

2022

Aluminum Foil For Aluminum Electrolytic Capacitor

ALUMINUM FOIL CATALOG

for Aluminum Electrolytic Capacitors

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New / Discontinued Products

Type	New	Discontinued
Formed Foil for Anode, Low Voltage	U198,U199,U191 LM108EF2	U805,U762,U870 U179H
Formed Foil for Anode, Mid. -High Voltage		G853,G864,G751,G855 G106,G916,G915 H175,H179X,H183
Etched Foil for Anode, Low Voltage	U198,U199,U191 LM108EF2	U805,U762,U870 U179H
Etched Foil for Anode, Mid. -High Voltage		G853,G751,G855,G906 G915,H129,H100
Formed Foil for Cathode		C209F

Specification Revision History

Specification revision	Type	Foil Part Number
Gauge	Formed Foil for Cathode	C208F

※The above specifications are subject to change without notice.

1. Formed Foil for Anode, Low Voltage 1/2

Foil Part Number	Capacitance ($\mu\text{F}/\text{cm}^2$)								
Vfs	8.0	9.9	12.8	15.7	20.5	26.2	32.9	45.6	50.2
D670	27.1	22.5	18.1	15.3	12.3	9.72	7.70	5.39	4.81
D672	37.9	31.6	25.4	21.6	17.3	13.8	10.9	7.61	6.81
D674	47.5	39.5	31.8	26.9	21.4	16.9	13.4	9.24	8.20
D676	62.3	53.4	43.1	36.2	28.4	22.3	17.7	11.9	10.5
U615	72.4	61.0	50.0	42.3	33.3	26.0	20.1	13.7	12.1
U715	81.6	68.5	55.5	47.1	37.2	29.1	22.7	15.5	13.7
U815	97.6	83.3	67.7	57.3	45.0	35.0	27.2	18.6	16.5
U850	115	95.5	76.7	64.7	51.4	40.5	31.6	21.2	18.6
U750	119	98.2	78.1	65.4	51.4	40.2	31.1	20.6	18.0
U752	129	109	88.4	74.6	57.8	44.5	34.3	22.6	19.8
U862	129	109	88.4	74.6	57.8	44.5	34.3	22.6	19.8
U854	148	124	100	84.5	66.9	51.4	39.2	25.8	22.6
U953	169	141	114	96.2	76.0	58.3	44.3	29.0	25.4
U873	190	157	125	105	83.3	63.8	48.3	30.9	26.4
U974	185	154	124	105	83.4	64.2	49.7	32.6	28.5
U155	187	156	126	107	85.0	65.3	49.9	32.7	28.5
U975	198	165	132	111	88.2	67.7	52.3	34.1	29.7
U976	212	177	142	119	92.0	71.1	54.0	34.0	29.2
U157	208	175	142	120	95.0	72.7	55.0	35.9	31.3
U177	208	175	142	120	95.0	72.7	55.0	35.9	31.3
U178	233	196	159	136	107	82.6	63.5	40.3	35.1
U198	233	196	159	136	107	82.6	63.5	40.3	35.1
U170	250	208	167	139	108	83.5	63.5	40.0	34.5
U199	271	227	184	158	124	95.8	73.7	46.9	40.6
U191	282	236	191	164	129	99.9	77.0	49.2	42.7
U846	—	—	—	—	—	—	—	—	—
U918	—	—	—	—	—	—	—	—	—
U919	—	—	—	—	—	—	—	—	—
U147	—	—	—	—	—	—	—	—	—
U140	—	—	—	—	—	—	—	—	—
LM108EF2	—	—	—	—	—	—	—	—	—

Foil Part Number	Capacitance ($\mu\text{F}/\text{cm}^2$)								
	Vfs	65.5	73.2	82.7	90.4	105	114	132	143
D670	3.49	3.03	2.58	2.27	1.86	1.64	1.34	1.17	—
D672	4.96	4.31	3.65	3.21	2.61	2.28	1.86	1.61	—
D674	5.82	5.00	4.20	3.68	2.98	2.58	2.04	1.74	—
D676	7.27	6.19	5.12	4.42	3.46	2.96	2.28	1.89	—
U615	8.60	7.34	6.11	5.34	4.16	3.55	2.60	2.15	—
U715	9.70	8.27	6.91	6.02	4.71	4.02	2.96	2.48	—
U815	11.6	9.93	8.29	7.22	5.64	4.77	3.53	2.95	—
U850	12.7	10.6	8.72	7.47	—	—	—	—	—
U750	12.1	10.2	8.26	7.04	—	—	—	—	—
U752	13.4	11.2	9.04	7.57	—	—	—	—	—
U862	13.4	11.2	9.04	7.57	—	—	—	—	—
U854	15.0	12.5	10.1	—	—	—	—	—	—
U953	16.9	14.1	11.1	—	—	—	—	—	—
U873	—	—	—	—	—	—	—	—	—
U974	19.0	—	—	—	—	—	—	—	—
U155	19.0	15.7	12.5	—	—	—	—	—	—
U975	19.7	16.6	13.5	—	—	—	—	—	—
U976	18.5	—	—	—	—	—	—	—	—
U157	20.7	17.0	13.4	—	—	—	—	—	—
U177	20.7	17.0	13.4	—	—	—	—	—	—
U178	23.4	—	—	—	—	—	—	—	—
U198	23.4	—	—	—	—	—	—	—	—
U170	—	—	—	—	—	—	—	—	—
U199	26.8	—	—	—	—	—	—	—	—
U191	28.4	—	—	—	—	—	—	—	—
U846	11.3	9.77	8.25	7.22	5.81	5.01	3.94	3.34	—
U918	13.7	—	10.0	8.82	7.04	6.00	4.70	4.00	—
U919	15.2	—	10.9	9.58	7.63	6.55	5.10	4.40	—
U147	17.5	15.0	12.6	11.0	8.80	7.50	5.65	4.78	3.24
U140	19.1	16.4	13.8	11.9	9.45	8.08	6.10	5.15	3.46
LM108EF2	20.5	17.6	14.7	12.8	10.1	8.59	6.51	5.34	—

1. Formed Foil for Anode, Low Voltage 2/2

Foil Part Number	Tensile Strength	Bending Strength	Capacitance Tolerance	Gauge	Purity of Raw Aluminum Foil	Nominal Length /Carton
	(N/cm)	R=0.5mm (bends)	(%)	±10% (μm)	(%)	(m)
D670	≧ 22.5	≧ 50	+10, -5	60	≧ 99.98	450
D672	≧ 21.6	≧ 50	+10, -5	60	≧ 99.98	450
D674	≧ 20.6	≧ 50	+10, -5	60	≧ 99.98	450
D676	≧ 21.6	≧ 50	+10, -5	62	≧ 99.98	430
U615	≧ 18.6	≧ 50	+10, -5	65	≧ 99.98	430
U715	≧ 18.6	≧ 50	+10, -5	70	≧ 99.98	400
U815	≧ 19.6	≧ 50	+10, -5	80	≧ 99.98	350
U850	≧ 23.5	≧ 50	+10, -5	80	≧ 99.98	350
U750	≧ 18.6	≧ 50	+10, -5	70	≧ 99.98	400
U752	≧ 18.6	≧ 50	+10, -5	70	≧ 99.98	400
U862	≧ 21.6	≧ 50	+10, -5	80	≧ 99.98	350
U854	≧ 18.6	≧ 50	+10, -5	80	≧ 99.98	350
U953	≧ 18.6	≧ 50	+10, -5	90	≧ 99.98	300
U873	≧ 18.6	≧ 50	+10, -5	80	≧ 99.98	350
U974	≧ 24.3	≧ 50	+10, -5	95	≧ 99.98	300
U155	≧ 18.6	≧ 50	+10, -5	100	≧ 99.98	250
U975	≧ 23.3	≧ 50	+10, -5	95	≧ 99.98	300
U976	≧ 18.6	≧ 50	+10, -5	90	≧ 99.98	300
U157	≧ 18.6	≧ 50	+10, -5	105	≧ 99.98	250
U177	≧ 25.8	≧ 50	+10, -5	100	≧ 99.98	250
U178	≧ 22.5	≧ 50	+10, -5	110	≧ 99.98	250
U198	≧ 18.0	—	+10, -5	110	≧ 99.98	250
U170	≧ 21.6	≧ 50	+10, -5	110	≧ 99.98	250
U199	≧ 17.2	—	+10, -5	120	≧ 99.98	230
U191	≧ 16.7	—	+10, -5	120	≧ 99.98	230
U846	≧ 21.6	≧ 50	+10, -5	80	≧ 99.98	350
U918	≧ 17.6	≧ 50	+10, -5	90	≧ 99.98	300
U919	≧ 17.6	≧ 50	+10, -5	95	≧ 99.98	300
U147	≧ 17.6	≧ 50	+10, -5	100	≧ 99.98	250
U140	≧ 17.6	≧ 50	+10, -5	105	≧ 99.98	250
LM108EF2	≧ 17.6	—	+10, -5	108	≧ 99.98	250

※ The purity of the raw aluminum foil is in accordance with JIS-H-4170 and JIS-H-4160.

2. Formed Foil for Anode, Ultra Low Voltage

Foil Part Number	Capacitance ($\mu\text{F}/\text{cm}^2$)		
	Vfs	3.0	4.0
U157	334	291	258
U177	334	291	258
U976	374	323	278
U178	382	333	295
U170	447	386	334
U199	463	404	358

Foil Part Number	Tensile Strength	Bending Strength	Capacitance Tolerance	Gauge	Purity of Raw Aluminum Foil	Nominal Length /Carton
	(N/cm)	R=0.5mm (bends, \square)	(%)	$\pm 10\%$ (μm)	(%)	(m)
U157	≥ 18.6	≥ 50	+15, -10	105	≥ 99.98	250
U177	≥ 25.8	≥ 50	+15, -10	100	≥ 99.98	250
U976	≥ 18.6	≥ 50	+15, -10	90	≥ 99.98	300
U178	≥ 22.5	≥ 50	+15, -10	110	≥ 99.98	250
U170	≥ 21.6	≥ 50	+15, -10	110	≥ 99.98	250
U199	≥ 17.2	—	+15, -10	120	≥ 99.98	230

※ The purity of the raw aluminum foil is in accordance with JIS-H-4170 and JIS-H-4160.

3. Formed Foil for Anode, Mid. -High Voltage

Please contact KDK if you would like to inquire formed foil for anode, mid - high voltage. We will respond according to the situation and requests.

4. Etched Foil for Anode, Low Voltage

Foil Part Number	Capacitance ($\mu\text{F}/\text{cm}^2$)			Tensile Strength (N/cm)	Bending Strength R=0.5mm (bends, \square)	Capacitance Tolerance (%)	Gauge $\pm 10\%$ (μm)	Nominal Length /Weight (m/kg)	Nominal Length /Carton (m)
	Vfs	20.5	65.5						
D670	—	3.49	1.34	≥ 22.5	≥ 80	+10, -5	60	15	450
D672	—	4.96	1.86	≥ 21.6	≥ 80	+10, -5	60	16	450
D674	—	5.82	2.04	≥ 20.6	≥ 80	+10, -5	60	16	450
D676	—	7.27	2.28	≥ 21.6	≥ 80	+10, -5	62	16	430
U615	33.3	8.60	—	≥ 18.6	≥ 80	+10, -5	65	16	430
U715	37.2	9.70	—	≥ 18.6	≥ 80	+10, -5	70	15	400
U815	45.0	11.6	—	≥ 19.6	≥ 80	+10, -5	80	14	350
U850	51.4	12.7	—	≥ 23.5	≥ 60	+10, -5	80	13	350
U750	51.4	12.1	—	≥ 18.6	≥ 60	+10, -5	70	15	400
U752	57.8	13.4	—	≥ 18.6	≥ 60	+10, -5	70	16	400
U862	57.8	13.4	—	≥ 21.6	≥ 60	+10, -5	80	13	350
U854	66.9	15.0	—	≥ 18.6	≥ 60	+10, -5	80	15	350
U953	76.0	16.9	—	≥ 18.6	≥ 60	+10, -5	90	14	300
U873	83.3	—	—	≥ 18.6	≥ 60	+10, -5	80	16	350
U974	83.4	19.0	—	≥ 24.3	≥ 60	+10, -5	95	13	300
U155	85.0	19.0	—	≥ 18.6	≥ 60	+10, -5	100	14	250
U975	88.2	19.7	—	≥ 23.3	≥ 60	+10, -5	95	13	300
U976	92.0	18.5	—	≥ 18.6	≥ 60	+10, -5	90	14	300
U157	95.0	20.7	—	≥ 18.6	≥ 60	+10, -5	105	13	250
U177	95.0	20.7	—	≥ 25.8	≥ 60	+10, -5	100	12	250
U178	107	23.4	—	≥ 22.5	≥ 60	+10, -5	110	12	250
U198	107	23.4	—	≥ 18.0	—	+10, -5	110	12	250
U170	108	—	—	≥ 21.6	≥ 60	+10, -5	110	12	250
U199	124	26.8	—	≥ 17.2	—	+10, -5	120	12	230
U191	129	28.4	—	≥ 16.7	—	+10, -5	120	12	230
U846	—	11.3	3.94	≥ 21.6	≥ 60	+10, -5	80	13	350
U918	—	13.7	4.70	≥ 17.6	≥ 60	+10, -5	90	13	300
U919	—	15.2	5.10	≥ 17.6	≥ 60	+10, -5	95	13	300
U147	—	17.5	5.65	≥ 17.6	≥ 60	+10, -5	100	13	250
U140	—	19.1	6.10	≥ 17.6	≥ 60	+10, -5	105	13	250
LM108EF2	—	20.5	6.51	≥ 17.6	—	+10, -5	108	13	250

※ The purity of the raw aluminum foil is 99.98% or more. It is in accordance with JIS-H-4170 and JIS-H-4160.

5. Etched Foil for Anode, Mid. -High Voltage

Foil Part Number	Capacitance ($\mu\text{F}/\text{cm}^2$)		Tensile Strength (N/cm)	Bending Strength R=1.0mm (bends, \square)	Capacitance Tolerance (%)	Gauge $\pm 10\%$ (μm)	Purity of Raw Aluminum Foil (%)	Nominal Length /Weight (m/kg)	Nominal Length /Carton (m)
	257	628							
G106	1.34	—	≥ 19.6	≥ 50	+10,-5	90	≥ 99.98	12	300
H124	1.85	—	≥ 21.6	≥ 40	+10,-5	105	≥ 99.99	9	250
H127	1.85	—	≥ 19.6	≥ 30	+10,-5	95	≥ 99.99	11	300
H131	2.00	—	≥ 19.6	≥ 40	+10,-5	105	≥ 99.99	10	250
H123	—	0.531	≥ 19.6	≥ 40	+10,-5	105	≥ 99.99	9	250
H180	—	0.611	≥ 21.6	≥ 30	+10,-4	120	≥ 99.99	9	230
H103	—	0.660	≥ 21.6	≥ 30	+10,-5	120	≥ 99.99	9	230

※ The purity of the raw aluminum foil is in accordance with JIS-H-4170 and JIS-H-4160.

6. Etched Foil for Cathode

Foil Part Number	Capacitance ($\mu\text{F}/\text{cm}^2$)	Change of Capacitance after Hydration Process (%)	Tensile Strength (N/cm)	Bending Strength R=0.5mm (bends)	Gauge (μm)	Purity of Raw Aluminum Foil (%)	Nominal Length /Weight (m/kg)	Nominal Length /Carton (m)
C352	105~210	—	≥ 12.7	≥ 80	27 \pm 3	≥ 99.80	32	900
C354	210~320	—	≥ 10.8	≥ 80	27 \pm 3	≥ 99.80	35	900
C356	265~375	—	≥ 10.8	≥ 80	35 \pm 4	≥ 99.80	28	800
C518	375~480	≥ -10	≥ 16.7	≥ 90	50 \pm 5	≥ 99.80	21	500
C519	480~560	≥ -10	≥ 12.7	≥ 85	50 \pm 5	≥ 99.80	23	500
C439	480~560	≥ -10	≥ 12.7	≥ 85	45 \pm 5	≥ 99.80	25	650
C531	560~690	≥ -10	≥ 12.7	≥ 85	53 \pm 5	≥ 99.80	23	500

※ The purity of the raw aluminum foil is in accordance with JIS-H-4170 and JIS-H-4160.

7. Formed Foil for Cathode

Foil Part Number	Formation Voltage (Vfs)	Capacitance ($\mu\text{F}/\text{cm}^2$)	Dielectric Withstanding Voltage (V)	Tensile Strength (N/cm)	Bending Strength R=0.5mm (bends)	Gauge (μm)	Purity of Raw Aluminum Foil (%)	Nominal Length /Weight (m/kg)	Nominal Length /Carton (m)
C208F	0.9	85~145	≥ -1.1	≥ 20.6	≥ 80	20 \pm 2	≥ 99.80	42	1,250
	2.0	30~100	≥ 0.3	≥ 20.6	≥ 80	20 \pm 2	≥ 99.80	42	1,250
C354F	3.0	50~90	≥ 1.1	≥ 10.8	≥ 80	27 \pm 3	≥ 99.80	35	900
C519F	1.0	400~500	≥ -0.9	≥ 12.7	≥ 85	50 \pm 5	≥ 99.80	23	500
	1.7	250~350	≥ 0.0	≥ 12.7	≥ 85	50 \pm 5	≥ 99.80	23	500
	3.0	170~240	≥ 1.1	≥ 12.7	≥ 85	50 \pm 5	≥ 99.80	23	500

※ The purity of the raw aluminum foil is in accordance with JIS-H-4170 and JIS-H-4160.

8. Specifications

8.1 Capacitance Specifications for Anode Foil

Items	Specifications
Effective Width of Foil	<p>① U147 ・ U140 Formed Foil : 480mm (485mm wide roll less 2.5mm at each edge) Etched Foil : 480mm (500mm wide roll less 10mm at each edge)</p> <p>① U199-50.2Vfs over ・ U191-45.6Vfs over 475mm (500mm wide roll less 12.5mm at each edge)</p> <p>③ All Other Foils Formed Foil: 480mm (500mm wide roll less 10mm at each edge) Etched Foil: 480mm (500mm wide roll less 10mm at each edge)</p>
Average Capacitance (X)	As per Specifications
Tolerance of Verage Capacitance (X)	As per Specifications
Calculation of Average Capacitance (X)	<p>A1, A2, A3 : Measured capacitance values at outer side of a foil B1, B2, B3 : Measured capacitance values at core side of a foil</p> $\bar{X} = (A \text{ max} + A \text{ min} + B \text{ max} + B \text{ min}) \div 4$
Dispersion Range	13% or less
Calculation of Dispersion Range	<p>A1, A2, A3 : Measured capacitance values at outer side of a foil B1, B2, B3 : Measured capacitance values at core side of a foil</p> $\text{Dispersion Rate} = \frac{A \text{ max or B max} - A \text{ min or B min}}{\text{Average Capacitance}} \times 100 (\%)$

※ Please download each test method from the KDK's website.
<http://www.kdk.com/index.html>

8.2 Specifications for Cathode Foil Capacitance

Items	Specifications
Effective Width of Foil	480mm (500mm wide roll less 10mm at each edge)
Capacitance	As per Section 3. Specifications
Determination of Capacitance	The minimum value of either outer side capacitance A or core side capacitance B
Hydration Process Time	60 minutes
Change of Capacitance after Hydration Process	$\Delta C_{60} \geq -10\%$

* ΔC_{60} (change of capacitance after Hydration Process) is applied to C518,C519,C439 and C531.

It is not applied to other cathode etched foil and cathode formed foil.

8.3 Nominal Formation Voltage Range

Foil Category	Nominal Formation Voltage Range
Formed Foil, Extreme Low Voltage	$3.0 \leq V_{fs} \leq 7.9$
Formed Foil, Low Voltage	$8.0 \leq V_{fs} \leq 170$
Formed Foil, Middle to High Voltage	$208 \leq V_{fs} \leq 664$
Formed Foil, Cathode	$0.9 \leq V_{fs} \leq 3.0$

8.4 Specifications for Residual Chloride Content

Items	Specifications	
Residual Chloride Content	Etched Foil for Anode, Low Voltage	2.0mg/m ² or less
	Formed Foil for Anode, Low Voltage, Cathode Formed Foil	0.8mg/m ² or less
	Etched Foil for Anode, Middle to High Voltage Formed Foil for Anode, Middle to High Voltage Cathode Etched Foil	1.0mg/m ² or less

8.5 Specifications for Visual Appearance

Items	Specifications
Visual Appearance	<p>For Etched and Formed Foil, the appearance of one roll may be slightly different from another. They may look different because of variances in raw foil, production process, etc. The following minor defects shall not be reasons for rejection as long as they are proven not to be harmful electrically and/or mechanically to the capacitor:</p> <ol style="list-style-type: none"> 1) Small speckles 2) Wrinkles and marks or visible corrections of them 3) Visible aluminum hydroxide on foil surface 4) Small pin-holes 5) Small scratch 6) Variations of surface color <p>If you have any question about your shipment of foil, please contact us based upon "12-4 Rejections and Claims".</p>

8.6 Specifications for Rise Time and Dielectric Withstanding Voltage

8.6.1 Formed Foil for Anode, Extreme Low Voltage

Items	Specifications
Nominal Formation Voltage Range	$3.0 \leq V_{fs} \leq 7.9$
Name of Test Methode	Vt Measurement
Code of Dielectric Withstanding Voltage	Vt
Dielectric Withstanding Voltage (Vt)	$V_{fs} \leq V_t$
Rise Time (Tr)	$Tr \leq (V_{fs} \times 0.5 + 100)$ second
Hydration Resistance Test Time	60 minutes
Rise Time after Hydration Process (Tr60)	$Tr_{60} \leq 150$ second

8.6.2 Formed Foil for Anode, Low Voltage

Items	Specifications
Nominal Formation Voltage Range	$8.0 \leq V_{fs} \leq 170$
Name of test methode	Vt Measurement
Code of Dielectric Withstanding Voltage	Vt
Dielectric Withstanding Voltage (Vt)	$V_{fs} \leq V_t$
Rise Time (Tr)	$Tr \leq (V_{fs} \times 0.5 + 100)$ second
Hydration Resistance Test Time	60 minutes
Rise Time after Hydration Process (Tr60)	$Tr_{60} \leq 150$ second

8.6.3 Formed Foil for Anode, Middle to High Voltage

Items	Specifications
Nominal Formation Voltage Range	$208 \leq V_{fs} \leq 664$
Name of Test Methode	Vt Measurement
Code of Dielectric Withstanding Voltage	Vt
Dielectric Withstanding Voltage (Vt)	$V_{fs} \leq V_t$
Rise Time (Tr)	$T_r \leq (V_{fs} \times 0.5 + 100)$ second
Hydration Resistance Test Time	60 minutes
Rise Time after Hydration Process (Tr60)	$T_{r60} \leq 150$ second

8.6.4 Formed Foil for Cathode

Items	Specifications
Nominal Formation Voltage Range	$0.9 \leq V_{fs} \leq 3.0$
Name of Test Methode	Vt Measurement
Code of Dielectric Withstanding Voltage	Vt
Dielectric Withstanding Voltage (Vt)	Each voltage is equivalent to the dielectric withstanding voltage in the catalog.

9. Nominal Length

9.1 Nominal Length for Etched and Formed Foil

(Unit:m)

Etched and Formed Foil			Size of Roll	Small	Medium	Large
Low	Middle High	Cathode	Standard Outside Diameter Gauge (μm)	200mm	280mm	390mm
		○	20	1,250	2,500	5,000
		○	27	900	1,800	3,600
		○	35	800	1,600	3,200
		○	45	650	1,300	2,600
		○	50	500	1,000	2,000
		○	53	500	1,000	2,000
○			60	450	900	1,800
○			62	430	860	1,720
○			65	430	860	1,720
○			70	400	800	1,600
○			80	350	700	1,400
○	○		90	300	600	1,200
○	○		95	300	600	1,200
○			100	250	500	1,000
○	○		105	250	500	1,000
○			108	250	500	1,000
○			110	250	500	1,000
○	○		120	230	450	890

10. Joint Specifications

10.1 Number of Joints and Joint Intervals for Etched and Formed Foil

Size of Roll	Small Size Roll	Medium Size Roll	Large Size Roll
Container Type	Carton		
Number of Joints	One or None	Two or Less	
Joint Intervals	Interval from joint to the end of foil is 50m or more.	Interval from joint to the end of foil is 50m or more. Interval between joints is 50m or more.	

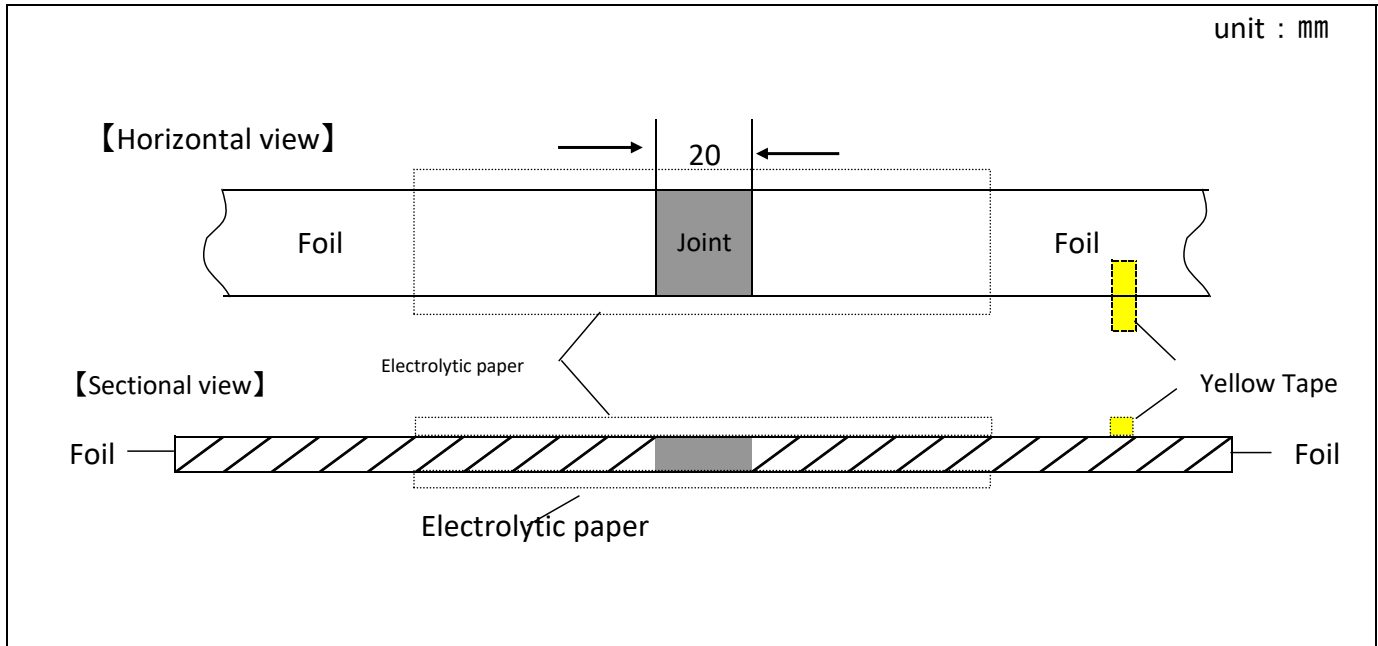
10.2 Marking of Joints for Etched and Formed Foil

For efficiency during the formation process and slitting process at the customer's site, colored tape is used within rolls to mark the location of joints. Yellow tape is affixed 3-5m before a joint and red tape (other than for Etched Foil for Anode, Low Voltage) is affixed just before the joint. And electrolytic paper is affixed on the joint.

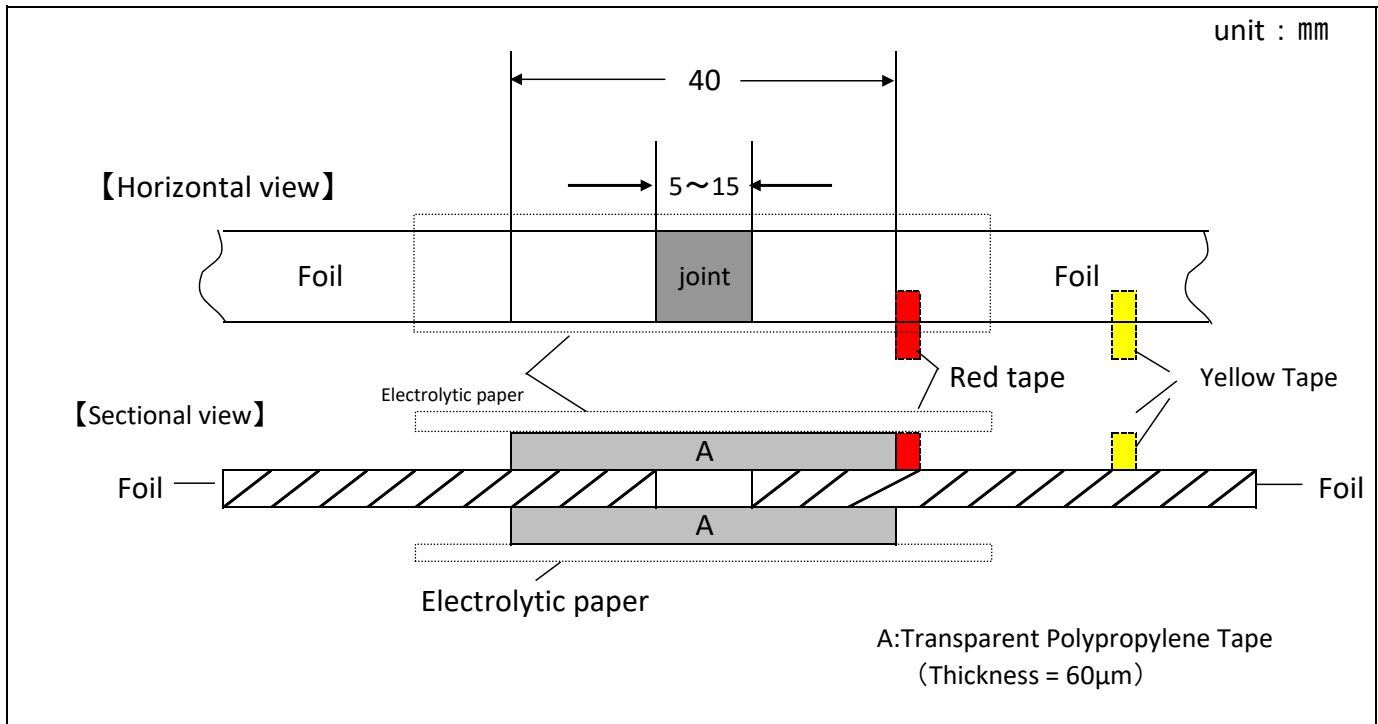
Item	Joint Markings
Etched Foil for Anode, Low Voltage	<p>Electrolytic paper</p> <p>3~5m</p> <p>Yellow tape</p>
Etched Foil for Anode, Middle to High Voltage Cathode Etched Foil Formed Foil for Anode, Low Voltage Formed Foil for Anode, Extreme Low Voltage Formed Foil for Anode, Middle to High Voltage Cathode Formed Foil	<p>Electrolytic paper</p> <p>3~5m</p> <p>Red tape</p> <p>Yellow tape</p>

10.3 Joint Methods for Etched and Formed Foil

10.3.1 Low Voltage Etched Foil (Cold Weld)



10.3.2 Middle to High Voltage Etched Foil, Formed Foil, Low Voltage Formed Foil, Formed Foil for Anode, Extreme Low Voltage, Cathode Etched Foil, Formed Foil



11. Packing Information

Care should be taken when transporting and storing the electrode foil to avoid damaging the product.

Product packaging is designed to facilitate handling after unpacking.

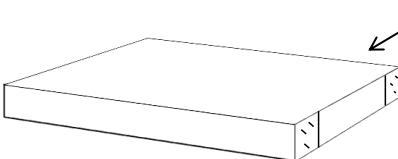
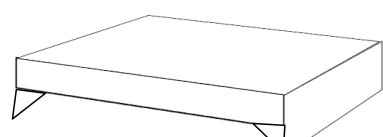
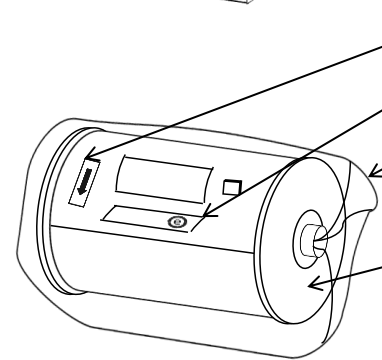
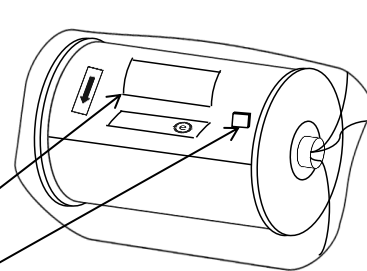
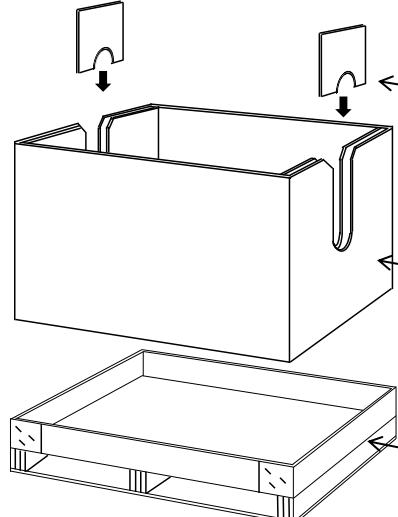
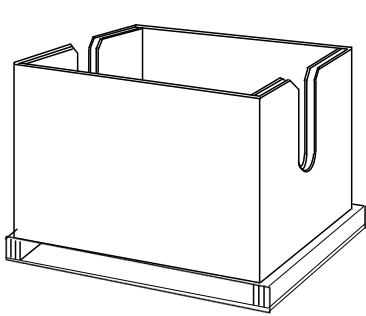
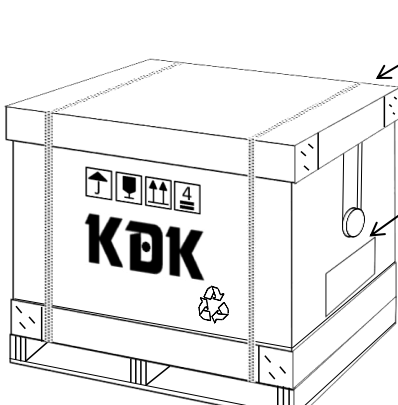
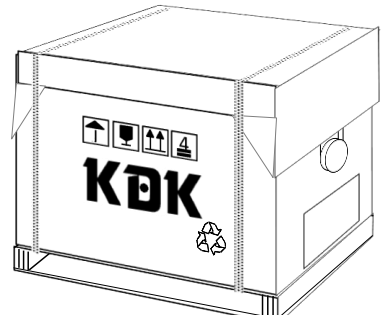
Packaging standards have been designed with this in mind.

11.1 Standard Packing Specifications

Items	Formed Foil / Etched Foil		
	Small Size Roll	Medium Size Roll	Large Size Roll
Container Type	Carton		
Foil Winding Width	① 500 $\begin{matrix} +5 \\ -0 \end{matrix}$ mm : All foils except for those specified below		
	② 485 $\begin{matrix} +5 \\ -0 \end{matrix}$ mm : U147 • U140 ; Formed foil for anode, low voltage		
Core Size	Length : 600 ± 1 mm I.D. : 75 $\begin{matrix} +2 \\ -1 \end{matrix}$ mm		
Core Materials	Aluminum Powder Coated Steel		
Dimensions of Container	400 D × 600 W × 470 H (mm)		470 D × 610 W × 540 H (mm)
Weight of One Roll (Without Container)	Approx. 25kg	Approx. 50 kg	Approx. 100 kg

11.2 Packing Methods

11.2.1 Etched, Formed Foil

Size of Roll	Packing Method	
Small Medium Large Size Roll	<p>Box Carton for Large size Roll</p> 	<p>Box Carton for Medium and Small Size Roll</p> 
		
		
		

11.3 Inspection Certificate (Data Sheet and Label)

An Inspection Certificate (Data Sheet and Label) which shows the following information is accompanied to each product delivered.

1	Foil Part No.		
2	Gauge	(μm)	
3	Purity of Raw Aluminum Foil	(%)	
4	Roll Width	(mm)	
5	Effective Width	(mm)	
6	Foil No.		
7	Date of Production		
8	Date of Inspection		
9	Foil Length	(m)	
10	Foil Area	(m ²)	
11	Joints	(time)	
12	Weight	(kg)	
13	Tensile Strength	(N/cm)	
14	Bending Strength	(bends)	
15	Residual Chloride Content	(mg/m ²)	(Etched and Formed Foil)
16	Capacitance at Each Measurement Point and Average Capacitance	($\mu\text{F}/\text{cm}^2$)	(Etched and Formed Foil)
17	Capacitance Dispersion Rate	(%)	(Etched and Formed Foil)
18	Nominal Formation Voltage	[Vfs]	(Formed foil)
19	Vt values at Each Measurement Point and Average Vt Values		(Formed Foil)

※1 "2 Gauge", "3 Purity of Raw Aluminum Foil", and "4 Roll Width" are listed the standard value.

※2 "13 Tensile Strength": All middle and high voltage formed foil don't have the standard value.

※3 "14 Bending Strength": All F-tech foil don't have the standard value.

※4 "15 Residual Chloride Content": All formed foil are listed the standard value.

12. Quality Assurance

12.1 Quality Assurance System Flow Chart

In the next Page.

12.2 Quality Assurance

12.2.1 Quality Assurance of Foil

During KDK's etching and formation processes, major processing conditions like electric current, voltage and temperature are automatically controlled and simultaneously recorded by KDK's continuous recording system. The quality assurance of KDK foil is achieved by maintaining the production conditions in accordance with the specified processing conditions.

12.2.2 Performance Tests for Large Size Roll

KDK's basic production policy is to produce large size rolls of aluminum foil for all etched and formed foils. Foil test samples for Etched Foil are taken from the outer side and the core side of every large roll of raw aluminum foil and used for all performance tests. Foil test samples for Formed Foil are taken from the outer side and core side of every large roll and used for all performance test. The test results from the large rolls are the ones presented to our customers.

12.2.3 Performance Tests for Small and Medium Size Rolls

Large size rolls are divided into small or medium size rolls after the performance tests. The test results of large rolls are printed on the Inspection Certificate that is attached to small and medium size rolls.

12.3 Factory Keep Samples

Besides our quality assurance system, KDK has a Factory Keep Sample system. The factory keeps samples of all foils ordered and delivered for twelve months. This makes it possible to trace quality problems, if any, by using these Keep Samples for reference and examination.

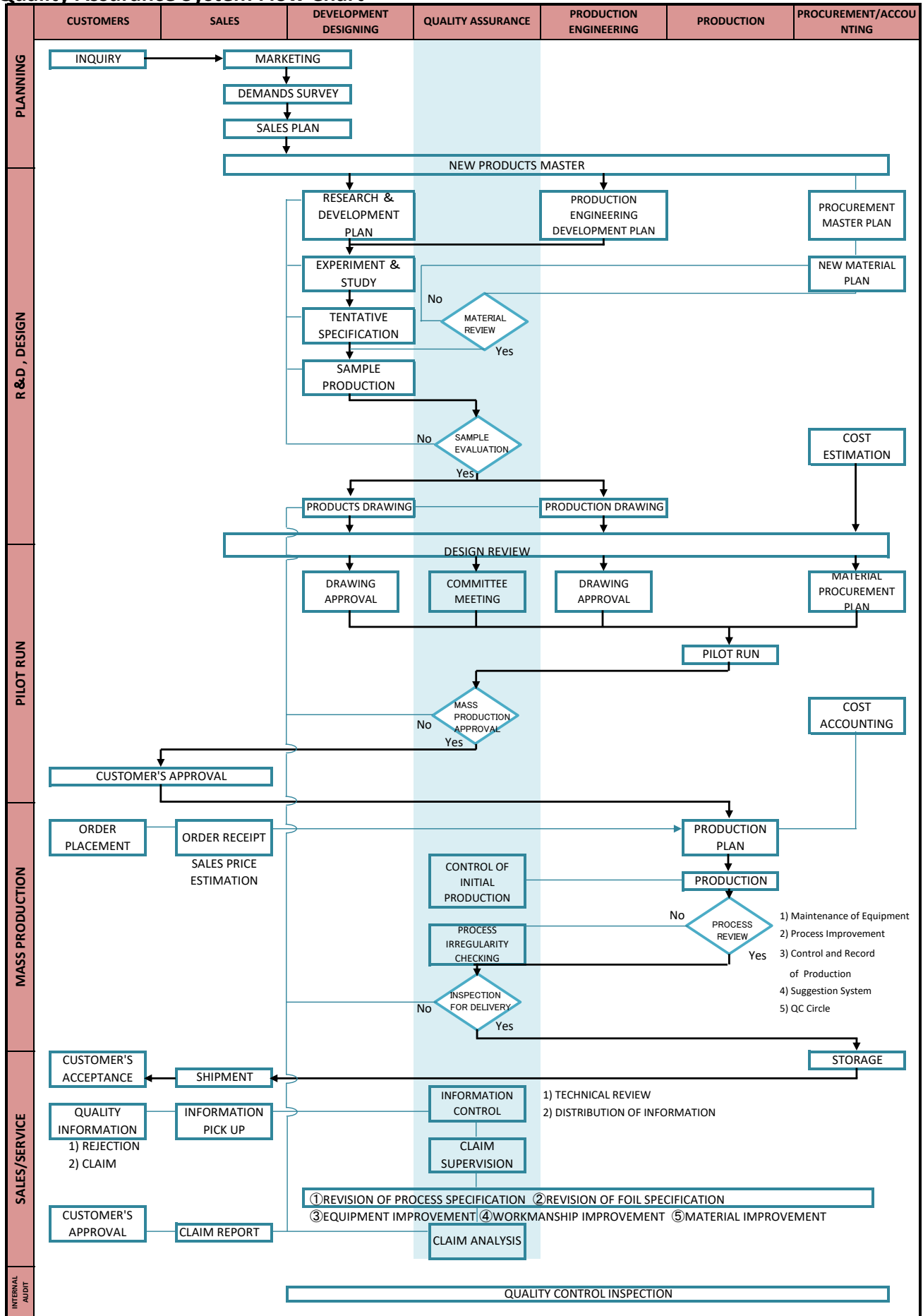
12.4 Rejections and Claims

If you have a problem with our foil, please send us the following information and materials that are essential to handling the case properly and promptly.

1. Customer's Foil Receiving Date
2. Customer's Acceptance Test Date
3. Foil Part Number, such as U915
4. Foil Number, such as "xxxxxx – xxxx" which appears on our Inspection Certificate (Data Sheet)
5. Rejected Quantity
6. Customer's Purchase Order Number
7. Foil Sample for Analysis (submit minimum size of product wide by 300 mm long, one piece)
8. Reason(s) for Rejection and/or Claim, and briefly describe how the defect was found.

KDK will analyze the rejection and/or claim based on the information above, check our production records and Keep Sample, if necessary, and advise the customer of our findings.

Quality Assurance System Flow Chart



13. Request for Quality Control

13.1 Acceptance Test

Upon receiving our foil, users generally perform their own acceptance test. Depending on foil type, please make sure the acceptance test is conducted at the following designated time:

- | | |
|----------------------------|-------------------|
| 1) Formed Foil for Anode | : Before Slitting |
| 2) Etched Foil for Anode | : Before Forming |
| 3) Etched Foil for Cathode | : Before Slitting |
| 4) Formed Foil for Cathode | : Before Slitting |

If you have any problems with our foil, please contact us after referring to the instructions specified under 12-4 Rejections and Claims on our web site.

13.2 Handling Aluminum Foil - <Do not handle foils with bare hands>

Never handle aluminum foil with your bare hands because the chloride in fingerprints and perspiration has a strong corrosive effect on aluminum. To prevent chloride contamination of aluminum foil during the manufacturing process of aluminum electrolytic capacitors, remember to wear clean, sterile gloves when handling the foil.

13.3 Storage at User's Site

When foils are stored at user's site, please remember the following points:

- 1) Keep Storage area free of chloride contamination.
- 2) Maintain normal temperature (5 to 30°C) and low humidity (less than 85%) in the storage area.
- 3) Never put water on any type of foil. Water on foil can create a gas over a period of time, and because foil is stored in closed containers, the build-up generated gas may cause an explosion.
- 4) Store foil in sealed containers until just before usage.
- 5) Do not subject foil to mechanical stress because it can cause problems during the manufacturing process.

13.4 Shelf Life

Your foil is guaranteed for the first six months after KDK shipment.

After six months, the foil should be tested before processing.

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