage applications
311-KAP-130	Plain copper wire, dipped	16	1,3	1,4	5.000	13	1,3	13,8	High current
311-KAP-170	Plain copper wire, dipped	14	1,63	1,8	12.000	17	2,1	8,6	Very high current and voltage
311-KAP-180	Plain copper wire, dipped	13	1,8	2	2.000	20	2,6	6,8	Very high current
311-KAP1	Silver plated copper wire, wrapped quality	30	0,25	0,55	4.000	1	0,05	360	Caburn UHV® Type, easy to strip, general instrumentation
311-KAP2	Silver plated copper wire, wrapped quality	22	0,6	0,9	4.000	4,5	0,28	64	Caburn UHV® Type, easy to strip, medium current
311-KAPM-025	Multi Strand silver plated wire, 7x 0,08mm	32	0,23	0,39	1000	0,5	0,04	508	High flexible instrumentation, low current and low voltage
311-KAPM-035	Multi Strand silver plated wire, 7x 0,12mm	28	0,35	0,5	1.000	1	0,08	225	High flexible, Sub-D connectors, low current and low voltage
311-KAPM-060	Multi Strand silver plated wire, 19x 0,1mm	26	0,6	0,67	1.000	2,5	0,15	119	High flexible, Sub-D connectors, medium current
311-KAPM-075	Multi Strand silver plated wire, 19x 0,15mm	22	0,75	0,8	1.000	5	0,33	53	High flexible, Sub-D connectors, higher current

1 AWG numbers for information only.

2 Max. Voltage in air is significant lower. Allectra does not recommend these wires for air use according this data sheet.

3 Max. Current depends strongly on use, specially for vacuum applications. If a coil is formed, a temperatur test should be done. As an approximation, 1/3 of the given current can be assumed to start with. As the heat dissipation is very low in vacuum, the cables will get hot by continuous use at the given values.

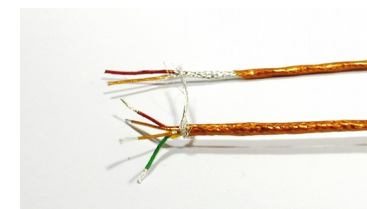
4 Calculated value with conductance of 56 S m / mm² at 20°C

Type	Construction	AWG	Conductor Diam. mm	Overall Diam max. mm	Max. Voltage in vacuum V DC	Max. Current A	Conductor area mm ²	Resistivity Ohm/km	Usage example
311-KAPM-100	Multi Strand silver plated wire, 19x 0,2mm	18	1	1,17	1.000	9	0,6	30	High flexible high current wire, up to 10A for short periods
311-KAPM-200	Ultra flexible thick Multi Strand wire, 400x0.08mm, silver plated	12	2	2,2	1.000	20	2,0	8,9	Heaters, ideal for use with COMBO Sub-D f/t's
311-KAPM-035-RAD	Multi Strand silver plated wire, 7x 0,12mm, Radiation Resistant, 300°C	28	0,35	0,5	4.000	1	0,08	225	Radiation resistant (10 ⁹ rad) and High Temperature (300°C) wire, higher voltage rating, low current
311-KAPM-060-RAD	Multi Strand silver plated wire, 19x 0,1mm, Radiation Resistant, 300°C	26	0,6	0,67	4.000	2,5	0,15	119	Radiation resistant (10 ⁹ rad) and High Temperature (300°C) wire, higher voltage rating, medium current
311-KAPM-100-RAD	Multi Strand silver plated wire, 19x 0,2mm, Radiation Resistant, 300°C	18	1	1,17	4.000	9	0,6	30	Radiation resistant (10 ⁹ rad) and High Temperature (300°C) wire, higher voltage rating, high current
311-KAPM-130-RAD	Multi Strand silver plated wire, 19x 0,25mm, Radiation Resistant, 300°C	17	1,3	1,4	4.000	12	0,93	18	Radiation resistant (10 ⁹ rad) and High Temperature (300°C) wire, higher voltage rating, high current
311-KAP50-RAD	50 Ohm coaxial wire, multi strand silver plated conductor, 7x 0,15mm, silver plated screen, Radiation Resistant, 300°C	26	0,45	2,3	10.000	1	0,12	144	Radiation resistant (10 ⁹ rad) and High Temperature (300°C) wire, higher voltage rating, 50 Ohm coaxial wire
311-KAP-TCK-RAD	Thermocouple Wire, double insulation, Radiation Resistant, 300°C	32	2x 0.2	~0,8x1,2	-	-	0,03	-	Radiation resistant (10 ⁹ rad) and High Temperature (300°C) wire, Thermocouple Type K
311-KAP50	50 Ohm coaxial wire, multi strand silver plated conductor, 7x 0,15mm, silver plated screen	26	0,45	2,3	5.000	1	0,12	144	All 50 Ohm connections, specially for SMA connectors, signals, which need shielding
311-KAP50S	Miniature 50 Ohm coaxial wire, multi strand silver plated conductor, 7x 0,08mm, silver plated screen	32	0,23	1,45	1.000	0,5	0,12	508	Thin and high flexible 50Ohm wire, similar RG178

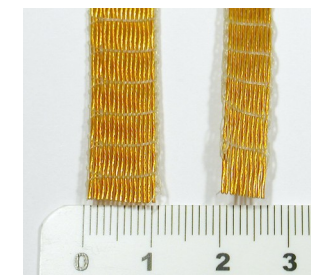
Type	Construction	AWG	Conductor Diam. mm	Overall Diam max. mm	Max. Voltage in vacuum V DC	Max. Current A	Conductor area mm ²	Resistivity Ohm/km	Usage example
311-KAPM-025-SHIELD	Multi-Strand coaxial wire, 7 x 0,08mm, outer <u>not</u> insulated	32	0,23	1	1.000	0,5	0,04	508	For all connections, where shielding is required and shielding is on ground
311-KAPM-060-COAX	Multi-Strand coaxial wire, 19 x 0,1mm, outer insulated	26	0,6	1,4	1000	2,5	0,15	119	For all connections, where shielding is required but no high frequency is involved
311-KAPM-060-PAIR1	Shielded Twisted Pair cable, 1 Pair	26	2x 0,6	1,7	1.000	2	0,15	119	Signals, High Frequency supplies, Limit Switches
311-KAPM-060-PAIR2	Shielded Twisted Pair cable, 2 Pairs (4 conductors)	26	4x0,6	2,2	1.000	2	0,15	119	Signals, Stepper motor connection
311-KAP-RIB4	Ribbon cable	28	4x0,35	0,5x3	1.000	1	0,08	225	Instrumentation
311-KAP-RIB10	Ribbon cable	28	10x0,35	0,5x6	1.000	1	0,08	225	Sub-D connections
311-KAP-RIB15	Ribbon cable	28	15x0,35	0,5x10	1.000	1	0,08	225	Sub-D connections
311-KAP-TCK	Thermocouple Wire, double insulation	32	2x 0,2	~0,8x1,2	-	-	0,03	-	Thermocouple Type K
312-KAP-TCK	Thermocouple Wire, one Wire Blank, with outer insulation	32	2x 0,2	~0,6x0,8	-	-	0,03	-	Thermocouple Type K
312-KAP-TCN	Thermocouple Wire, one Wire Blank, with outer insulation	32	2x 0,2	~0,6x0,8	-	-	0,03	-	Thermocouple Type N

Also available on order: Thermocouple type J, T

Bending Radii of the cables: The Overall diameter * 7.5 gives a safe bend radius for all cables.
 For single bends, the factor can be reduced to 5.
 For continuous bends (~ 1.000 and more) the factor must be 10 or higher.
 Allectra has no values for lifetime of the cables with bends above 1.000 times.



Twisted Pair cables (1 and 2 pairs, shielded)



Compact Ribbon cables, 311-KAP-RIB10 and 311-KAP-RIB15

	Dipped Wire	Wrapped and Multi-Strand Wire	Radiation Resistant Wires
Temperature range (vacuum)	4K to 260°C, up to 300°C for short periods ⁵⁾	4K to 260°C	4K to 300°C
Dielectric constant (1KHz)	~3.5	~3.1	~3.4
Dielectric strength (dry) kV/mm	>135	>135	>200
Dissipation factor	0.0015	0.0015	0.0018
Vacuum range	UHV, <10 ⁻¹¹ mbar	UHV, <10 ⁻¹¹ mbar	UHV, <10 ⁻¹¹ mbar
Radiation resistance	10 ⁹ Rad = 10 ⁷ Gy	10 ⁷ Rad = 10 ⁵ Gy (non-flexing applications)	10 ⁹ Rad = 10 ⁷ Gy

Additional values for 50 Ω Cables:

	311-KAP50	311-KAP50S
Impedance	50Ω +/-10%	50Ω +/-10%
Nom. Capacitance	115 pF/m	120pF/m
Attenuation	0.1db/m at 100MHz 1.1db/m at 500MHz 1.9db/m at 1 GHz	~3db/m at 1GHz
Dimension similar to	RG174	RG178
Conductor	0.45mm	0.23mm
Dielectric	1.55mm	0.9mm
Shield	2.0mm	1.35mm
Max. Frequency	~17 GHz	

(measured with UHV-SMA connectors mounted)

Some help for choosing the right wire:

Dipped wire are a good choice, if the parts need no or little movement. These are the cheapest types. Stripping is difficult.

For radiation environment and temperatures above 260°C Radiation Resistant (-RAD) wires or dipped wires can be used

For higher voltage applications the Caburn UHV® qualities or the RAD qualities are best choice.

If flexibility is required, Multi Strand types should be used. These are the typical wires for connecting sensors, motors etc. Stripping is easy.

Kapton wire in vacuum will outgas water on first use. A bake to 120° C for 4 to 5 hours will remove excess gas.

50 Ohm wire can be supplied ready fitted with 50 Ω SMA / SMB / BNC / MHV / SHV / N / Microdot vacuum connectors.

All values are given to best knowledge. Values might change without notice. Allectra does not guarantee the given figures.

Last revised: 2015-06-11

⁵ Temperatures above 260°C will change the electrical specs after some 100 hours, lifetime of cable is reduced.