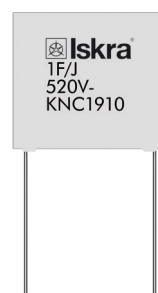


Capacitors for Use in Electronics

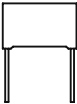
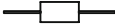
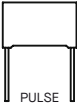
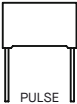
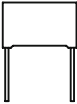
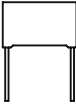


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General information

on Iskra Capacitors for use in electronics

Type	Version	Pitch (mm)	Dielectric	Capacitance range	Rated voltage	Page
KEU1910		10; 15; 22.5; 27.5	Metallized polyester film (MKT)	0.22 μ F – 22 μ F 0.068 μ F – 10 μ F 0.033 μ F – 10 μ F 0.01 μ F – 4.7 μ F 4700 pF – 1.5 μ F 1000 pF – 0.68 μ F	63 V DC 100 V DC 250 V DC 400 V DC 630 V DC 1000 V DC	13
KEU1012		axial leads	Metallized polyester film (MKT)	0.15 μ F – 10 μ F 0.068 μ F – 10 μ F 0.047 μ F – 10 μ F 0.01 μ F – 3.3 μ F 1000 pF – 1 μ F 1000 pF – 0.47 μ F	63 V DC 100 V DC 250 V DC 400 V DC 630 V DC 1000 V DC	16
KL11910		10; 15; 22.5; 27.5	Polypropylene film (KP)	6800 pF – 0.15 μ F 3300 pF – 0.1 μ F 2200 pF – 0.047 μ F 1000 pF – 0.047 μ F 100 pF – 0.22 μ F 1000 pF – 0.22 μ F 1000 pF – 0.1 μ F 1000 pF – 0.047 μ F	100 V DC 160 V DC 250 V DC 400 V DC 630V DC 1000 V DC 1600 V DC 2000 V DC	19
KN11910		10; 15; 22.5	Metallized polypropylene film (MKP)	680 pF – 2.2 μ F 680 pF – 1.8 μ F 680 pF – 0.39 μ F 3300 pF – 0.33 μ F 1000 pF – 0.15 μ F 1000 pF – 0.1 μ F	250 V DC 400 V DC 630 V DC 1000 V DC 1600 V DC 2000 V DC	24
KNU1910		10; 15; 22.5; 27.5	Metallized polypropylene film (MKP)	0.022 μ F – 6.8 μ F 0.01 μ F – 2.2 μ F 4700 pF – 1 μ F 0.01 μ F – 1 μ F 1000 pF – 0.33 μ F	250 V DC 400 V DC 630 V DC 1000 V DC 1600 V DC	30
KNC1910		10; 15; 22.5	Metallized polypropylene film (MKP)	120 nF – 5.6 μ F 82 nF – 2.7 μ F 68 nF – 2.2 μ F	450 V DC 520 V DC 630 V DC	32

General technical data

ISKRA capacitors for use in electronics are made of dielectric materials as follow:

- polypropylene film
- polyester (polyethyleneterephthalate).

Survey of specific properties of individual dielectrics and use:

Polyester (polyethyleneterephthalate) film

Dielectric constant (25 °C/1 kHz):

$\epsilon_r = 3.25$; ASTM D 150-65T

Dielectric loss (25 °C/60 Hz):

$\tan\delta \leq 20 \cdot 10^{-4}$ C;
ASTM D 150-65T

Dielectric strength (25 °C/60 Hz):

295 kV/mm; ASTM D 149-64,
ASTM D 2305-67

Temperature coefficient of capacitance:

TC $\approx + 500$, 10-6 C/°C

Temperature range max.:

+ 125 °C

Water absorption (sink for 24 h):

0.8 % max.; ASTM D 570-63

Dielectric absorption:

0.2 to 0.8 %

Polyester capacitors are used mainly in electronic devices where special characteristics of electrical parameters are not required and where wider temperature range is required. Mainly they are used as conjunctive or block capacitors.

Polypropylene film

Dielectric constant (25 °C/1 kHz):

$\epsilon_r = 2.2$; ASTM D 150

Dielectric loss (25 °C/1 kHz):

$\tan\delta \leq 5 \cdot 10^{-4}$ C; ASTM D 150

Dielectric strength (25 °C/1 kHz):

300 to 380 kV/mm; ASTM D 149

Temperature coefficient of capacitance:

(-100 \leq TC \leq -300), 10-6/°C

Temperature range max.:

+ 100 °C

Water absorption:

< 0.05 %; ASTM D 202

Dielectric absorption:

0.03 %

Polypropylene capacitors are used mainly in electronic circuits, where following requirements appear:

- small dielectric losses
- high insulation resistance
- negative and defined temperature coefficient (temperature compensation at oscillating circles with ferrite coil)
- high pulse loading
- loading with AC voltage.

Designation of dielectric in type code of capacitors

Type code is composed by three letters and four figures:

K	X	X	Y	Y	Y	Y
↓	↓	↓	↓	↓	↓	↓
1	2	3	4	5	6	7

1st Letter "K" means capacitor

2nd Letter tells the type of dielectric (special for metallized version)

3rd Letter tells the purpose of use

4th, 5th, 6th, 7th Figure describes construction and design of capacitor and leads

Survey of letter used for single kinds of dielectric:

E - metallized polyester film

L - polypropylene film

N - metallized polypropylene film

Electrical characteristics

1. Rated capacitance

Rated capacitance C_R values are available according to E-ranges. Available E-ranges (E6, E12, E24, E48, E96, on request E192) are stated at type descriptions in catalogue. The values from range E6 are privileged.

The E-ranges are put down in accordance to IEC-publ. 60063 and DIN 41426. Required values from E-range are all values from table below, multiplied by positive or negative whole number power exponent of the number 10.

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %
100	100	100	100	100	100
				101	102
				102	104
				105	105
				106	106
				107	107
			109	110	
			110	110	
			111	113	
			113	114	
			114	115	
			115	117	
		117	118		
		118	120		
		120	121		
		121	123		
		123	124		
		124	126		
		126	127		
		127	29		
		29	130		
		130	132		
		132	133		
		133	135		
	135	137			
	137	138			
	138	140			
	140	142			
	142	143			
	143	145			
	145				

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %
150	150	150	147	147	147
				149	150
				150	152
				154	154
				154	156
				158	158
			160	162	
			162	162	
			162	164	
			165	165	
			165	167	
			167	169	
		169	172		
		172	174		
		174	176		
		176	178		
		178	180		
		180	182		
		182	184		
		184	187		
		187	187		
		187	189		
		189	191		
		191	193		
	193	196			
	196	198			
	198	200			
	200	200			
	200	203			
	203	205			
	205	205			
	205	208			
	208	210			
	210	213			
	213				



E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %	E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %		
220	220	220	215	215	215	330	330	330	316	316	316		
				218	218					320			
				221	221					324			
				223	223					328			
				226	226					332			
			226	226	226				226	226	332	332	
									229	229	336		
									232	232	340		
									234	234	344		
									237	237	348		
		240	240	237	237				237	348	348		
					240				240	352			
					243				243	357			
					246				246	361			
					249				249	365			
				249	249				249	249	249	365	365
										252	252	370	
										255	255	374	
										258	258	379	
										261	261	383	
	270	270	261	261	261			383	383				
				264	264			388					
				267	267			392					
				271	271			397					
				274	274			402					
			274	274	274			274	274	402	402		
								277	277	407			
								280	280	412			
								284	284	417			
								287	287	422			
	300	300	287	287	287			422	422				
				291	291			427					
				294	294			432					
				298	298			437					
				301	301			442					
			301	301	301			301	301	442	442		
								305	305	448			
								309	309	453			
								312	312	459			
								316	316	464			

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %				
470	470	470	464	464	464				
				470	470				
				475	475	475			
					481	481			
				487	487	487			
					493	493			
			499		499				
			505		505				
			510	511	511	511	511		
						517	517		
					523	523	523		
						530	530		
		536			536	536	536		
						542	542		
				549	549	549			
					556	556			
				560	562	562	562	562	
							569	569	
		576				576	576		
						583	583		
		590				590	590	590	
							597	597	
					604	604	604		
						612	612		
					620	619	619	619	619
								626	626
		634	634				634		
			642			642			
		649	649	649		649			
				657		657			
665	665		665						
	673		673						

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %				
680	680	680	681	681	681				
				690	690				
				698	698	698			
					706	706			
				715	715	715			
					723	723			
			732		732				
			741		741				
			750	750	750	750	750		
						759	759		
					768	768	768		
						777	777		
		787			787	787	787		
						796	796		
				806	806	806			
					816	816			
				820	825	825	825	825	
							835	835	
		845				845	845		
						856	856		
		866				866	866	866	
							876	876	
					887	887	887		
						898	898		
					910	909	909	909	909
								920	920
		931	931				931		
			942			942			
		953	953	953		953			
				965		965			
976	976		976						
	988		988						



2. Tolerance of rated capacitance

Standard tolerances and belonging codes for marking tolerances of rated capacitances are as follow:

Tolerance %	± 20	± 10	± 5%	(± 2.5)	± 2	(± 1.25)	± 1	± 0.5
Code	M	K	J	(H)	G	(E)	F	D

The narrowest possible tolerance is ± 1 pF (Z).

Available tolerances of rated capacitances are stated at type descriptions in catalogue.

3. Temperature dependence of capacitance

Temperature coefficient TC is defined for temperature range $\vartheta_1... \vartheta_2$ according to DIN 41380 as follows:

$$TC = \frac{C_2 - C_1}{C_3 (\vartheta_2 - \vartheta_1)}$$

C_1 - capacitance at temperature ϑ_1

C_2 - capacitance at temperature ϑ_2

C_3 - capacitance at temperature (25 ± 10) °C

Temperature coefficient for single type of capacitors is given in 10⁻⁶/°C.

4. Rated voltage UR

The rated voltage UR is the maximum direct voltage which may be applied continuously to the terminals of a capacitor at any temperature between the lower category temperature and the rated temperature.

5. Category voltage UC

Category voltage UC is the maximum direct voltage which may be applied to the terminals of a capacitor at its upper category temperature. Adequate reducing of voltage for temperature range between upper rated temperature and category temperature is given at single types of capacitors in catalogue.

6. Alternating voltage loading

Allowed alternating voltage loading for single types is limited to frequency 50 to 60 Hz. The sum of applied alternating voltage (amplitude) and direct voltage to the terminals of a capacitor must not exceed category voltage UC. In general mica and plastic foil capacitors are not suitable for connection to network, except special versions of capacitors, which are suitable also for such purposes.

7. Allowed self-heating because of alternating voltage loading

If capacitors are loaded with alternating voltages of higher frequencies with sinusoidal or non-sinusoidal shape of alternating voltage, self-heating and pulse loading is to consider.

Self heating of capacitor ($\Delta\vartheta$) is in operating of capacitor conditioned by belonging power loss (P_i) and outer surface of capacitor (S), and is calculated by the following from:

$$\Delta\vartheta(K) = \frac{P_i \text{ (mW)}}{S(\text{cm}^2)\beta}$$

where the base for thermoplastic case is used

$$\beta = 1 \left(\frac{\text{mW}}{\text{K} \cdot \text{cm}^2} \right)$$

Power loss of capacitor (P_i) at loading with sinusoidal voltage of higher frequencies is calculated as follows:

$$P_i = U_{\text{ef}}^2 \cdot 2\pi \cdot f \cdot C \cdot \tan\delta_{(f)}$$

where:

C = capacitance in F

U_{ef} = effective voltage in V

f = frequency in Hz

$\tan\delta_{(f)}$ = loss factor at frequency f

P_i = power loss in W

At non-sinusoidal alternating voltage it is to be dismantled according to Fourier's analysis to sinusoidal voltages and calculated the power loss as a sum of single partial sinusoidal power losses. For carrying-out the Fourier's analysis the voltage-time diagram is needed.

The sum of temperatures because of self-heating and temperature of surroundings of capacitor may be equal or lower than permitted category temperature with considering the category voltage UC.

8. Pulse loading

The capacitors charged with non-sinusoidal voltage pulses with quick rise (high du /dt) will be loaded with high current pulses. Because of overloading of internal contacts and connections in capacitor the current must be limited, the boundary current for single types of capacitors depend on:

- amplitude and shape of pulse
- rated voltage of capacitor
- capacitance
- geometrical shape of capacitor.

At the repeating pulses the current loading will be limited by self-heating, surrounding temperature and cooling. The limit of allowed current loading is given with allowed voltage rise in time (du/dt) in V/μs (volts per microsecond).

$$I_{\text{max}} = C_R \frac{du}{dt}$$

C_R = rated capacitance in μF

du/dt = allowed pulse loading in V/μs

At single types of capacitors the data of allowed pulse loading is valuable for unlimited number of pulses (charging and discharging of capacitors) up to rated voltage U_n . Minimum resistance in series with capacitor is then:

$$R = \frac{U_R}{C_R \cdot du/dt}$$

where:

U_R = rated voltage of the capacitor in V

C_R = rated capacitance in μF

R = min. series resistance in Ohm

At the pulses of lower voltage than rated voltage the given values of allowed pulse loading are to multiply with the relation factor rated voltage/pulse voltage.

If the demanded pulse loading of the capacitor comply with the requests in certain case, the control is needed to be sure that power loss is not exceeded, resp. self-heating is in area of allowed pulse loading max. 15 °C. In critical cases the capacitor surface temperature is to measure and temperature fall of 5 °C inside capacitor is to consider.

9. Dissipation factor $\tan\delta$

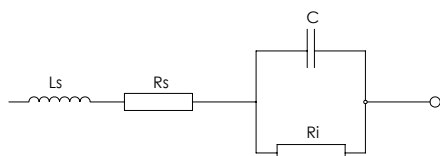
Every capacitor has beside desired capacitance also of her electrical properties, which are shown as constituent elements in following by connection:

L_s - serial inductance

R_s - serial resistance

R_i - insulation resistance (parallel resistance)

C - capacitance



The real capacitor has always incorrectnesses as serial inductance L_s and loss resistance R_s and R_i . The inductance can be reduced but not to zero. At certain frequency f_0 the capacitance and inductance reactance are equal:

$$\frac{1}{\omega_0 C} = \omega_0 L$$

where

$$\omega_0 = 2\pi f_0$$

At frequencies higher than f_0 (the resonant frequency) the inductive component prevail. The resistance R_s is the resistance of the capacitor's wires, transitional resistance of electrode contacting, the resistance of capacitor electrodes and polarization losses in capacitor dielectric. Resistance R_i is insulating resistance depending on insulating properties of dielectric in capacitor.

Values R_s and R_i determine losses in capacitor and depend on temperature, frequency, voltage and capacitance and cause heating of capacitor. The resistance R_i is much bigger then the resistance R_s so we can change both resistances only with equivalent serial resistance of capacitor ESR.

The relation between equivalent serial resistance of capacitor ESR and his reactance $1/\omega C$ is dissipation factor of capacitor and is marked with $\tan\delta$.

$$\tan\delta = ESR \cdot \omega \cdot C$$

The values of dissipation factor ($\tan\delta$) are given at single types of capacitors in catalogue.

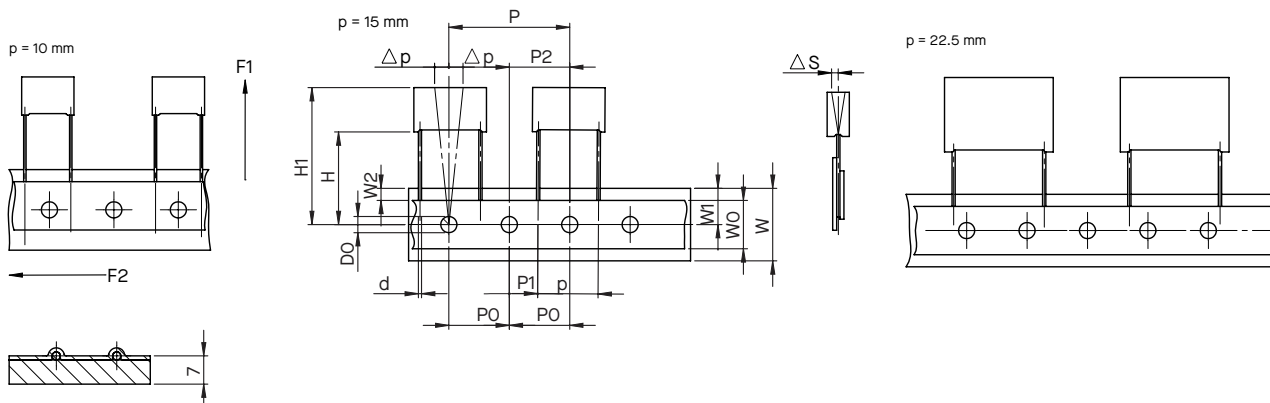
10. Insulation resistance R_i

Insulation resistance of capacitor is given as resistance R_i in $M\Omega$ or as time constant in seconds: $R_i \cdot C_R = M\Omega \cdot \mu F$.

The insulation resistance is the relation between the applied direct voltage and the current, after precise determined time. The limited values for insulation resistance are given for testing time 60 sec. at 20 °C. Test voltages in accordance to rated voltages are as follows:

Rated voltage U_R	Test voltage
< 100 V	10 V
100 V \leq U_R < 500 V	100 V
\geq 500 V	500 V

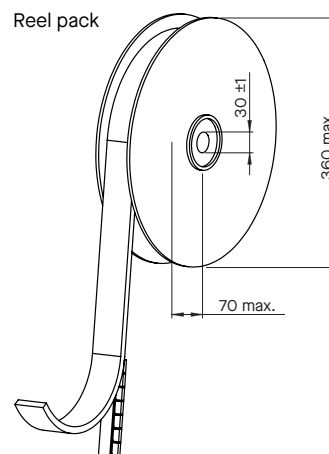
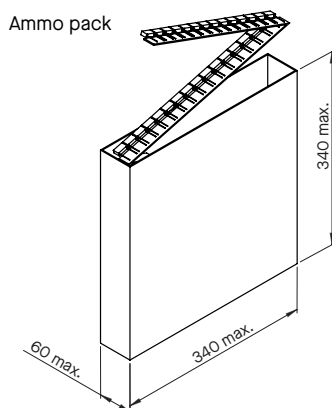
Taping specification for radial capacitors acc. to IEC 60286-2



Description	Symbol	Dimensions (mm)			Tolerances
		Lead spacing 10 mm	Lead spacing 15 mm	Lead spacing 22.5 mm	
Carrier tape width	W	18	18	18	+ 1/-0.5
Hold-down tape width	W ₀	12 or 6	12 or 6	12 or 6	± 0.5
Hotel position	W ₁	9	9	9	± 0.5
Hold-down tape position	W ₂	3	3	3	max
Feed hole diameter	D ₀	4	4	4	± 0.2
Pitch of component	P	25.4	25.4	38.1	± 1
Feed hole pitch	P ₀ *	12.7	12.7	12.7	± 0.2
Feed hole center to lead	P ₁	7.7	5.2	7.8	± 0.7
Feed hole center to component center	P ₂	12.7	12.7	19.5	± 1.3
Height from feed hole center to the component body	H	18.5	18.5	18.5	± 0.5
Component alignment	Δp	0	0	0	± 1.3
	ΔS	0	0	0	± 2
Lead spacing	p	10	15	22.5	+ 0.6/-0.1
Lead wire diameter	d	0.6	0.8	0.8	± 0.5
Total tape thickness	t	0.7	0.7	0.7	± 0.2
Extraction force for components	F ₁	5	5	5	min. (N)
Break force of the tape	F ₂	15	15	15	min. (N)
Component height	H ₁	31	34	39	max

* Cumulative pitch error over any 20 pitches: max. ±1 mm

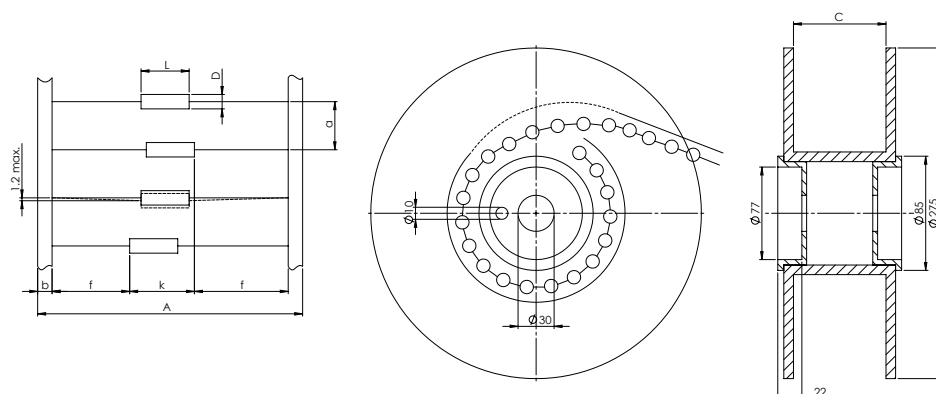
Package units for radial taped film capacitors:



Taped package units

Pitch (mm)	Capacitor thickness b (mm)	Ammo-pack (pcs/box)	Reel-pack (pcs/reel)
10	4; 4.3	900	900
	5	768	700
	6	648	550
15	5	768	600
	5.5	696	600
	6	648	500
	7	552	450
	7.5	504	400
	8.5	444	350
	9	420	350
22.5	6	424	350
	6.5	392	350
	7	368	300
	8.5	304	250
	10	256	200
	10.5	240	200

Taping specification for axial capacitors acc. to IEC 60286-1



Reel packing

Description	Symbol	Dimensions (mm)
Capacitor diameter	D	4.5 – 19.5
Body length of capacitor	L	11 – 33.5
Outer spacing of tapes	A	See table II
Inner reel width	C	See table II
Tape width	b	6 ± 1
Lead length from the capacitor body to the adhesive tape	f	≥ 20 mm
Body location (permissible lateral deviation)	k	$L_{max} + 1.4$
Component spacing	a	See table I
Permissible deviation over 10 spacing	Δa	See table I

Table I

D (mm)	a (mm)	Δa (mm)
≤ 5	5 ± 0.5	± 2
5.1 – 9.5	10 ± 0.5	± 2
9.6 – 14.7	15 ± 0.75	± 3
14.8 – 19.5	20 ± 1	± 4

Table II

L_{max} (mm) body	A (mm)	C (mm)
≤ 11	75 ± 2	77
14 – 21.5	85 ± 2	87
≥ 26.5	95 ± 2	97

METALLIZED POLYESTER CAPACITORS

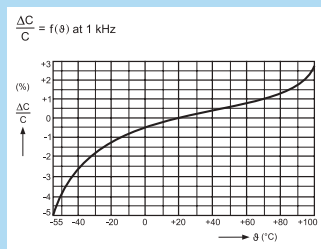
Type KEU

As a dielectric high-quality polyester film with good electrical properties is used. Electrodes of capacitor are vacuum metallized aluminium. The thickness of aluminium is approximately 0.01 μF to 0.04 μF , so the capacitor is self-regenerative after break down. The weak point in dielectric because of non-homogeneous material in some microseconds regenerate with energy of current bow of charged capacitor. In this process metallized layer of aluminium in the area of weak point without any damage of dielectric burns out. The weak point is blameless insulated. Therefore, metallized capacitor withstands breakdowns without a permanent short circuit with considering self-healing resp. regeneration.

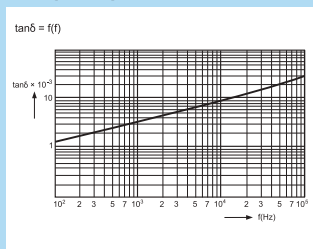
The majority of weak points are cleared during the high voltage burning-out in the manufacturing process. Contact surface is made by spraying the parts of metal contact material. Leads are electrically welded on contact surface. The technology and control system in production assure high liability of capacitors also in use on low voltages and high frequencies. In the case of pulse loading or loading the capacitor with alternative voltage of high gradient of growth is to consider allowed pulse loading du/dt resp. maximal allowed current.

Typical electrical characteristics of metallized polyester capacitors KEU

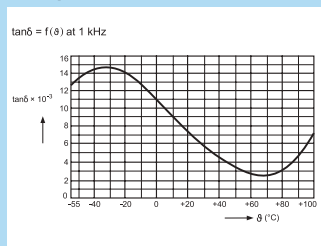
Variation of capacitance as a function of temperature



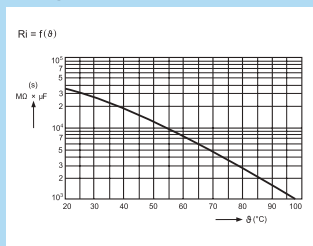
Variation of dissipation factor ($\tan\delta$) as a function of frequency



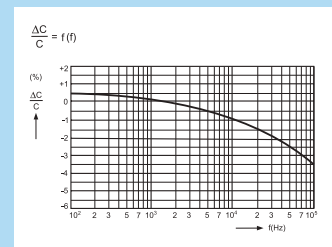
Variation of dissipation factor ($\tan\delta$) as a function of temperature



Variation of insulation resistance as a function of temperature



Variation of capacitance as a function of frequency



METALLIZED POLYESTER CAPACITORS

KEU1910
radial leads, pitch 10 mm to 27.5 mm

Technical data

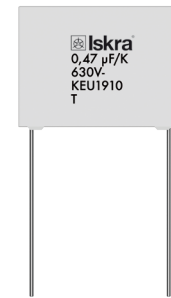
General technical data

Dielectric	polyester (polyethylene terephthalate) film
Electrodes	vacuum metallized aluminium on dielectric
Winding	non-inductive flat shape
Leads	tinned copper wire; standard lengths l1: 4 ^{+0.5} ; 6 ⁻¹ ; 25 ⁺⁵ . Other lead lengths on request.
Encapsulation	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking	Iskra symbol, capacitance, tolerance, rated voltage
Climatic category	55/100/56 and 55/125/56 IEC 60068-1
Temperature range	- 55 °C to + 100 °C and - 55 °C to + 125 °C
Complies with standards	IEC 60384-2

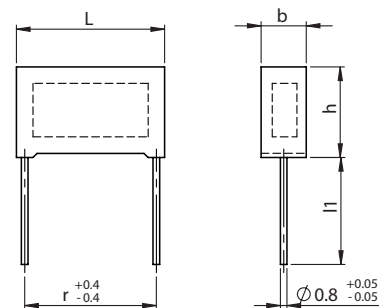
Electrical data

Capacitance range	1000 pF to 22 µF
Standard values of capacitance (C _R)	range E6
Capacitance tolerance	± 20 % (M), ± 10 % (K) and ± 5 % (J) on special request
Rated voltage (U _R)	63 V DC, 100 V DC, 250 V DC, 400 V DC, 630 V DC, 1000 V DC
Allowed alternative voltage up to 60 Hz	40 V AC, 63 V AC, 160 V AC, 200 V AC, 220 V AC, 250 V AC
Category voltage (U _C)	up to + 85 °C U _C = U _R ; from + 85 °C to + 125 °C voltage U _R is lowered for 1.25 % per 1 °C
Test voltage	1.6 x U _R , 2 s
Dissipation factor (tanδ)	≤ 80 × 10 ⁻⁴ at 1 kHz and 20 °C
Self inductance	10 nH/cm length of capacitor and leads
Soldering on printed circuit board	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R _i) at 20 °C	

Rated capacitance C _R (µF)	Min. R _i or R _i × C _R between terminals	
	U _R > 100 V DC	U _R ≤ 100 V DC
≤ 0.33	30000 MΩ	15000 MΩ
> 0.33	10000 s	5000 s



KEU1910 (dimensions in mm)



Diameter of leads

Pitch r (mm)	Diameter of lead ø (mm)
10	0.6
15; 22.5; 27.5	0.8

Pulse loading (du/dt)

U _R (V DC)	Pitch r (mm)			
	10	15	22.5	27.5
	Allowed pulse loading (V/µs)			
63	9	6	3	2.5
100	12	8	5	4
250	22	14	9	7
400	35	20	12	10
630	45	32	17	13
1000	90	45	26	20

METALLIZED POLYESTER CAPACITORS

KEU1910
radial leads, pitch 10 mm to 27.5 mm

Capacitance (μF)	Rated voltage UR																								
	63 V DC				100 V DC				250 V DC				400 V DC				630 V DC				1000 V DC				
	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	
	(mm)				(mm)				(mm)				(mm)				(mm)				(mm)				
0.001																					13	9	4	10	
0.0015																						13	9	4	10
0.0022																						13	9	4	10
0.0033																						13	9	4	10
0.0047																						13	9	4	10
0.0068																						13	9	4	10
0.01														13	9	4	10					13	9	4	10
0.015														13	9	4	10					13	9	4	10
0.022														13	9	4	10					13	10.5	5	10
0.033													13	9	4	10					13	11.5	6	10	
0.047													13	9	4	10					13	9	4	10	
0.068													13	9	4	10					13	10.5	5	10	
0.1													13	9	4	10					13	11.5	6	10	
0.15													13	9	4	10					13	9.5	4.3	10	
0.22	13	9	4	10									13	10.5	5	10					13	10.5	5	10	
0.33	13	9	4	10									13	11.5	6	10									
0.47	13	9	4	10																					
0.68	13	9.5	4.3	10																					
1	13	10.5	5	10																					
1.5	13	11.5	6	10																					
0.01																									
0.015																									
0.022																									
0.033																									
0.047																									
0.068																									
0.1																									
0.15																									
0.22																									
0.33																									
0.47																									
0.68																									
1																									
1.5																									
0.01																									
0.015																									
0.022																									
0.033																									
0.047																									
0.068																									
0.1																									
0.15																									
0.22																									
0.33																									
0.47																									
0.68																									
1																									
1.5																									
2.2																									
3.3																									
4.7																									

Taped version details data see page 9

METALLIZED POLYESTER CAPACITORS

KEU1910
radial leads, pitch 10 mm to 27.5 mm

Capacitance (μF)	Rated voltage UR																							
	63 V DC				100 V DC				250 V DC				400 V DC				630 V DC				1000 V DC			
	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r
	(mm)				(mm)				(mm)				(mm)				(mm)				(mm)			
0.033																	26.5	15	6	22.5				
0.047																	26.5	15	6	22.5				
0.068																	26.5	15	6	22.5				
0.1																26.5	15	6	22.5	26.5	16.5	8.5	22.5	
0.15																26.5	15	6	22.5	26.5	18.5	10	22.5	
0.22													26.5	15	6	22.5	26.5	16	7	22.5				
0.33													26.5	15	6	22.5	26.5	18.5	9	22.5				
0.47								26.5	15	6	22.5	26.5	15	6	22.5	26.5	20.5	11	22.5					
0.68								26.5	15	6	22.5	26.5	16	7	22.5									
1								26.5	15	6	22.5	26.5	18.5	9	22.5									
1.5					26.5	16	7	22.5	26.5	16	7	22.5	26.5	20.5	11	22.5								
2.2					26.5	16.5	8.5	22.5	26.5	18.5	9	22.5												
3.3	26.5	15	6	22.5	26.5	18.5	10	22.5	26.5	20.5	11	22.5												
4.7	26.5	15	6	22.5																				
6.8	26.5	16	7	22.5																				
10	26.5	17	8.5	22.5																				
15	26.5	20.5	11	22.5																				
0.15																				32	17	9	27.5	
0.22																				32	19	10	27.5	
0.33																	32	17	9	27.5	32	22	13	27.5
0.47																	32	19	10	27.5	32	24.5	15	27.5
0.68													32	17	9	27.5	32	21	12	27.5	32	28	18	27.5
1													32	17	9	27.5	32	23.5	14	27.5				
1.5								32	17	9	27.5	32	19	10	27.5	32	26.5	17	27.5					
2.2								32	17	9	27.5	32	21	12	27.5									
3.3								32	19	10	27.5	32	24.5	15	27.5									
4.7					32	20	11	27.5	32	21	12	27.5	32	28	18	27.5								
6.8					32	22	13	27.5	32	24.5	15	27.5												
10	32	17	9	27.5	32	28.5	15	27.5	32	28	18	27.5												
15	32	20	11	27.5																				
22	32	21	12	27.5																				

Taped version details data see page 9

Technical data

General technical data

Dielectric:	polyester (polyethylene terephthalate) film
Electrodes:	vacuum metallized aluminium on dielectric
Winding:	non-inductive construction, cylindrical shape
Leads:	tinned copper wire
Encapsulation:	polyester film, ends sealed with epoxy resin
Marking:	capacitance, tolerance, rated voltage (at larger dimensions also Iskra symbol, type designation)
Climatic category:	55/100/21, IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-2

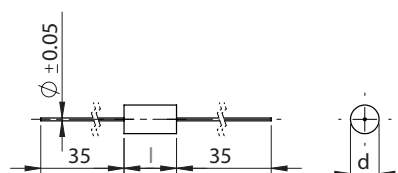
Electrical data

Capacitance range	1000 pF to 10 µF
Standard values of capacitance (C _R)	range E6
Capacitance tolerance	± 20 % (M), ± 10 % (K), and ± 5 % (J) on special request
Rated voltage (U _R)	63 V DC, 100 V DC, 250 V DC, 400 V DC, 630 V DC, 1000 V DC
Allowed alternative voltage up to 60 Hz	440 V AC, 63 V AC, 160 V AC, 200 V AC, 220 V AC, 250 V AC
Category voltage (U _C)	up to + 85 °C U _C = U _R ; from + 85 °C to + 100 °C voltage U _R is lowered for 1.25 % per 1 °C
Test voltage:	1.6 x U _R , 2 s
Dissipation factor (tanδ)	≤ 80 × 10 ⁻⁴ at 1 kHz and 20 °C
Self inductance	10 nH/cm length of capacitor and leads
Soldering on printed circuit board	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R _i) at 20 °C	

Rated capacitance C _R (µF)	Min. R _i or R _i × C _R between terminals	
	U _R > 100 V DC	U _R ≤ 100 V DC
≤ 0.33	30000 MΩ	15000 MΩ
> 0.33	10000 s	5000 s



KEU1012 (dimensions in mm)



Diameter of leads

Pitch I _{max} (mm)	Diameter of lead ø (mm)
11; 14; 19	0.6
26.5; 31.5	0.8

Pulse loading (du/dt)

U _R (V DC)	I _{max} (mm)				
	11	14	19	26.5	31.5
Allowed pulse loading (V/µs)					
63	12	9	6	3	2.5
100	18	12	8	5	4
250	32	22	14	9	7
400	55	35	20	12	10
630	70	45	32	17	13
1000	-	90	45	26	20

Capacitance (μF)	Rated voltage UR											
	63 V DC		100 V DC		250 V DC		400 V DC		630 V DC		1000 V DC	
	$d_{\text{max.}}$	$l_{\text{max.}}$	$d_{\text{max.}}$	$l_{\text{max.}}$	$d_{\text{max.}}$	$l_{\text{max.}}$	$d_{\text{max.}}$	$l_{\text{max.}}$	$d_{\text{max.}}$	$l_{\text{max.}}$	$d_{\text{max.}}$	$l_{\text{max.}}$
	(mm)		(mm)		(mm)		(mm)		(mm)		(mm)	
0.001									5	11	5	14
0.0015									5	11	5	14
0.0022									5	11	5	14
0.0033									5	11	5.5	14
0.0047									5	11	6	14
0.0068									5.5	11	7	14
0.01							5	11	5	14	6	19
0.015							5	11	5.5	14	6.5	19
0.022							5	11	6.5	14	7.5	19
0.033							5.5	11	6	19	8.5	19
0.047					5	11	5.5	14	6.5	19	10	19
0.068			5	11	5.5	11	6	14	7.5	19	9	26.5
0.1			5	11	5.5	14	7	14	9	19	10.5	26.5
0.15	5	11	5	11	6	14	6.5	19	8.5	26.5	11.5	31.5
0.22	5	11	6	11	7	14	7.5	19	10	26.5	13.5	31.5
0.33	5.5	11	6	14	6.5	19	9	19	12	26.5	16	31.5
0.47	6	14	6.5	14	7.5	19	8.5	26.5	12.5	31.5	18.5	31.5
0.68	6	14	7.5	14	8.5	19	10	26.5	14.5	31.5		
1	7	14	7	19	8.5	26.5	10.5	31.5	17.5	31.5		
1.5	6.5	19	8.5	19	10	26.5	12.5	31.5				
2.2	7.5	19	9.5	19	11	31.5	15	31.5				
3.3	9	19	9.5	26.5	13	31.5	18	31.5				
4.7	9	26.5	11	26.5	15	31.5						
6.8	10	26.5	12	31.5	18	31.5						
10	10.5	31.5	14	31.5	21	31.5						

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POLYPROPYLENE CAPACITORS

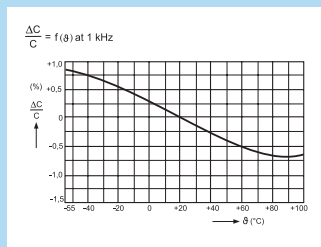
Type KLI

18

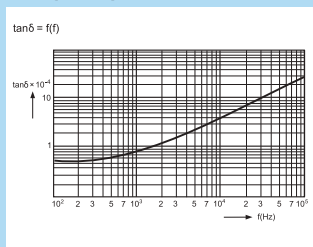
As a dielectric a high-quality polypropylene film with excellent electrical properties is used. The electrodes are of aluminium foil and vacuum evaporated metal on polypropylene film for internal serial connection. Winding is extended foil design and enables contacting of leads on aluminium electrodes for high currents. Capacitors are suitable for operating in pulse circuits (for instance in TV sets in thyristor or transistor deflection steps) where high pulse loading appear.

Typical electrical characteristics of polypropylene polyester capacitors KLI

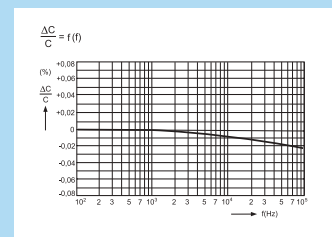
Variation of capacitance as a function of temperature



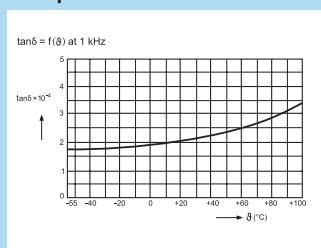
Variation of dissipation factor ($\tan\delta$) as a function of frequency



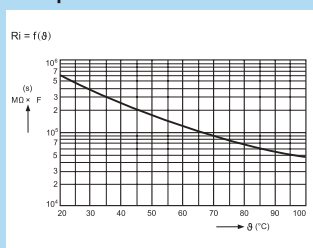
Variation of capacitance as a function of frequency



Variation of dissipation factor ($\tan\delta$) as a function of temperature



Variation of insulation resistance as a function of temperature



POLYPROPYLENE CAPACITORS

KLI1910
radial leads, pitch 10 mm to 27.5 mm

Technical data

General technical data

Dielectric	polypropylene film
Electrodes	metal foil; metal foil and metallized polypropylene film (internal series connection for $U_R \geq 630V$ DC and $r \geq 15$ mm)
Winding	non-inductive construction, flat shape
Leads	tinned copper wire, standard lengths l_1 : 4 ^{±0.5} ; 6 ⁻¹ ; 25 ^{±5} . Other lead lengths on request.
Encapsulation	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking	Iskra symbol, capacitance, tolerance, rated voltage, type designation
Climatic category	55/100/56 IEC 60068-1
Temperature range	- 55 °C to + 100 °C
Complies with standards	IEC 60384-13; IEC 60384-16

Electrical data

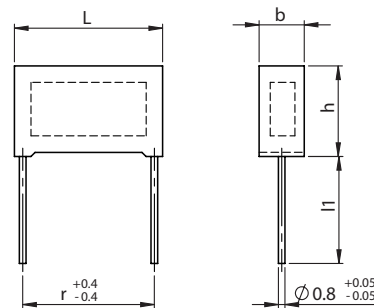
Capacitance range	100 pF to 0.22 µF
Standard values of capacitance (C_R)	range E6 and E12
Capacitance tolerance	± 20 % (M), ± 10 % (K) and ± 5 % (J)
Rated voltage (U_R)	100 V DC, 160 V DC, 250 V DC, 400 V DC, 630 V DC, 1000 V DC, 1600 V DC, 2000 V DC
Allowed alternative voltage up to 60 Hz	63 V AC, 90 V AC, 125 V AC, 160 V AC, 200 V AC (for 630 V DC, $r \leq 10$ mm), 300 V AC, 400 V AC, 500 V AC, 600 V AC
Category voltage (U_C)	up to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1.25 % per 1 °C
Test voltage	2 x U_R (for $U_R \leq 630$ V), 2 s; 1.6 x U_R (for $U_R \geq 630$ V and $r \geq 15$ mm), 2 s
Dissipation factor ($\tan\delta$)	$\leq 5 \times 10^{-4}$ at 1 kHz and 20 °C $\leq 6 \times 10^{-4}$ at 10 kHz and 20 °C $\leq 10 \times 10^{-4}$ at 100 kHz and 20 °C for $C_R \leq 0.1$ µF.
Soldering on printed circuit board	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R_i) at 20 °C	≥ 100000 MΩ

Pulse loading (du/dt)

U_R (V DC)	Pitch r (mm)			
	10	15	22.5	27.5
	Allowed pulse loading (V/µs)			
100	4500	2200	-	-
160	5500	2700	-	-
250	9300	4500	-	-
400	13000	6100	-	-
630	16000	8000	3500	270
1000	-	10900	4700	3600
1600	-	16400	8200	6100
2000	-	20500	10200	7700



KLI1910 (dimensions in mm)



Diameter of leads

Pitch r (mm)	Diameter of leads ϕ (mm)
10	0.6
15; 22.5; 27.5	0.8

Typical application:

Switching circuits in electronic ballast; applications with high voltage and very high current.

Dimensional data - r10 mm: KLI1910

Capacitance (µF)	Rated voltage UR																			
	100 V DC/63 V AC				160 V DC/90V AC				250 V DC/125V AC				400 V DC/160V AC				630V DC/200V AC			
	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>
	(mm)				(mm)				(mm)				(mm)				(mm)			
0.0015																	13	9	4	10
0.0022													13	9	4	10	13	10.5	5	10
0.0033									13	9	4	10	13	10.5	5	10	13	11.5	6	10
0.0047									13	9	4	10	13	10.5	5	10	13	12	6	10
0.0068					13	9	4	10	13	10.5	5	10	13	11.5	6	10				
0.01					13	9	4	10	13	11.5	6	10								
0.015	13	9	4	10	13	10.5	5	10												
0.022	13	10.5	5	10	13	11.5	6	10												
0.033	13	11.5	6	10																

Taped version details data see page 9

Dimensional data - r15 mm: KLI1910

Capacitance (µF)	Rated voltage UR															
	100 V DC/63 V AC				160 V DC/90V AC				250 V DC/125V AC				400 V DC/160V AC			
	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>	<i>l</i> _{max.}	<i>h</i> _{max.}	<i>b</i> _{max.}	<i>r</i>
	(mm)				(mm)				(mm)				(mm)			
0.01													18	11	5	15
0.015									18	11	5	15	18	12	6	15
0.022									18	11	5.5	15	18	13.5	7.5	15
0.033					18	11	5	15	18	12	7	15	18	16.5	8.5	15
0.047	18	11	5	15	18	11	5.5	15	18	13.5	7.5	15	18	18.5	9	15
0.068	18	12	6	15	18	12	7	15								
0.1	18	12	7	15	18	13.5	7.5	15								
0.15	18	14.5	8.5	15												

Taped version details data see page 9

Dimensional data - r15 mm - Internal series connection: KLI1910

Capacitance (µF)	Rated voltage UR															
	630 V DC/300 V AC				1000 V DC/400 V AC				1600 V DC/500 V AC				2000 V DC/600 V AC			
	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r
	(mm)				(mm)				(mm)				(mm)			
0.001					18	11	5	15	18	11	5	15	18	11	5	15
0.0012					18	11	5	15	18	11	5	15	18	11	5	15
0.0015					18	11	5	15	18	11	5	15	18	11	5	15
0.0018					18	11	5	15	18	11	5	15	18	11	5	15
0.0022					18	11	5	15	18	11	5	15	18	11	5.5	15
0.0027					18	11	5	15	18	11	5	15	18	12	6	15
0.0033	18	11	5	15	18	11	5	15	18	11	5.5	15	18	13	7	15
0.0039	18	11	5	15	18	11	5	15	18	12	6	15	18	13	7	15
0.0047	18	11	5	15	18	11	5	15	18	13	7	15	18	14.5	8.5	15
0.0056	18	11	5	15	18	11	5	15	18	13	7	15	18	14.5	8.5	15
0.0068	18	11	5	15	18	11	5.5	15	18	13.5	7.5	15				
0.0082	18	11	5	15	18	12	6	15	18	14.5	8.5	15				
0.01	18	11	5.5	15	18	13	7	15								
0.012	18	12	6	15	18	13.5	7.5	15								
0.015	18	13	7	15	18	14.5	8.5	15								
0.018	18	13	7	15	18	16.5	8.5	15								
0.022	18	14.5	8.5	15												
0.027	18	16.5	8.5	15												

Taped version details data see page 9

Dimensional data - r22.5 mm - Internal series connection: KLI1910

Capacitance (µF)	Rated voltage UR															
	630 V DC/300 V AC				1000 V DC/400 V AC				1600 V DC/500 V AC				2000 V DC/600 V AC			
	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r
	(mm)				(mm)				(mm)				(mm)			
0.0068													26.5	15	6	22.5
0.0082													26.5	16	7	22.5
0.01									26.5	15	6	22.5	26.5	16.5	7.5	22.5
0.012									26.5	16	7	22.5	26.5	17	8.5	22.5
0.015									26.5	16.5	7.5	22.5	26.5	18.5	9	22.5
0.018									26.5	17	8.5	22.5	26.5	20.5	11	22.5
0.022					26.5	15	6	22.5	26.5	18.5	9	22.5				
0.027					26.5	16	7	22.5	26.5	20.5	11	22.5				
0.033	26.5	15	6	22.5	26.5	16	7	22.5								
0.039	26.5	15	6	22.5	26.5	17	8.5	22.5								
0.047	26.5	16	7	22.5	26.5	18.5	9	22.5								
0.056	26.5	16.5	7.5	22.5	26.5	18.5	10	22.5								
0.068	26.5	17	8.5	22.5	26.5	20.5	11	22.5								
0.082	26.5	18.5	9	22.5												
0.1	26.5	20.5	11	22.5												

Taped version details data see page 9



Dimensional data - r27.5 mm - Internal series connection: KLI1910

Capacitance (μ F)	Rated voltage UR															
	630 V DC/300 V AC				1000 V DC/400 V AC				1600 V DC/500 V AC				2000 V DC/600 V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
	(mm)				(mm)				(mm)				(mm)			
0.022													32	19	10	27.5
0.027													32	20	11	27.5
0.033									32	19	10	27.5	32	21	12	27.5
0.039									32	20	11	27.5	32	23.5	14	27.5
0.047									32	21	12	27.5	32	24.5	15	27.5
0.056									32	23.5	14	27.5				
0.068									32	24.5	15	27.5				
0.082					32	19	10	27.5	32	26.5	17	27.5				
0.1					32	21	12	27.5	32	28	18	27.5				
0.12	32	19	10	27.5	32	21	12	27.5								
0.15	32	20	11	27.5	32	23.5	14	27.5								
0.18	32	21	12	27.5	32	26.5	17	27.5								
0.22	32	23.5	14	27.5	32	26.5	17	27.5								

Taped version details data see page 9

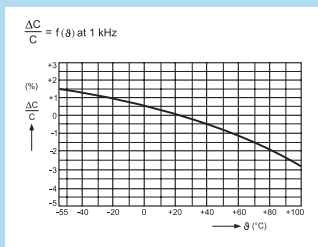
METALLIZED POLYPROPYLENE CAPACITORS

Type KNI

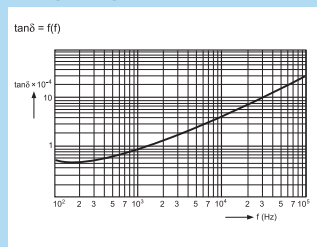
As a dielectric a high-quality polypropylene film of excellent electrical properties is used. Electrodes of capacitors are of double sides vacuum metallized aluminium on polyester film. Winding is cylindrical extended foil design. Such construction enables both very good contacting and the ability to translate higher currents. The capacitor has the property to regenerate after break-down. Capacitors are suitable for use in high pulse loading (for instance in TV sets for "S" correction) because of self-regenerative properties and low loss angle, where common types of metallized capacitors do not comply the requirements.

Typical electrical characteristics of metallized polypropylene capacitors KNI

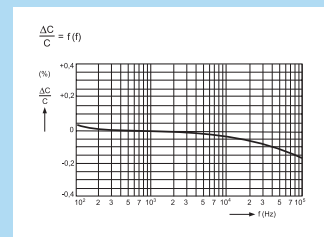
Variation of capacitance as a function of temperature



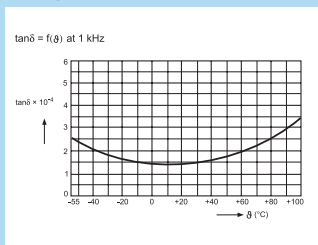
Variation of dissipation factor ($\tan\delta$) as a function of frequency



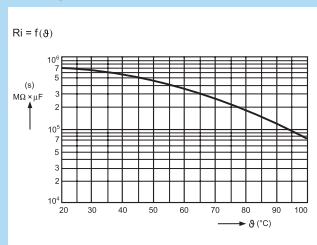
Variation of capacitance as a function of frequency



Variation of dissipation factor ($\tan\delta$) as a function of temperature



Variation of insulation resistance as a function of temperature



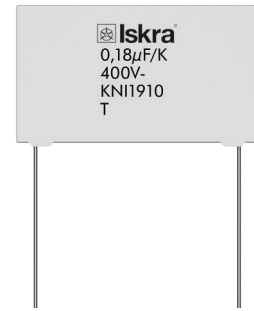
Technical data

General technical data	
Dielectric	polypropylene film
Electrodes	double-sided metallized polyester film and metallized polypropylene film (internal series connection for $U_R \geq 630V$ DC and $r \geq 15mm$)
Winding	non-inductive construction, flat shape
Leads	tinned copper wire, standard lengths l_1 : 4 ^{+0.5} ; 6 ⁻¹ ; 25 ⁺⁵ . Other lead lengths on request.
Encapsulation	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking	Iskra symbol, capacitance, tolerance, rated voltage, type designation
Climatic category	55/100/56 IEC 60068-1
Temperature range	- 55 °C to + 100 °C
Complies with standards	IEC 60384-16; IEC 60384-17

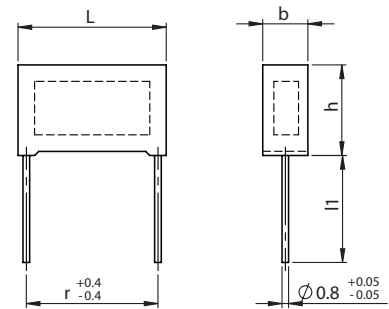
Electrical data	
Capacitance range	680 pF to 2.2 μ F
Standard values of capacitance (C_R)	range E12
Capacitance tolerance	$\pm 20\%$ (M), $\pm 10\%$ (K) and $\pm 5\%$ (J)
Rated voltage (U_R)	250 V DC, 400 V DC, 630 V DC, 1000 V DC, 1600 V DC, 2000 V DC
Allowed alternative voltage up to 60 Hz	180 V AC, 250 V AC, 300 V AC, 400 V AC, 500V AC, 630 V AC, 650 V AC
Category voltage (U_C)	up to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1.25 % per 1 °C
Test voltage	1.6 \times U_R , 2 s
Dissipation factor ($\tan\delta$)	$\leq 3 \times 10^{-4}$ at 1 kHz and 20 °C, $\leq 6 \times 10^{-4}$ at 10 kHz and 20 °C for $C_R \leq 1 \mu F$ $\leq 15 \times 10^{-4}$ at 100 kHz and 20 °C for $C_R \leq 0.1\mu F$.
Soldering on printed circuit board	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R_i) at 20 °C	$\geq 100000 M\Omega$ at 20 °C for $C_R \leq 0.33 \mu F$ $R_i \times C_R \geq 30000$ s at 20 °C for $C_R > 0.33 \mu F$

Pulse loading (du/dt)

U_R (V DC)	Pitch r (mm)			
	10	15	22.5	27.5
	Allowed pulse loading (V/ μ s)			
250	1100	750	450	300
400	1600	1000	600	500
630	1800	2500	1500	1000
1000	-	3200	2000	1200
1600	-	4500	2500	1800
2000	-	7000	3200	2200



KN1910
(dimensions in mm)



Diameter of leads

Pitch (mm)	Diameter of leads ϕ (mm)
10	0.6
15; 22.5; 27.5	0.8

Typical application:

Deflection circuits in TV-sets; protection circuits in SMPS (switch mode power supplies) and in electronic ballast; applications with high voltage and current.

Dimensional data - r10 mm: KNI1910

Capacitance (μ F)	Rated voltage UR											
	250 V DC/180 V AC				400 V DC/250 V AC				630 V DC/300 V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
	(mm)				(mm)				(mm)			
0.001									13	9	4	10
0.0012									13	9	4	10
0.0015									13	9	4	10
0.0018									13	9	4	10
0.0022									13	9	4	10
0.0027									13	9	4	10
0.0033									13	9	4	10
0.0039									13	9	4	10
0.0047									13	9	4	10
0.0056									13	9	4	10
0.0068									13	9	4	10
0.0082									13	9	4	10
0.01	13	9	4	10	13	9	4	10	13	9	4	10
0.012	13	9	4	10	13	9	4	10	13	9	4	10
0.015	13	9	4	10	13	9	4	10	13	9	4	10
0.018	13	9	4	10	13	9	4	10	13	10.5	5	10
0.022	13	9	4	10	13	9.5	4.3	10	13	10.5	5	10
0.027	13	9	4	10	13	10.5	5	10	13	11.5	6	10
0.033	13	10.5	4	10	13	10.5	5	10	13	12	6	10
0.039	13	10.5	4	10	13	11.5	6	10	13	12	6	10
0.047	13	11.5	4	10	13	12	6	10				
0.056	13	11.5	4	10								
0.068	13	12	4	10								



Dimensional data - r15 mm: KN11910

Capacitance (µF)	Rated voltage UR																										
	250V DC/180V AC				400V DC/250V AC				630V DC/400V AC				1000V DC/500V AC				1600V DC/630V AC				2000V DC/650V AC						
	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r	l _{max.}	h _{max.}	b _{max.}	r			
	(mm)				(mm)				(mm)				(mm)				(mm)										
0.001																	18	11	5	15	18	11	5	15			
0.0012																	18	11	5	15	18	11	5	15			
0.0015																	18	11	5	15	18	11	5	15			
0.0018																	18	11	5	15	18	11	5	15			
0.0022																	18	11	5	15	18	11	5	15			
0.0027																	18	11	5	15	18	11	5	15			
0.0033												18	11	5	15	18	11	5	15	18	11	5.5	15				
0.0039												18	11	5	15	18	11	5	15	18	12	6	15				
0.0047												18	11	5	15	18	11	5.5	15	18	12	7	15				
0.0056												18	11	5	15	18	12	6	15	18	13	7	15				
0.0068												18	11	5	15	18	12	7	15	18	13.5	7.5	15				
0.0082												18	11	5	15	18	13	7	15	18	14.5	8.5	15				
0.01												18	11	5	15	18	11	5.5	15	18	13.5	7.5	15	18	16	9.5	15
0.012												18	11	5	15	18	12	6	15	18	14.5	8.5	15	18	18.5	9	15
0.015												18	12	6	15	18	12	7	15	18	16	9.5	15	18	18.5	11	15
0.018												18	12	7	15	18	13	7	15	18	18.5	9	15				
0.022												18	13	7	15	18	14.5	8.5	15	18	18.5	11	15				
0.027												18	13.5	7.5	15	18	16.5	8.5	15	18	20	12.5	15				
0.033								18	11	5	15	18	14.5	8.5	15	18	18.5	9	15								
0.039								18	11	5	15	18	16.5	8.5	15	18	18.5	11	15								
0.047	18	11	5	15	18	11	5	15	18	18.5	9	15															
0.056	18	11	5	15	18	11	5	15	18	18.5	11	15															
0.068	18	11	5	15	18	12	6	15	18	20	12.5	15															
0.082	18	11	5.5	15	18	12	6	15																			
0.1	18	12	6	15	18	13	7	15																			
0.12	18	12	7	15	18	13.5	7.5	15																			
0.15	18	13.5	7.5	15	18	14.5	8.5	15																			
0.18	18	14.5	8.5	15	18	16.5	8.5	15																			
0.22	18	16.5	8.5	15	18	18.5	9	15																			
0.27	18	18.5	9	15																							
0.33	18	18.5	11	15																							
0.39	18	20	12.5	15																							

Dimensional data - r22.5 mm: KNI1910

Capacitance (μ F)	Rated voltage UR																							
	250V DC/180V AC				400V DC/250V AC				630V DC/400V AC				1000V DC/500V AC				1600V DC/630V AC				2000V DC/650V AC			
	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r
	(mm)				(mm)				(mm)				(mm)				(mm)							
0.0033																	26.5	14	6	22.5				
0.0039																	26.5	14	6	22.5				
0.0047																	26.5	14	6	22.5				
0.0056																	26.5	14	6	22.5				
0.0068																	26.5	14	6	22.5				
0.0082																	26.5	14	6	22.5				
0.01																26.5	14	6	22.5	26.5	15	6	22.5	
0.012																26.5	14	6	22.5	26.5	15.5	7.5	22.5	
0.015																26.5	15	6	22.5	26.5	16.5	8.5	22.5	
0.018																26.5	15.5	7.5	22.5	26.5	17	8.5	22.5	
0.022													26.5	14	6	22.5	26.5	16.5	7.5	22.5	26.5	18.5	10	22.5
0.027													26.5	14	6	22.5	26.5	17	8.5	22.5	26.5	20.5	11	22.5
0.033								26.5	14	6	22.5	26.5	15	6	22.5	26.5	18.5	10	22.5	26.5	21.5	12.5	22.5	
0.039								26.5	15	6	22.5	26.5	16	7	22.5	26.5	20.5	11	22.5					
0.047								26.5	16	7	22.5	26.5	16.5	8.5	22.5	26.5	21.5	12.5	22.5					
0.056								26.5	16.5	7.5	22.5	26.5	17	8.5	22.5	26.5	21.5	12.5	22.5					
0.068								26.5	17	8.5	22.5	26.5	18.5	10	22.5									
0.082								26.5	18.5	9	22.5	26.5	20.5	11	22.5									
0.1								26.5	18.5	10	22.5	26.5	21.5	12.5	22.5									
0.12					26.5	14	6	22.5	26.5	20.5	11	22.5												
0.15					26.5	14	6	22.5	26.5	21.5	12.5	22.5												
0.18	26.5	14	6	22.5	26.5	15	6	22.5																
0.22	26.5	15	6	22.5	26.5	16	7	22.5																
0.27	26.5	16	7	22.5	26.5	16.5	8.5	22.5																
0.33	26.5	16.5	8.5	22.5	26.5	18.5	9	22.5																
0.39	26.5	17	8.5	22.5	26.5	18.5	10	22.5																
0.47	26.5	18.5	9	22.5	26.5	20.5	11	22.5																
0.56	26.5	18.5	10	22.5																				
0.68	26.5	20.5	11	22.5																				
0.82	26.5	21.5	12.5	22.5																				

Dimensional data - r27.5 mm: KN1910

Capacitance (μ F)	Rated voltage UR																											
	250V DC/180V AC				400V DC/250V AC				630V DC/400V AC				1000V DC/500V AC				1600V DC/630V AC				2000V DC/650V AC							
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{mvax.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r				
	(mm)				(mm)				(mm)				(mm)				(mm)				(mm)							
0.022																					32	17	9	27.5				
0.027																					32	17	11	27.5				
0.033																					32	17	9	27.5	32	17	11	27.5
0.039																					32	17	9	27.5	32	20	11	27.5
0.047																					32	17	11	27.5	32	21	12	27.5
0.056																					32	20	11	27.5	32	22	13	27.5
0.068													32	17	9	27.5	32	21	12	27.5	32	24.5	15	27.5				
0.082													32	17	11	27.5	32	22	13	27.5	32	26.5	17	27.5				
0.1													32	17	11	27.5	32	24.5	15	27.5	32	28	18	27.5				
0.12													32	20	11	27.5	32	26.5	17	27.5								
0.15									32	20	11	27.5	32	22	13	27.5	32	28	18	27.5								
0.18									32	21	12	27.5	32	23.5	14	27.5												
0.22									32	23.5	14	27.5	32	24.5	15	27.5												
0.27									32	24.5	15	27.5	32	26.5	17	27.5												
0.33									32	26.5	17	27.5	32	28	18	27.5												
0.39					32	17	9	27.5	32	28	18	27.5																
0.47					32	17	11	27.5																				
0.56	32	17	9	27.5	32	20	11	27.5																				
0.68	32	17	11	27.5	32	20	11	27.5																				
0.82	32	20	11	27.5	32	22	13	27.5																				
1	32	21	12	27.5	32	23.5	14	27.5																				
1.2	32	22	13	27.5	32	24.5	15	27.5																				
1.5	32	24.5	15	27.5	32	26.5	17	27.5																				
1.8	32	26.5	17	27.5	32	28	18	27.5																				
2.2	32	26.5	17	27.5																								

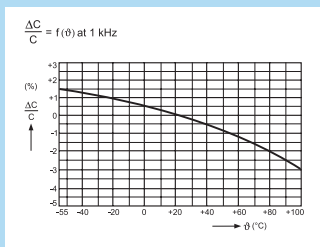
METALLIZED POLYPROPYLENE CAPACITORS

Type KNU, KNC

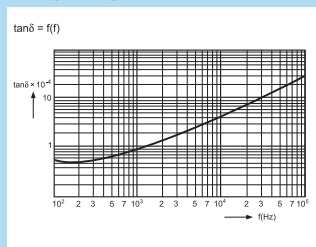
As a dielectric a high-quality polypropylene film of excellent electrical properties is used. Electrodes are of vacuum evaporated metal on dielectric. Leads are electrically welded on contact surface of capacitors. As a result, the possibility for bad contact or even loss of contact during the operation of capacitors is excluded.

Typical electrical characteristics of metallized polypropylene capacitors KNU, KNC

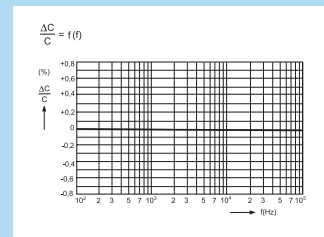
Variation of capacitance as a function of temperature



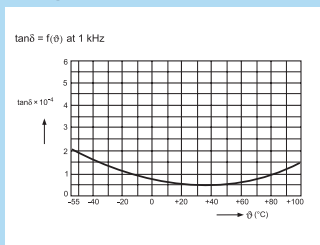
Variation of dissipation factor ($\tan\delta$) as a function of frequency



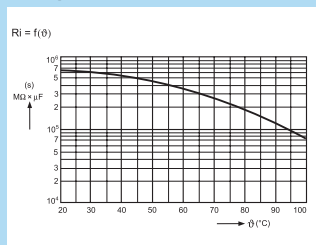
Variation of capacitance as a function of frequency



Variation of dissipation factor ($\tan\delta$) as a function of temperature



Variation of insulation resistance as a function of temperature



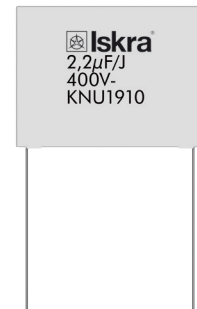
METALLIZED POLYPROPYLENE CAPACITORS

KNU1910
radial leads, pitch 10 mm to 27.5 mm

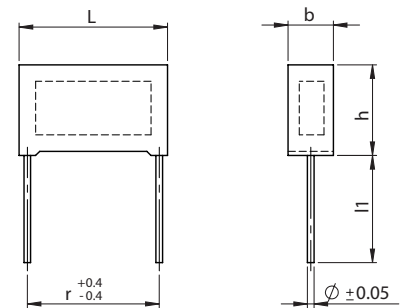
Technical data

General technical data

Dielectric	polypropylene film
Electrodes	vacuum metallized on dielectric
Winding	non-inductive construction, flat shape
Leads	tinned copper wire, standard lengths l: 4 ^{±0.5} ; 6 ⁻¹ ; 25 ^{±5} . Other lead lengths on request.
Encapsulation	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-O, resistant to wash in halogenated solvents
Marking	Iskra symbol, capacitance, tolerance, rated voltage, type designation
Climatic category	55/100/56 and 55/125/56 IEC 60068-1
Temperature range	- 55 °C to + 100 °C and - 55 °C to + 125 °C
Complies with standards	IEC 60384-16



KNU1910 (dimensions in mm)



Electrical data

Capacitance range	1000 pF to 6.8 µF
Standard values of capacitance (C _R)	range E6
Capacitance tolerance	± 20 % (M), ± 10 % (K) and ± 5 % (J) on special request
Temperature coefficient of capacitance (T _C)	appr. - 200 × 10 ⁻⁶ / °C
Rated voltage (U _R)	250 V DC, 400 V DC, 630 V DC, 1000 V DC, 1600 V DC
Allowed alternative voltage up to 60 Hz	160 V AC, 220 V AC, 250 V AC, 300 V AC, 500 V AC
Category voltage (U _C)	up to + 85 °C U _C = U _R ; from + 85 °C to + 125 °C voltage U _R is lowered for 1.35 % per 1 °C
Test voltage	1.6 × U _R , 2 s
Insulation resistance (R _i) at 20 °C	≥ 100000 MΩ at 20 °C for C _R ≤ 0.33 µF R _i × C _R ≥ 30000 s at 20 °C for C _R > 0.33 µF
Self inductance	approx. 10 nH/cm length of capacitor and leads
Soldering on printed circuit board	temperature of soldering bath 270 °C max., soldering time 5 s max.

Diameter of leads

r (mm)	Diameter of leads ø (mm)
10	0.6
15; 22.5; 27.5	0.8

Pulse loading (du/dt)

U _R (V DC)	Pitch r (mm)			
	10	15	22.5	27.5
	Allowed pulse loading (V/µs)			
250	180	120	60	45
400	200	150	90	65
630	230	180	120	90
1000	-	210	130	100
1600	-	450	190	140

Dissipation factor (tan)

f (kHz)	C _R ≤ 0.1 µF	0.1 µF < C _R ≤ 1 µF	C _R > 1 µF
1	≤ 5 × 10 ⁻⁴	≤ 5 × 10 ⁻⁴	≤ 5 × 10 ⁻⁴
10	≤ 10 × 10 ⁻⁴	≤ 20 × 10 ⁻⁴	-
100	≤ 30 × 10 ⁻⁴	-	-

Dimensional data: KNU1910

Capacitance (μ F)	Rated voltage U_R																			
	250 V DC				400 V DC				630 V DC				1000 V DC				1600 V DC			
	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{max}	b_{max}	r	l_{max}	h_{mvax}	b_{max}	r
	(mm)				(mm)				(mm)				(mm)				(mm)			
0.001																	18	11	5	15
0.0015																	18	11	5	15
0.0022																	18	11	5	15
0.0033																	18	11	5	15
0.0047									13	9	4	10					18	11	5	15
0.0068									13	9	4	10					18	11	5	15
0.01					13	9	4	10	13	9	4	10	18	11	5	15	18	11	5.5	15
0.015					13	9	4	10	13	9.5	4.3	10	18	11	5	15	18	13	7	15
0.022	13	9	4	10	13	9	4	10	13	10.5	5	10	18	11	5	15	18	14.5	8.5	15
0.033	13	9	4	10	13	9.5	4.3	10	13	11.5	6	10	18	11	5.5	15	26.5	15	6	22.5
0.047	13	9	4	10	13	10.5	5	10	18	11	5	15	18	13	7	15	26.5	16	7	22.5
0.068	13	9.5	4.3	10	13	11.5	6	10	18	11	5.5	15	18	13.5	7.5	15	26.5	18.5	9	22.5
0.1	13	10.5	5	10	18	11	5	15	18	13	7	15	26.5	15	6	22.5	26.5	20.5	11	22.5
0.15	13	11.5	6	10	18	11	5.5	15	18	14.5	8.5	15	26.5	16.5	7.5	22.5	31.5	21	12	27.5
0.22	18	11	5	15	18	13	7	15	26.5	15	6	22.5	26.5	18.5	9	22.5	31.5	23.5	14	27.5
0.33	18	12	6	15	18	14.5	8.5	15	26.5	16.5	7.5	22.5	31.5	19	10	27.5	31.5	26.5	17	27.5
0.47	18	13	7	15	26.5	16	7	22.5	26.5	18.5	9	22.5	31.5	21	12	27.5				
0.68	18	14.5	9	15	26.5	17	8.5	22.5	26.5	20.5	11	22.5	31.5	23.5	14	27.5				
1	26.5	15	6	22.5	26.5	18.5	10	22.5	31.5	21	12	27.5	31.5	26.5	17	27.5				
1.5	26.5	17	8.5	22.5	31.5	19	10	27.5												
2.2	26.5	20.5	11	22.5	31.5	23.5	14	27.5												
3.3	31.5	21	12	27.5																
4.7	31.5	23.5	14	27.5																
6.8	31.5	26.5	17	27.5																

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METALLIZED POLYPROPYLENE CAPACITORS

KNC1910
radial leads, pitch 10 mm to 22.5 mm

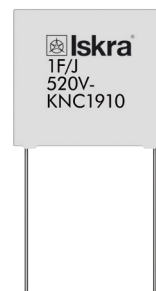
Technical data

General technical data

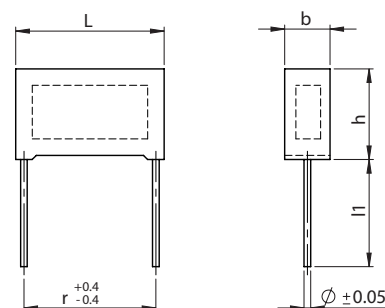
Dielectric	polypropylene film
Electrodes	vacuum metallized on dielectric
Winding	non-inductive construction, flat shape
Leads	tinned copper wire, standard lengths l: 4 ^{±0.5} ; 6 ⁻¹ ; 25 ^{±5} . Other lead lengths on request.
Encapsulation	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-O, resistant to wash in halogenated solvents
Marking	Iskra symbol, capacitance, tolerance, rated voltage, type designation
Climatic category	55/110/56 IEC 60068-1
Temperature range	- 55 °C to + 110 °C
Complies with standards	IEC 60384-16

Electrical data

Capacitance range	68 nF to 5.6 µF
Capacitance tolerance	± 20 % (M), ± 10 % (K) and ± 5 % (J) on special request
Rated voltage (U _R)	450 V DC, 520 V DC, 630 V DC
Temperature coefficient of capacitance (T _C)	approx. -200 × 10 ⁻⁶ / °C
Allowed alternative voltage up to 60 Hz	160 V AC, 200 V AC
Category voltage (U _C):	up to + 85 °C U _C = U _R ; from + 85 °C to + 110 °C voltage U _R is lowered for 1.35 % per 1 °C
Test voltage	1.6 × U _R , 2 s
Self inductance	approx. 10 nH/cm length of capacitor and leads
Soldering on printed circuit board	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R _i) at 20 °C:	≥ 30000 MΩ at 20 °C for C _R ≤ 0.33 µF R _i × C _R ≥ 10000 s at 20 °C for C _R > 0.33 µF
Dissipation factor (tanδ)	≤ 10 × 10 ⁻⁴ at 1 kHz and 20 °C



KNC1910 (dimensions in mm)



Diameter of leads

r (mm)	Diameter of leads Ø (mm)
10	0.6
15; 22.5	0.8

Pulse loading (du/dt)

U _R (V DC)	Pitch r (mm)		
	10	15	22.5
	Allowed pulse loading (V/µs)		
450	165	110	65
520	220	150	90
630	250	165	100

Capacitance (μF)	Rated voltage U_R			
	450 V DC			
	$l_{\text{max.}}$	$h_{\text{max.}}$	$b_{\text{max.}}$	r
	(mm)			
0.12	13	9	4	10
0.15	13	9	4	10
0.18	13	10.5	5	10
0.22	13	10.5	5	10
0.27	13	11	5.5	10
0.33	13	12	6	10
0.39	13	12	6	10
0.47	13	12	6	10
0.33	18	11	5	15
0.39	18	11	5	15
0.47	18	11	5	15
0.56	18	11	5.5	15
0.68	18	12	6	15
0.82	18	13	7	15
1	18	13.5	7.5	15
1.2	18	14.5	9	15
1.5	18	16.5	8.5	15
1.8	18	16	9.5	15
2	18	18.5	11	15
2.2	18	18.5	11	15
2.7	18	20	11	15
1	26.5	15	6	22.5
1.2	26.5	15	6	22.5
1.5	26.5	16	7	22.5
1.8	26.5	16	7	22.5
2	26.5	16	7	22.5
2.2	26.5	17	8.5	22.5
2.7	26.5	18.5	9	22.5
3.3	26.5	18.5	9	22.5
3.9	26.5	20.5	11	22.5
4.7	26.5	20.5	11	22.5
5.6	26.5	21.5	12.5	22.5

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Capacitance (μF)	Rated voltage U_R			
	520 V DC			
	$l_{\text{max.}}$	$h_{\text{max.}}$	$b_{\text{max.}}$	r
	(mm)			
0.082	13	9	4	10
0.1	13	9	4	10
0.12	13	10.5	5	10
0.15	13	10.5	5	10
0.18	13	11	5.5	10
0.22	13	12	6	10
0.18	18	11	5	15
0.22	18	11	5	15
0.27	18	12	6	15
0.33	18	12	6	15
0.39	18	12	6	15
0.47	18	13	7	15
0.56	18	13.5	7.5	15
0.68	18	14.5	9	15
0.82	18	16.5	8.5	15
1	18	16	9.5	15
1.2	18	18.5	11	15
1.5	18	20	11	15
1.8	18	20	12.5	15
0.47	26.5	14	6	22.5
0.56	26.5	14	6	22.5
0.68	26.5	14	6	22.5
0.82	26.5	15	6	22.5
1	26.5	16	7	22.5
1.2	26.5	17	8.5	22.5
1.5	26.5	18.5	9	22.5
1.8	26.5	18.5	9	22.5
2	26.5	18.5	10	22.5
2.2	26.5	20.5	11	22.5
2.7	26.5	21.5	12.5	22.5

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Capacitance (μF)	Rated voltage U_R			
	630 V DC			
	$l_{\text{max.}}$	$h_{\text{max.}}$	$b_{\text{max.}}$	r
	(mm)			
0.068	13	9	4	10
0.082	13	10.5	5	10
0.1	13	10.5	5	10
0.12	13	11	5.5	10
0.15	13	12	6	10
0.18	13	12	6	10
0.1	18	11	5	15
0.15	18	11	5	15
0.18	18	11	5.5	15
0.22	18	11	5.5	15
0.27	18	12	6	15
0.33	18	13	7	15
0.39	18	13	7	15
0.47	18	14.5	9	15
0.56	18	14.5	9	15
0.68	18	16	9.5	15
0.82	18	19	10	15
1	18	19	10	15
1.2	18	20	11	15
0.33	26.5	14	6	22.5
0.39	26.5	14	6	22.5
0.47	26.5	14	6	22.5
0.56	26.5	14	6	22.5
0.68	26.5	16	7	22.5
0.82	26.5	16	7	22.5
1	26.5	17	8.5	22.5
1.2	26.5	18.5	9	22.5
1.5	26.5	18.5	10	22.5
1.8	26.5	20.5	11	22.5
2	26.5	20.5	11	22.5
2.2	26.5	21.5	12.5	22.5

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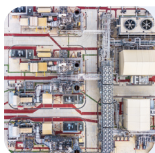
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