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KSC-4001 NO. 3683



KAB-QC-06



KAB-EC-16



achines

EUNSUNG

Low-Voltage Power Capacitors



ES EUNSUNG IND. CO., LTD.

We devote for best quality with state of the art technology which will a key for future, this is also our goal and destiny.

최고의 품질을 만들기 위하여 신기술개발로 미래를 열어갑니다.

CONTENTS

- 06 Description of Product List | 생산품목 소개
- 07 Introduce Production Line | 생산라인 소개
- 09 Specification | 사양
- 10 Characteristic | 특성
- 11 Harmonics | 고조파
- 13 Power Factor Correction | 역율개선
- 14 Capacity Calculation table of Capacitor – 콘덴서 용량 산출표
- 15 The Thickness of wire | 콘덴서 전류에 따른 전선 굵기
- 16 Construction & Dimension | 구조 및 치수
- 18 Rated Voltage 220V (60Hz) | 정격 전압 220V (60Hz)
- 19 Rated Voltage 380V (60Hz) | 정격 전압 380V (60Hz)
- 20 Rated Voltage 440V (60Hz) | 정격 전압 440V (60Hz)
- 22 For Export (50Hz) | 수출용 (50Hz)
- 23 For Export (60Hz) | 수출용 (60Hz)
- 25 Installation of Capacitor | 콘덴서 설치
- 26 Capacitor Maintenance and Inspection | 콘덴서 보수 및 점검
- 30 Condition for Operation and storage | 콘덴서 사용 및 보관
- 31 Certification | 인증서

SPECIFICATIONS

Specification | 사양

1. Installation Place : Indoor Type
2. Ambient Temperature : -25°C to 45°C
(Below 35°C for 24 Hours Average)
3. Construction and Class : SH, E Type
4. Capacitance Tolerance : -5% to $+10\%$
(Inter phase unbalance factor of capacitance : Max. 103%)
5. Maximum Permissible Voltage (JIS C 4901, KS C 4801, IEC 60831)

Overload Voltage (%)	Maximum Duration
110	Less than 8 hours during 24 hours
115	Less than 30 minute during 24 hour
120	Less than 2 times during 5 minutes for 1 month
130	Less than 2 times during 1 minutes for 1 month

6. Maximum Permissible Overcurrent :
130% of Rated Current
7. Maximum Permissible Capacity :
135% of Rated VA Reactive
8. Dissipation Factor : Max. 0.35%
9. Withstanding Voltage :
 - * Between Terminals : Rated Voltage $\times 2.15$, 1 Minute
 - * Between Terminals to Case : 3000VAC, 1 Minute
10. Discharge : Voltage decreases to below 75V in
3 minutes when disconnected from power source.
11. Sealing : There shall be no oil leakage even if for
3 hours under a thermostatic chamber 70°C
12. Safety Device
 - * Protective device (pressure sensitive interrupter)
13. Filling : Pu Resin (Non PCB) or Epoxy
14. Painting Color : Munsell No. 5Y 7/1
15. Reference Standard :
KS C 4801, JIS C 4901, IEC 60831

1. 설치 장소 : 옥 내 용
2. 사용 주위 온도 : $-25^{\circ}\text{C} \sim 45^{\circ}\text{C}$
(24시간 평균 35°C 이하)
3. 구조 및 종류 : SH, E 형
4. 용량 허용 차 : $-5\% \sim 10\%$
(상간 용량 불 평형율 : 103 % 이하)
5. 최고 허용 과전압(JIS C 4901, KS C 4801, IEC 60831)

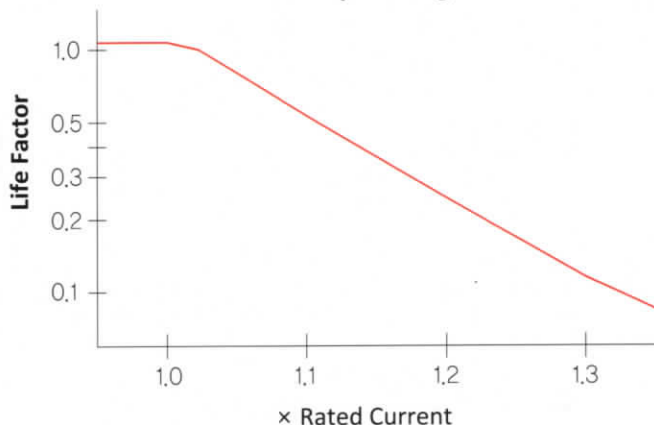
과전압율(%)	과전압 인가 시간
110	24시간중 8시간 이내
115	24시간중 30분 이내
120	1개월중에서 5분이내가 2회 이하
130	1개월 중에서 1분 이내가 2회 이하

6. 최대 허용 과전류
정격전류의 130% 이내
7. 최대 허용 용량
정격용량(var)의 135% 이내
8. 손실율 : 0.35% 이내
9. 내전압:
 - * 단자 상호간 : 정격 전압 $\times 2.15$ 배, 1분간
 - * 단자 일괄 케이스간 : 3000VAC, 1분간
10. 방전성 : 전원에서 개방후의 잔류 전압이
3분 이내 75V 이하
11. 밀폐성 : 70°C 항온조에 3시간 방치후 함침제의
누출이 없을것.
12. 보안성
 - * 보안장치 내장형 (압력 감지 차단형)
13. 충진제 : Pu Resin (Non PCB), Epoxy
14. 도장 색상 : Munsell No. 5Y 7/1
15. 관련 규격 :
KS C 4801, JIS C 4901, IEC 60831

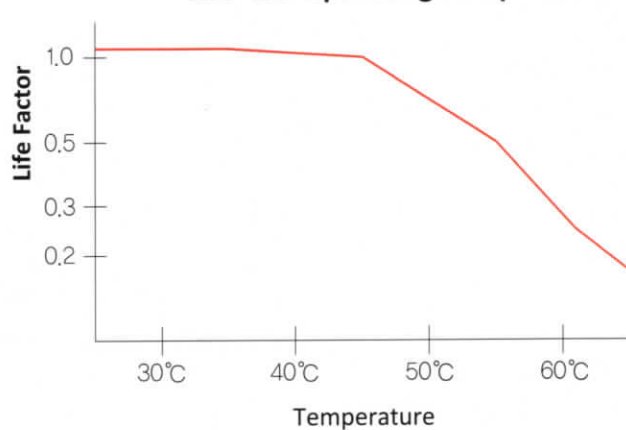
SPECIFICATIONS

Characteristic | 특성

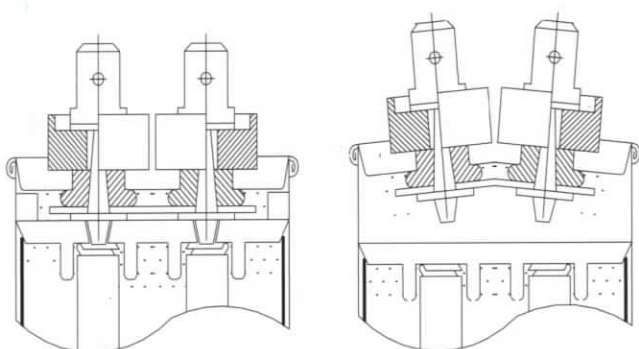
Life vs. Operating Current



Life vs. Operating Temp.



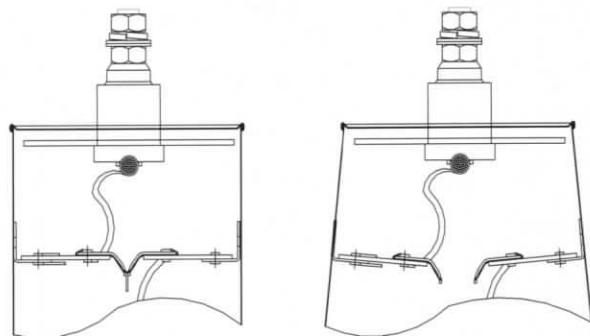
Pressure sensitive interrupter | 압력식 보안 장치



Normal Condition

Operating Condition

Page 10 Fig 1 ~ 2



Normal Condition

Operating Condition

Page 10 Fig 3 ~ 6

Harmonics | 고조파

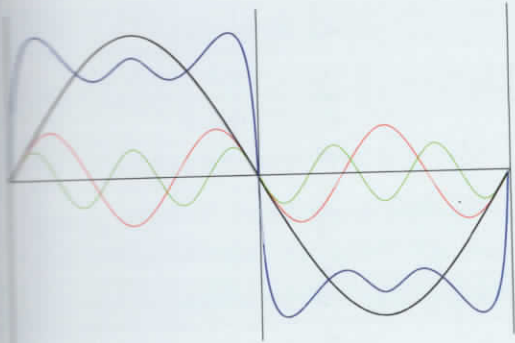
Harmonics are sinusoidal voltage and current with multiple frequencies of the 50 or 60Hz line frequency.
고조파란 전원 주파수(50Hz 또는 60Hz)의 정수배의 전압 및 전류를 말합니다.

◆ : Harmonic voltage regulation level | 전압 고조파 규제치 ◆ (IEE519)

Sinusoidal waveform 기본파	n Harmonics n 고조파
50 Hz	50 × n Hz
60 Hz	60 × n Hz

Receiving voltage 수 전 전 압 (kV)	Delicate line VTHD% 개별 또는 특수 수용가 전압 고조파 왜형률	General line VTHD% 일반 계통 전압 고조파 왜형률
Less than 69kV | 69kV 이하	3.0	5.0
69 kV ~ 161kV	1.5	2.5
More than 161kV | 161kV 이상	1.0	1.5

Synthetic waveform of Harmonic 고조파합성형태



- Synthetic waveform | 합성 파형
- Sinusoidal waveform | 기본 파형
- 3-Harmonic waveform | 3 고조파 파형
- 5-Harmonic waveform | 5 고조파 파형

◆ Harmonic current regulation level | 전류 고조파 규제치 ◆ (IEE519)

I_{sc}/I_L	Harmonic current regulation level 전류 고조파 규제치					TDD
	Less than 11th 11차 이하	11th ~ 17th 11차 ~ 17차	17th ~ 23th 17차 ~ 23차	23th ~ 35th 23차 ~ 35차	More than 35th 35차 이상	
Under 20 | 20 미만	4.0	2.0	1.5	0.6	0.3	5.0
20 ~ 50	7.0	3.5	2.5	1.0	0.5	8.0
50 ~ 100	10.0	4.5	4.0	1.5	0.7	12.0
100 ~ 1000	12.0	5.5	5.0	2.0	1.0	15.0
1000 초과	15.0	7.0	6.0	2.5	1.4	20.0

※ I_{sc} : Short-circuit current 단락 전류 I_L : Maximum load current 최대 부하 전류

VTTHD(Voltage Total Harmonic Distortion, 전압 총합 왜형률)

: Content of the sinusoidal waveform voltage contrast harmonic voltage
: 기본파 전압 대비 고조파 전압의 함유율.(고조파 전압 규제치의 판단 기준값)

ITTHD(Current Total Harmonic Distortion, 전류 총합 왜형률)

: Content of the sinusoidal waveform current contrast harmonic current
: 기본파 전류 대비 고조파 전류의 함유율.

ITDD(Current Total Demand Distortion, 전류 총 수요 왜형률)

: Content of the maximum load current contrast harmonic current
: 최대 부하 전류 대비 고조파 전류의 함유율.(고조파 전류 규제치의 기준값)

Protection of the capacitor by harmonic 고조파 유입에 따른 콘덴서 보호

Harmonic current content, which is created from harmonic generation source, is obeyed of Ohm's law which is basic of electrical circuit, so the harmonic current is flowed to lower impedance.

Harmonic current is a current (high frequency) which has integer ratio frequency against basic pulse, so high frequency harmonic current is for low impedance equipment, as mainly for power factor correction capacitor (capacitor impedance is $-j \cdot \frac{1}{2\pi \cdot f \cdot C}$ current is $2\pi \cdot f \cdot C \cdot V(A)$). So it could incur a disability by over current caused by harmonic current, and in this case please install series reactor for capacitor protection. When series reactor L(%) is installed, capacitor terminal voltage is risen as $\frac{100}{100-L} \times 100(\%)$ please select rated voltage of capacitor, which is provided for voltage rise, so overload voltage can't be applied.

고조파 발생원으로부터 발생한 고조파 전류 성분은 전기회로의 기본 법칙인 옴의 법칙에 따르게 되는데 즉, 고조파 발생원에서 발생한 고조파 전류는 임피던스가 낮은 쪽으로 흐른다. 고조파 전류란 기본파의 정수배의 주파수를 가진 전류(주파수가 높다)이고, 이러한 주파수가 높은 고조파전류는 임피던스가 낮은 기기, 즉 주로 역률 개선용 콘덴서이므로(콘덴서의 임피던스는 $-j \cdot \frac{1}{2\pi \cdot f \cdot C}$ 이고, 전류는 $2\pi \cdot f \cdot C \cdot V(A)$) 고조파전류로 인한 과전류가 유입 되어 장애를 발생시키게 되므로, Capacitor 보호용 직렬 Reactor를 설치 하여 주십시오.

직렬 Reactor L(%)를 설치할 경우에 콘덴서 단자 전압은 $\frac{100}{100-L} \times 100(\%)$ 로 상승하기 때문에 전압상승을 고려한 콘덴서 정격 전압을 선정하시어 과전압이 인가 되지 않도록 해야 합니다.

SPECIFICATIONS

Harmonic Generation Source | 고조파발생원

Generally harmonic generation source is nonlinear circuit (electrical circuit includes circuit component

일반적으로 고조파 발생원은 비 선형 회로(옴의 법칙이 적용되지 않는 회로소자를 포함한 전기 회로)에서 발생되며, 그 종류는 아래 표와 같다.

Harmonic Generation Source
Transformer, Rotation machine which is generated by magnetic saturation,
Arc furnace, Welding machine, Induction furnace
SCR AC phase control system, UPS
DC rectifier, Converter, Inverter
Single phase rectifier system (Computer etc), Elevator, Escalator
Fluorescent lamp ballast, Dimmer

고 조 파 발 생 원
변압기, 회전기 등의 자기 포화에 의한 발생.
아크로, 용접기, 유도로
SCR 교류 위상 제어 장치, UPS
DC 정류기, Converter, Inverter
단상 정류 장치(컴퓨터 등), Elevator, Escalator
형광등 안정기, Dimmer

Influence of harmonic | 고조파 영향

Name	Influence
Capacitor Reactor	· Circuit impedance is dropped due to resonant phenomenon caused by harmonic current, overheat / damage / vibration / noise can be appeared.
Transformer	· Noise due to magnetization phenomenon of metal core by · Capacitance drops due to rise of iron loss and copper loss by harmonic current and voltage.
Fluorescent lamp	· Impedance drops by harmonic current, overheat and damage on choke coil and power factor correction capacitor.
Cable	· Neutral line overheat due to inflow of harmonic current on neutral line of 3 phase circuit.
Induction motor	· periodical change of number of rotation caused by appearance of stationary vibration torque of harmonic current.
Instrument Transformer	· In case of initial phase tolerance in voltage transformer, Measuring accuracy drops due to harmonic (ϕ is phase angle of control current as thyristor phase control).
Intergrated wattmeter	· Measuring tolerance appearance in useful magnetic flux of voltage and current due to non-operation of the flux change by nonlinear property.
Rectifier controller	· Malfunction caused by phase dislocation of control signal.
Relay	· Excess of set value by harmonic voltage and current · Malfunction or out of function caused by phase change.
Power fuse	· Break caused by excess harmonic current
Circuit breaker	· Malfunction caused by excess harmonic current

기 기 명	영 향 의 종 류
콘 덴 서 리 액 터	· 고조파 전류로 인하여 회로의 임피던스가 공진현상 등에 의해 감소하여 과대 전류가 유입되고, 과열, 소손, 진동, 소음 발생 함.
변압기	· 고조파 전류에 의한 철심의 자화 현상으로 소음 발생 · 고조파 전류, 전압에 의한 철손, 동손의 증가로 용량 감소
형광등	· 고조파 전류때문에 임피던스가 감소하여 역률개선용 콘덴 서 및 초크코일에 과전류 유입으로 과열, 소손
케이블	· 3상 회로의 중성선에 고조파 전류 유입에 의한 중성선 과열
유도전동기	· 고조파 전류로 정상진동 토오크가 발생하여 회전수의 주기적 변동 · 철손, 동손 등 손실 증가
계기용변성기	· 계기용 변성기에 초기 위상오차가 있는 경우, 고조파 (ϕ 는 사이리 스타 위상제어 등 제어전류의 위상각)의 영향으로 측정 정밀도 저하
적산전력계	· 전압, 전류의 유효자속이 비선형 특성으로 자속변화가 완전히 적응하지 못하므로 측정오차 발생 · 고조파 전류의 과대한 유입에 의한 전류코일 소손
정류기제어장치	· 제어신호의 위상 어긋남에 의한 오제어 등
계전기	· 고조파 전류, 전압에 의한 설정값 등의 초과 · 위상변화에 의한 오동작 또는 동작 하지 않음.
전력 fuse	· 과대한 고조파 전류에 의한 용단
배선용차단기	· 과대한 고조파 전류에 의한 오동작

Power factor correction | 역율 개선 효과

▶ Power Factor Correction 역율 개선의 효과 ◀

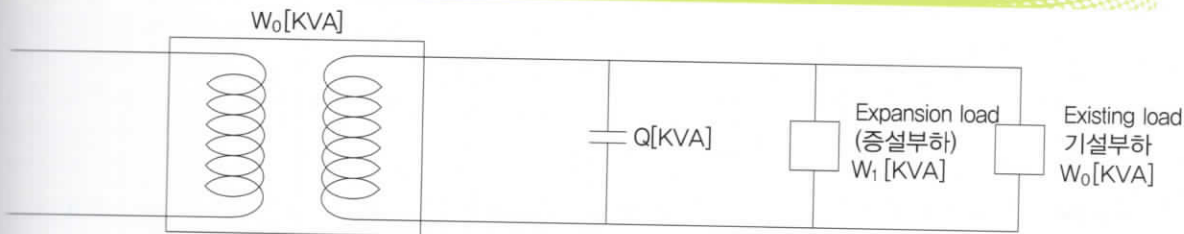
- 1) Reduction of transformer, distribution line loss | 변압기, 배전선의 손실 저감
- 2) Efficient use of transformer | 설비 용량의 증가
- 3) Voltage drop compensation | 전압 강하의 경감.

1. Reduction of Transformer Loss 변압기/배전선의 손실 저감

The loss of distribution line(선로의 손실은) $P_L = I^2 R = \left(\frac{P}{V \cos \theta}\right)^2 R = \frac{P^2 R}{V^2 \cdot \cos^2 \theta}$ 에서

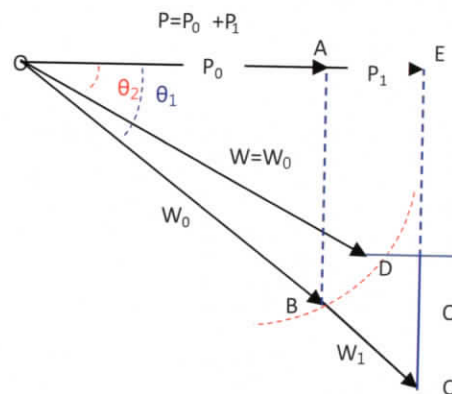
- Loss is inversely proportional to the square power factor so the loss reduced if the power factor correction.
- 손실은 역율 제곱에 반비례 하므로 역율을 개선 하면 손실을 감소 시킬 수 있습니다.

2. Efficient use of transformer 설비 용량의 여유 증가



1) Capacity of new machine | 새로운 설비 용량 W1은

$$W_1 = \overline{OC} - \overline{OB} = \frac{P}{\cos \theta_1} - W_0 = \frac{W_0 \cos \theta_1}{\cos \theta_1} - W_0 = W_0 \left(\frac{\cos \theta_1}{\cos \theta_2} - 1 \right)$$



2) Power increase | 전력의 증가분

$$P_1 = P - P_0 = W_1 \cdot \cos \theta_1 = W_0 (\cos \theta_2 - \cos \theta_1) \text{ [KVA]}$$

3. Voltage drop Compensation 전압 강하의 경감.

1) Before correction | 개선전

$$\Delta e = I \cdot (R \cos \theta_1 + X \sin \theta_1) = \frac{Pr}{Er} (R + X \tan \theta_1)$$

2) After correction | 개선후

$$\Delta e' = I \cdot (R \cos \theta_2 + X \sin \theta_2) = \frac{Pr}{Er} (R + X \cdot \tan \theta_2)$$

3) Before and after correction | 개선 전후 의 경감

$$\Delta e - \Delta e' = \frac{X \cdot Pr}{Er} (X \cdot \tan \theta_1 - X \cdot \tan \theta_2)$$

$$\tan \theta_1 > X \tan \theta_2 \text{ 이므로 } \Delta e > \Delta e'$$

4) Reduce the voltage drop rate | 전압 강하 경감률

$$\frac{\Delta e - \Delta e'}{Er} \times 100 = \frac{X \cdot Pr}{Er^2} (\tan \theta_1 - \tan \theta_2) \times 100 = \frac{X}{Er^2} Pr \cdot (\tan \theta_1 - \tan \theta_2) \times 100 \cong \frac{X_c}{R_c} \times 100$$

$RC \cong \frac{Er^2}{X}$ Short-circuit capacity of the capacitor installation busbar (콘덴서 설치 모선의 단락 용량)

$QC = Pr(\tan \theta_1 - \tan \theta_2) \rightarrow$ Capacity of capacitor (콘덴서 용량)

SPECIFICATIONS

Capacity Calculation Table of Capacitors | 콘덴서 용량산출표

Power factor after correction $\cos \Theta_2$ 개선후 역률

Power factor before correction $\cos \Theta_1$ 개선전 역률

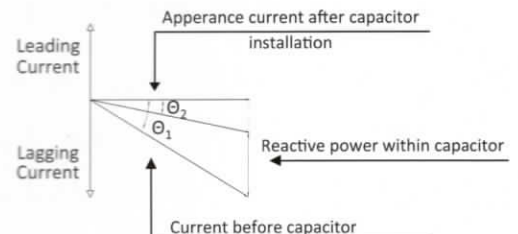
	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.80
0.50	137	159	153	148	144	140	137	134	131	128	125	122	119	117	114	111	109	106	103	101	98
0.51	169	154	148	144	140	136	132	129	126	123	120	118	115	112	109	107	104	102	99	96	94
0.52	164	150	144	139	135	131	125	125	122	119	116	113	110	108	105	102	100	97	95	92	89
0.53	160	146	140	135	131	127	124	121	117	114	112	109	106	103	101	98	95	96	90	88	85
0.54	156	142	136	131	127	123	120	116	113	110	108	105	102	99	97	94	91	89	86	84	81
0.55	152	138	132	127	123	119	110	112	109	106	104	101	98	95	93	90	87	85	82	80	77
0.56	148	134	128	123	119	115	112	109	105	102	100	97	94	91	89	86	83	81	78	76	73
0.57	144	130	124	119	115	111	108	105	102	99	96	93	90	88	85	82	80	77	74	72	69
0.58	141	126	120	115	111	108	104	101	98	95	92	89	87	84	81	79	76	73	71	68	66
0.59	137	123	117	112	108	104	101	97	94	91	89	86	83	80	78	75	72	70	67	65	62
0.60	133	119	113	108	104	100	97	94	91	88	85	82	79	77	74	71	69	66	64	61	58
0.61	130	116	110	105	101	97	94	90	87	84	82	79	76	73	71	68	65	63	60	58	55
0.62	127	112	106	102	97	94	90	87	84	81	78	75	73	70	67	65	62	59	57	54	52
0.63	123	109	103	98	94	90	87	84	81	78	75	72	69	67	64	61	59	56	54	51	48
0.64	120	106	100	95	91	87	84	81	78	75	72	69	66	63	61	58	56	53	50	48	45
0.65	117	103	97	92	88	84	81	77	74	71	69	66	63	60	58	55	52	50	47	45	42
0.66	114	100	94	89	85	81	78	74	71	68	65	63	60	57	55	52	48	47	44	41	39
0.67	111	97	91	86	82	78	75	71	68	65	62	60	57	54	52	49	46	44	47	38	36
0.68	108	94	88	83	79	75	72	68	65	62	59	57	54	51	49	46	43	41	38	35	33
0.69	105	91	85	80	76	72	69	65	62	59	57	54	51	48	46	43	40	37	35	32	30
0.70	102	88	82	77	73	69	66	63	59	56	54	51	48	45	43	40	37	35	32	30	27
0.71	99	85	79	74	70	66	63	60	57	54	51	48	45	43	40	37	35	32	29	27	24
0.72	96	82	76	71	67	64	60	57	54	51	48	45	42	40	37	34	32	29	27	24	21
0.73	94	79	73	69	64	61	57	54	51	48	45	42	40	37	34	32	29	26	24	21	19
0.74	91	77	71	66	62	58	55	51	48	45	43	40	37	34	32	29	26	24	21	19	16
0.75	88	74	68	63	59	55	52	49	46	43	40	37	34	32	29	26	24	21	18	16	13
0.76	86	71	65	60	56	53	49	46	43	40	37	34	32	29	26	24	21	18	16	13	11
0.77	83	69	63	58	54	50	47	43	40	37	35	32	29	26	24	21	18	16	13	11	8
0.78	80	66	60	55	51	47	44	41	38	35	32	29	26	24	21	18	16	13	10	8	5
0.79	78	63	57	53	48	46	41	38	35	32	29	26	24	21	18	16	13	10	8	5	2.6
0.80	75	61	55	50	46	42	39	36	32	29	27	24	21	18	16	13	10	8	5	2.6	
0.81	72	58	52	47	43	40	36	33	30	27	24	21	18	16	13	10	8	5	2.6		
0.82	70	56	50	45	41	37	34	30	27	24	21	19	16	13	10	8	5	2.6			
0.83	67	53	47	42	38	34	31	28	25	22	19	16	13	10	8	5	2.6				
0.84	65	50	44	40	35	32	28	25	22	19	16	13	11	8	5	2.6					
0.85	62	48	42	37	33	29	26	23	19	16	14	11	8	5	2.7						
0.86	59	45	39	34	30	26	23	20	17	14	11	8	5	2.7							
0.87	57	42	36	32	28	24	20	17	14	11	8	6	2.7								
0.88	54	40	34	29	25	21	18	15	11	8	6	2.8									
0.89	51	37	31	26	22	18	15	12	9	6	2.8										
0.90	48	34	28	23	19	16	12	9	6	2.8											
0.91	46	31	25	21	16	13	9	6	3												
0.92	43	28	22	18	13	10	6	3.1													
0.93	40	25	19	14	10	7	3.2														
0.94	36	22	16	11	7	3.4															
0.95	33	19	13	8	3.7																
0.96	29	15	9	4.1																	
0.97	25	11	4.8																		
0.98	20	6																			
0.99	14																				

How to use table

1. In case of improve the power factor to 0.95 from 0.75 at load capacity 500kW.
Look for the cross point 55(%) from vertical axis 0.75 and horizontal axis 0.95 Then demanded capacity = $500kW \times 0.55 = 275kVA$
2. In case of KVA load,
At first calculate $KW = KVA \times \cos \Theta_1$
then calculate as same as #1

Q_c = Capacity(Kvar) Q_c = 필요로 하는 콘덴서 용량(Kvar)
 P_r = Active power (kW) P_r = 전부하 용량 (kW)
 $\cos \Theta_1$ = Power factor before correction $\cos \Theta_1$ = 현재 역률
 $\cos \Theta_2$ = Power factor after correction $\cos \Theta_2$ = 개선 후 역률

$$Q_c = P_r \left(\frac{\sqrt{1 - \cos^2 \Theta_1}}{\cos \Theta_1} - \frac{\sqrt{1 - \cos^2 \Theta_2}}{\cos \Theta_2} \right)$$



Capacity calculation table for load | 부하별 콘덴서 용량산출표

■ : Three-Phase induction motor 3상 유도 전동기

Out Put		필요한 콘덴서 용량 (60Hz)					
		220 VAC		380 VAC		440 VAC	
		μF	Kvar	μF	Kvar	μF	Kvar
0.2	1/4	15	0.27	5	0.27	5	0.36
0.4	1/2	20	0.36	5	0.27	5	0.36
0.75	1	30	0.55	7.5	0.41	5	0.36
1	1.3	30	0.55	7.5	0.41	7.5	0.55
1.1	1.5	30	0.55	10	0.54	7.5	0.55
1.5	2	50	0.91	10	0.54	10	0.73
2	2.5	50	0.91	15	0.82	10	0.73
2.2	3	75	1.37	15	0.82	15	1.09
3	4	75	1.37	20	1.09	15	1.09
3.7	5	100	1.82	20	1.09	20	1.46
4	5.5	100	1.82	30	1.63	20	1.46
5	7	100	1.82	40	2.18	30	2.19
5.5	7.5	175	3.19	50	2.72	30	2.19
7.5	10	200	3.65	75	4.08	40	2.92
10	13.5	250	4.56	100	5.44	50	3.65
11	15	300	5.47	100	5.44	75	5.47
15	20	400	7.30	100	5.44	75	5.47
19	25	500	9.12	150	8.17	100	7.30
20	26.5	500	9.12	150	8.17	100	7.30
22	30	500	9.12	150	8.17	100	7.30
25	33.5	600	10.9	200	10.9	150	10.9
30	40	800	14.6	200	10.9	150	10.9
37	50	900	16.4	250	13.6	200	14.6
40	53.5	1000	18.2	300	16.3	200	14.6
45	60	1100	20.1	300	16.3	250	18.2
50	66.5	1200	21.9	350	19.1	250	18.2
55	75	1300	23.7	400	21.8	300	21.9

■ Arc welder for 220VAC 220VAC 아크 용접기

Input (kVA)	콘덴서 용량 (60Hz)	
	μF	Kvar
1	50	0.91
2	75	1.37
3	100	1.82
5	150	2.74
7.5	250	4.56
10	300	5.47
15	450	8.21
20	600	10.9
25	700	12.8
30	900	16.4
35	1000	18.2
40	1100	20.1
45	1300	23.7
50	1450	26.5

AC resistance welding machine and DC welding machine uses to 1/2 of μF 교류 저항 용접기와 DC 용접기는 상기 μF 에 1/2 로 사용함.

■ Single-Phase induction motor 단상 유도 전동기

Out Put		Capacity of Capacitors(콘덴서 용량 (60Hz))			
		220 VAC		380 VAC	
kW	HP	μF	Kvar	μF	Kvar
0.1	1/8	15	0.27	5	0.27
0.2	1/4	20	0.36	5	0.27
0.25		30	0.55	7.5	0.41
0.4	1/2	30	0.55	7.5	0.41
0.55		30	0.55	10	0.54
0.75	1	50	0.91	10	0.54
1.0		50	0.91	15	0.82

The thickness of wire & connecting with capacitor

The least thickness of electric wire(copper)(mm²)				2.0	3.5	5.5	8.0	14	22	30	38	50	60	80	100
Rated current of capacitor(A)				10	15	20	30	40	50	60	75	90	100	125	150
Capacity of switch (A)				15	30	30	50	75	100	100	150	200	200	225	300
Capacitance (μF)	60 Hz	1 Φ	220V	120	180	240	360	485	600	730	910	1100	1200	1500	1800
		3 Φ	220V	210	315	415	630	840	1015	1250	1550	1900	2100	2600	3150
			380V	120	180	240	360	485	600	730	910	1100	1200	1500	1800
			440V	105	155	210	310	420	520	630	780	940	1050	1300	1500

※ Please use exclusive breaker for capacitor and allowable current can be 1.5 times higher than capacitor.

※ 차단기는 Capacitor 전용 차단기를 사용 하시고 허용 전류는 Capacitor의 1.5배의 전류 제품을 사용 하십시오.

SPECIFICATIONS

Construction & dimension | 구조 및 치수

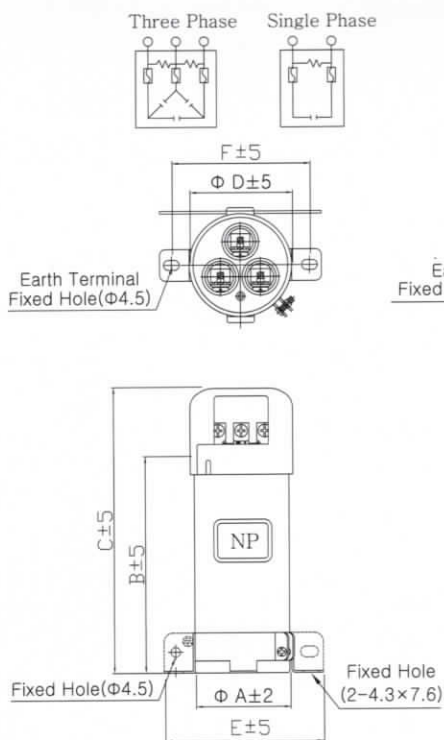


Fig1

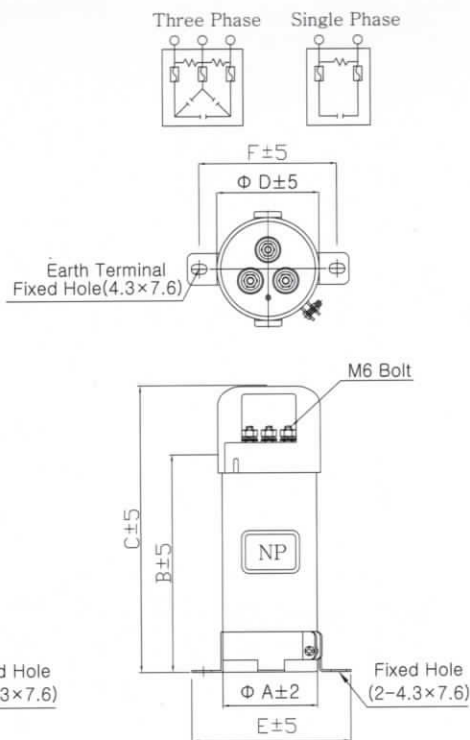


Fig2

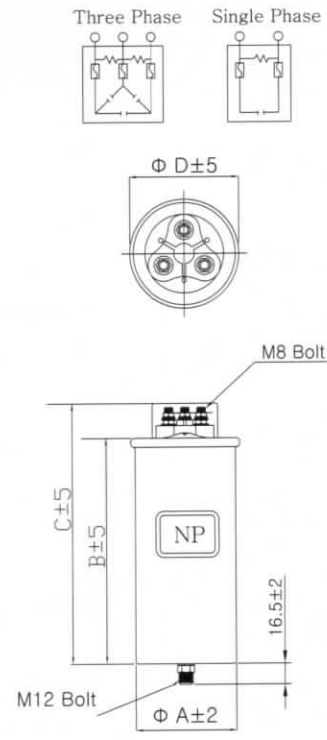


Fig3

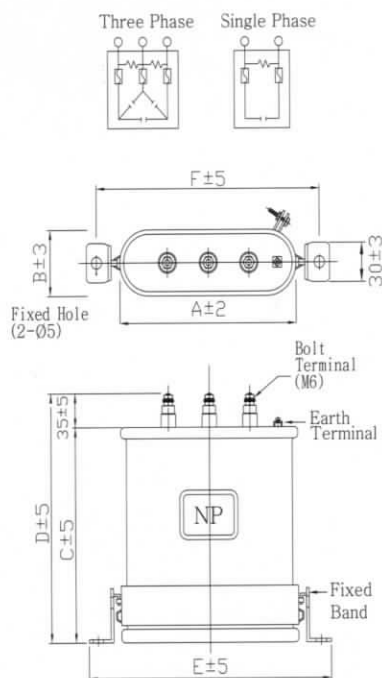


Fig4

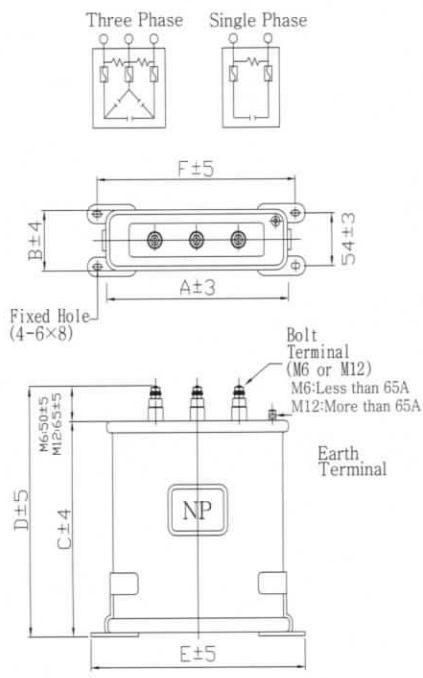


Fig5

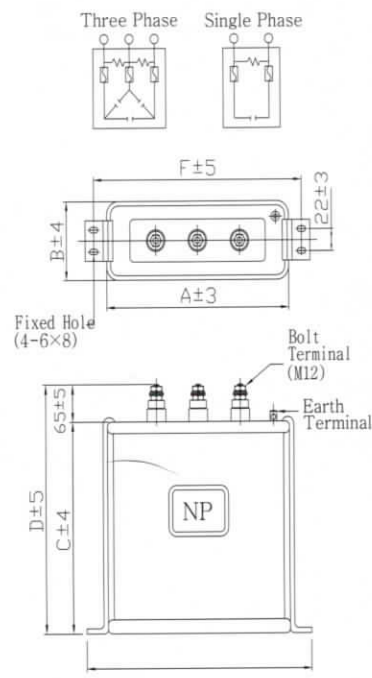
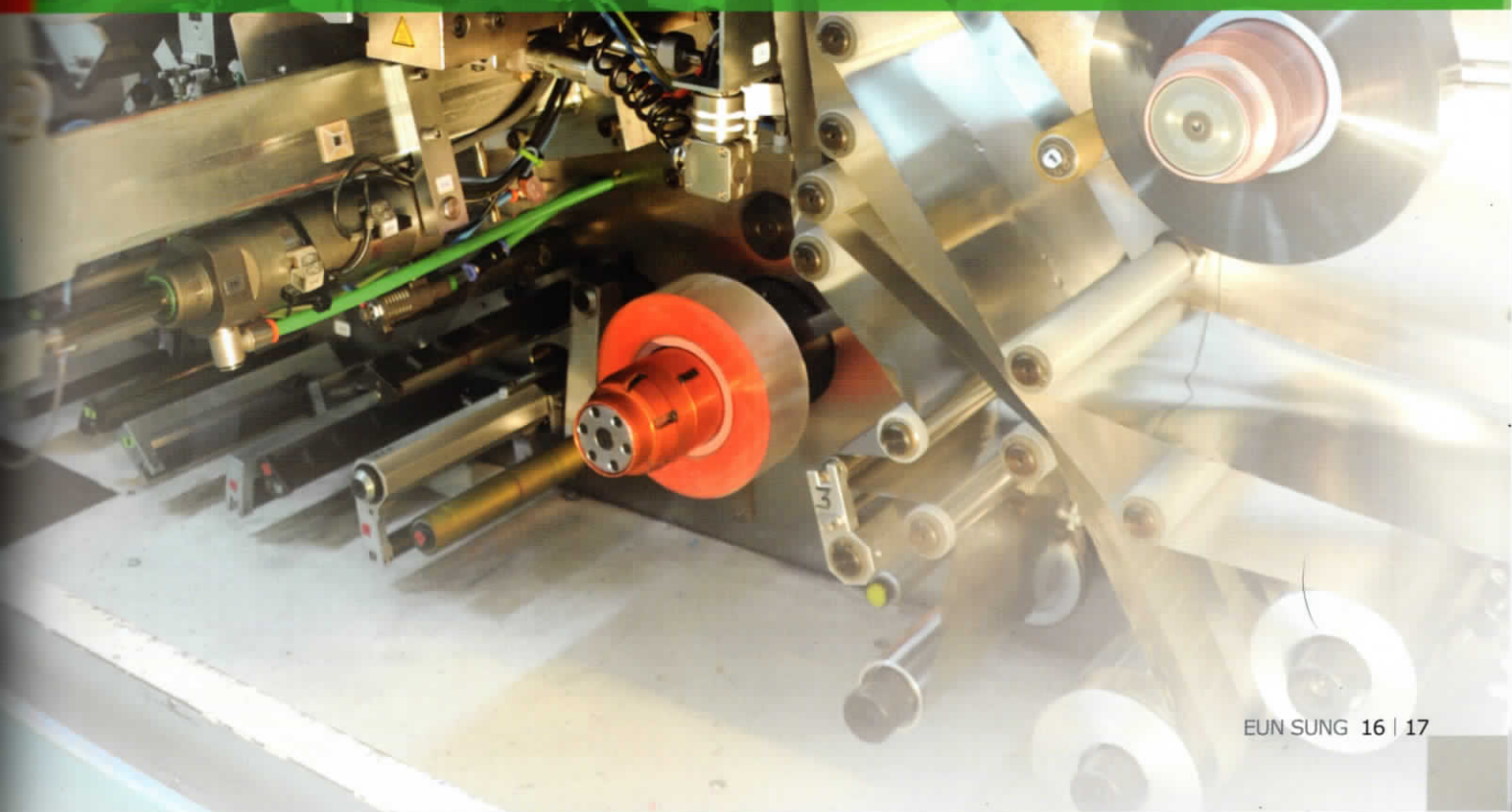


Fig6



PRODUCT DESCRIPTIONS

For DOMESTIC | 내수용



PRODUCT DESCRIPTIONS

For DOMESTIC | 내수용 | 220V, 60Hz

Permitted Overload Voltage			허용 과전압		
24 Hr	.....	220 VAC	24시간	.....	220 VAC
Less than 8 hours during 24 hours	.....	242 VAC	24시간중 8시간 이내	.....	242 VAC
Less than 30 minute during 24 hours	.....	253 VAC	24시간중 30분 이내	.....	253 VAC
Less than 2 times during 5 minute for 1 month	.....	264 VAC	1개월중에서 5분이내가 2회 이하	.....	264 VAC
Less than 2 times during 1 minute for 1 month	.....	286 VAC	1개월 중에서 1분 이내가 2회 이하	.....	286 VAC

TYPE NO.		Rated Voltage (VAC)	Rated Capacity		Phase (Ø)	Rated Current(A)		Dimension (mm)						Fig
1Ø	3Ø		µF	KVAR		1Ø	3Ø	A	B	C	D	E	F	
ESLII-22010 S		220	10	0.18	1	0.83		50	65	110	53	80	65	1
ESLII-22015 S			15	0.27		1.24		50	65	110	53	80	65	
ESLII-22020 S			20	0.36		1.66		50	65	110	53	80	65	
ESLII-22030 S			30	0.55		2.49		50	65	110	53	80	65	
ESLII-22040 S			40	0.73		3.32		50	65	110	53	80	65	
ESLII-22050 S			50	0.91		4.15		50	65	110	53	80	65	
ESLII-22075 S			75	1.37		6.22		50	110	155	53	80	65	
ESLII-22100 S			100	1.82		8.29		50	110	155	53	80	65	
	ESLII-22010 T		10	0.18	3		0.48	50	95	140	53	80	65	
	ESLII-22015 T		15	0.27			0.72	50	95	140	53	80	65	
	ESLII-22020 T		20	0.36			0.96	50	95	140	53	80	65	
	ESLII-22030 T		30	0.55			1.44	50	125	170	53	80	65	
	ESLII-22040 T		40	0.73			1.92	50	125	170	53	80	65	
	ESLII-22050 T		50	0.91			2.39	50	125	170	53	80	65	
	ESLII-22075 T		75	1.37			3.59	50	125	170	53	80	65	
	ESLII-22100 T		100	1.82			4.79	50	150	195	53	80	65	
ESLII-22150 S	ESLII-22150 T		150	2.74	1 or 3	12.4	7.18	50	150	195	53	80	65	
ESLII-22200 S	ESLII-22200 T		200	3.65		16.6	9.58	63	165	220	66	90	80	
ESLII-22250 S	ESLII-22250 T		250	4.56		20.7	12.0	63	165	220	66	90	80	
ESLII-22300 S	ESLII-22300 T		300	5.47		24.9	14.4	63	165	220	66	105	95	
ESLII-22400 S	ESLII-22400 T		400	7.30		33.2	19.2	76	165	220	79	105	95	2
								170	60	100	135	215	195	4
ESLII-22500 S	ESLII-22500 T		500	9.12		41.5	23.9	76	195	250	79	105	95	2
								170	60	120	155	215	195	4
ESLII-22600 S	ESLII-22600 T		600	10.9		49.8	28.7	170	60	160	195	215	195	
ESLII-22750 S	ESLII-22750 T		750	13.7		62.2	35.9	170	60	180	215	215	195	
ESLII-22900 S	ESLII-22900 T		900	16.4		74.6	43.1	170	60	220	255	215	195	
ESLII-221000 S	ESLII-221000 T		1000	18.2		82.9	47.9	170	60	220	255	215	195	
ESLII-2202.5 KS	ESLII-2202.5 KT	220	137	2.5	1 or 3	11.4	6.56	50	150	195	53	80	65	1
ESLII-2205 KS	ESLII-2205 KT		274	5		22.7	13.1	63	165	220	66	105	95	2
ESLII-2207.5 KS	ESLII-2207.5 KT		411	7.5		34.1	19.7	76	165	220	79	105	95	
								170	60	100	135	215	195	4
ESLII-22010 KS	ESLII-22010 KT		548	10		45.5	26.2	76	195	250	79	105	95	2
								170	60	160	195	215	195	4
ESLII-22012.5 KS	ESLII-22012.5 KT		685	12.5		56.8	32.8	170	60	180	215	215	195	
ESLII-22015 KS	ESLII-22015 KT		822	15		68.2	39.4	170	60	180	215	215	195	
ESLII-22020 KS	ESLII-22020 KT		1096	20		90.9	52.5	170	60	260	295	215	195	
ESLII-22025 KS	ESLII-22025 KT		1370	25	3	113.6	65.6	220	60	240	285	260	240	5
ESLII-22030 KS	ESLII-22030 KT		1644	30		136.4	78.7	220	60	260	305	260	240	
	ESLII-22040 KT		2192	40			105.0	240	85	260	335	280	270	6
	ESLII-22050 KT		2740	50			131.2	240	85	300	375	280	270	

※ This dimension is able to change without notice for better quality.

※ 상기 치수는 품질 개선으로 변경될 수 있으므로 주문시 당사로 확인 바랍니다.

For DOMESTIC | 내수용 | 380V, 60Hz



Permitted Overload Voltage		허용 과전압	
24 Hr	 380 VAC	24시간	 380 VAC
Less than 8 hours during 24 hours	 418 VAC	24시간중 8시간 이내	 418 VAC
Less than 30 minute during 24 hours	 437 VAC	24시간중 30분 이내	 437 VAC
Less than 2 times during 5 minute for 1 month	 456 VAC	1개월중에서 5분이내가 2회 이하	 456 VAC
Less than 2 times during 1 minute for 1 month	 494 VAC	1개월 중에서 1분 이내가 2회 이하	 494 VAC

TYPE NO.		Rated Voltage (VAC)	Rated Capacity		Phase (Ø)	Rated Current(A)		Dimension (mm)						Fig
1Ø	3Ø		µF	KVAR		1Ø	3Ø	A	B	C	D	E	F	
ESLII-38010 S	ESLII-38010 T	380	10	0.54	1 or 3	1.43	0.83	50	95	140	53	80	65	1
ESLII-38015 S	ESLII-38015 T		15	0.82		2.15	1.24	50	95	140	53	80	65	
ESLII-38020 S	ESLII-38020 T		20	1.09		2.87	1.65	50	95	140	53	80	65	
ESLII-38030 S	ESLII-38030 T		30	1.63		4.30	2.48	50	125	170	53	80	65	
ESLII-38040 S	ESLII-38040 T		40	2.18		5.73	3.31	50	125	170	53	80	65	
ESLII-38050 S	ESLII-38050 T		50	2.72		7.16	4.14	50	150	195	53	80	65	
ESLII-38075 S	ESLII-38075 T		75	4.08		10.7	6.20	63	165	220	66	90	80	2
ESLII-38100 S	ESLII-38100 T		100	5.44		14.3	8.27	63	165	220	66	90	80	
ESLII-38150 S	ESLII-38150 T		150	8.17		21.5	12.4	76	165	220	79	105	95	
ESLII-38200 S	ESLII-38200 T		200	10.89		28.7	16.5	170	60	100	135	215	195	
ESLII-38250 S	ESLII-38250 T		250	13.61		35.8	20.7	76	165	220	79	105	95	
ESLII-38300 S	ESLII-38300 T		300	16.3		43.0	24.8	170	60	120	155	215	195	
ESLII-38400 S	ESLII-38400 T		400	21.8		57.3	33.1	76	195	250	79	105	95	4
ESLII-38500 S	ESLII-38500 T		500	27.2		71.6	41.4	170	60	160	195	215	195	
ESLII-38600 S	ESLII-38600 T		600	32.7		86.0	49.6	170	60	220	255	215	195	5
ESLII-38750 S	ESLII-38750 T		750	40.8		107.4	62.0	220	60	260	295	215	195	
ESLII-38900 S	ESLII-38900 T		900	49.0		128.9	74.4	220	60	300	345	260	240	6
ESLII-381000 S	ESLII-381000 T		1000	54.4		143.3	82.7	240	85	230	305	280	270	
ESLII-3802.5 KS	ESLII-3802.5 KT	380	45.9	2.5	1 or 3	6.58	3.80	63	165	220	66	90	80	1
ESLII-3805 KS	ESLII-3805 KT		91.8	5		13.2	7.60	63	165	220	66	90	80	
ESLII-3807.5 KS	ESLII-3807.5 KT		138	7.5		19.7	11.4	63	165	220	66	90	80	
ESLII-38010 KS	ESLII-38010 KT		184	10		26.3	15.2	76	165	220	79	105	95	2
ESLII-3812.5 KS	ESLII-3812.5 KT		230	12.5		32.9	19.0	170	60	100	135	215	195	
ESLII-38015 KS	ESLII-38015 KT		276	15		39.5	22.8	76	195	250	79	105	95	
ESLII-38020 KS	ESLII-38020 KT		367	20		52.6	30.4	170	60	120	155	215	195	4
ESLII-38025 KS	ESLII-38025 KT		459	25		65.8	38.0	170	60	160	195	215	195	
ESLII-38030 KS	ESLII-38030 KT		551	30		78.9	45.6	170	60	220	255	215	195	
ESLII-38040 KS	ESLII-38040 KT		735	40		105.3	60.8	220	60	260	295	215	195	5
ESLII-38050 KS	ESLII-38050 KT		918	50		131.6	76.0	220	60	300	345	260	240	
ESLII-38075 KS	ESLII-38075 KT		1378	75		151.9	85.0	240	85	230	305	280	270	
ESLII-38100 KS	ESLII-38100 KT		1837	100				240	85	260	335	280	270	6

■ This dimension is able to change without notice for better quality.

■ 상기 치수는 품질 개선으로 변경될 수 있으므로 주문시 당사로 확인 바랍니다.

PRODUCT DESCRIPTIONS

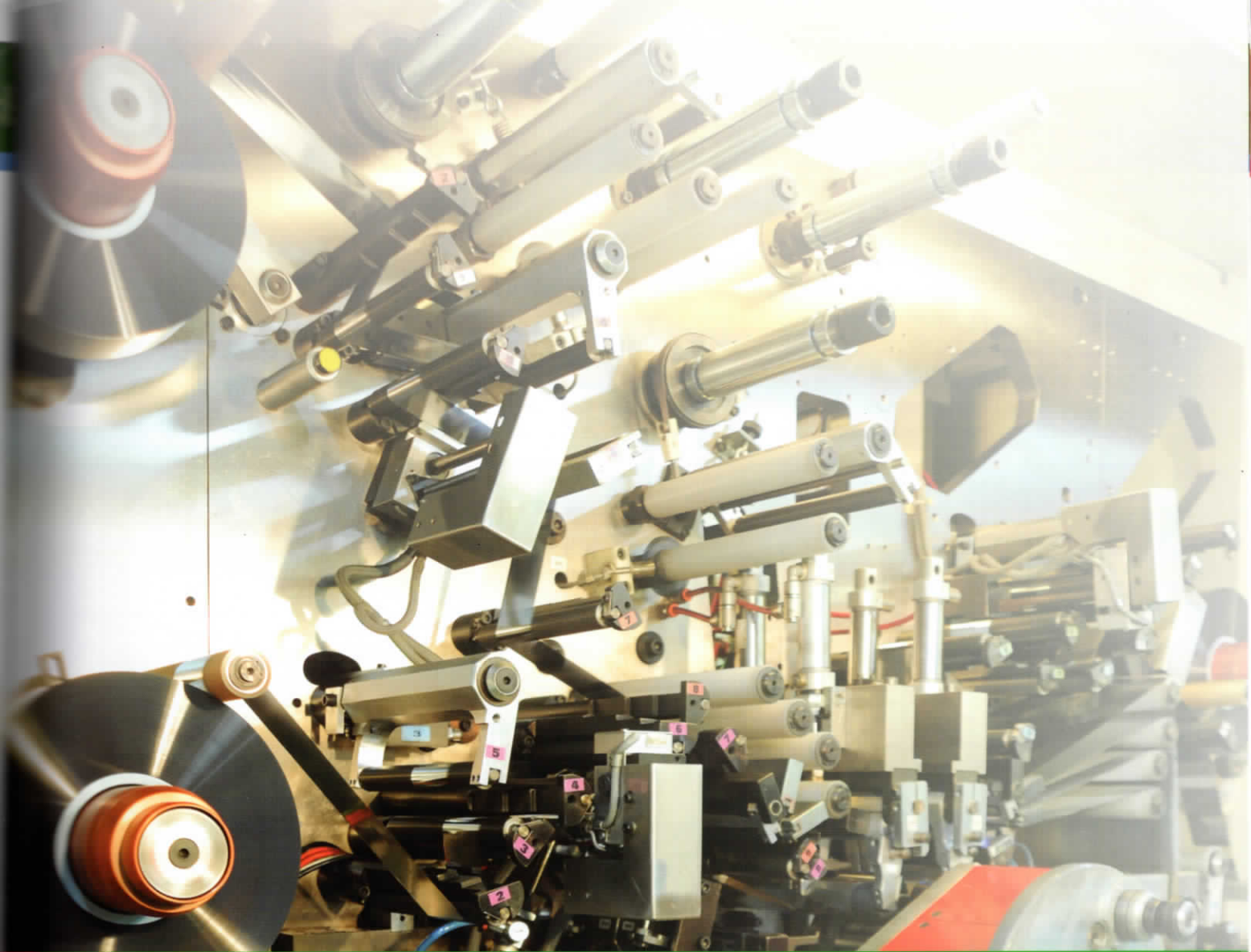
For DOMESTIC | 내수용 | 440V, 60Hz

Permitted Overload Voltage			허용 과전압		
24 Hr	.....	440 VAC	24시간	.....	440 VAC
Less than 8 hours during 24 hours	.....	484 VAC	24시간중 8시간 이내	.....	484 VAC
Less than 30 minute during 24 hours	.....	506 VAC	24시간중 30분 이내	.....	506 VAC
Less than 2 times during 5 minute for 1 month	.....	528 VAC	1개월중에서 5분이내가 2회 이하	.....	528 VAC
Less than 2 times during 1 minute for 1 month	.....	572 VAC	1개월 중에서 1분 이내가 2회 이하	.....	572 VAC

TYPE NO.		Rated Voltage (VAC)	Rated Capacity		Phase (Ø)	Rated Current(A)		Dimension (mm)						Fig
1Ø	3Ø		µF	KVAR		1Ø	3Ø	A	B	C	D	E	F	
ESLII-44010 S	ESLII-44010 T	440	10	0.73	1 or 3	1.66	0.96	50	95	140	53	80	65	1
ESLII-44015 S	ESLII-44015 T		15	1.09		2.49	1.44	50	95	140	53	80	65	
ESLII-44020 S	ESLII-44020 T		20	1.46		3.32	1.92	50	95	140	53	80	65	
ESLII-44030 S	ESLII-44030 T		30	2.19		4.98	2.87	50	125	170	53	80	65	
ESLII-44040 S	ESLII-44040 T		40	2.92		6.64	3.83	50	150	195	53	80	65	
ESLII-44050 S	ESLII-44050 T		50	3.65		8.29	4.79	63	165	220	66	90	80	
ESLII-44075 S	ESLII-44075 T		75	5.47		12.4	7.18	63	165	220	66	90	80	
ESLII-44100 S	ESLII-44100 T		100	7.30		16.6	9.58	63	165	220	66	90	80	
ESLII-44150 S	ESLII-44150 T		150	10.9		24.9	14.4	76	165	220	79	105	95	2
				0.0				170	60	120	155	215	195	
ESLII-44200 S	ESLII-44200 T		200	14.6		33.2	19.2	170	60	160	195	215	195	4
ESLII-44250 S	ESLII-44250 T		250	18.2		41.5	23.9	170	60	180	215	215	195	
ESLII-44300 S	ESLII-44300 T		300	21.9		49.8	28.7	170	60	220	255	215	195	
ESLII-44400 S	ESLII-44400 T		400	29.2		66.4	38.3	170	60	260	295	215	195	5
ESLII-44500 S	ESLII-44500 T		500	36.5		82.9	47.9	220	60	260	305	260	240	
ESLII-44600 S	ESLII-44600 T		600	43.8		99.5	57.5	220	60	320	365	260	250	
ESLII-44750 S	ESLII-44750 T		750	54.7		124.4	71.8	240	85	260	335	280	270	6
ESLII-44900 S	ESLII-44900 T		900	65.7		149.3	86.2	240	85	280	355	280	270	
	ESLII-441000 T		1000	73.0	3		95.8	240	85	300	375	280	270	
ESLII-4402.5 KS	ESLII-4402.5 KT	440	34.3	2.5	1 or 3	5.68	3.28	50	150	195	53	80	65	1
ESLII-4405 KS	ESLII-4405 KT		68.5	5		11.4	6.56	63	165	220	66	90	80	
ESLII-4407.5 KS	ESLII-4407.5 KT		103	7.5		17.0	9.84	76	165	220	79	105	95	2
								170	60	100	135	215	195	4
ESLII-44010 KS	ESLII-44010 KT		137	10		22.7	13.12	76	165	220	79	105	95	2
								170	60	100	135	215	195	4
ESLII-4412.5 KS	ESLII-4412.5 KT		171	12.5		28.4	16.40	76	195	250	79	105	95	2
								170	60	120	155	215	195	4
ESLII-44015 KS	ESLII-44015 KT		206	15		34.1	19.7	170	60	160	195	215	195	
ESLII-44020 KS	ESLII-44020 KT		274	20		45.5	26.2	170	60	180	215	215	195	
ESLII-44025 KS	ESLII-44025 KT		343	25		56.8	32.8	170	60	220	255	215	195	
ESLII-44030 KS	ESLII-44030 KT		411	30		68.2	39.4	170	60	260	295	215	195	
ESLII-44040 KS	ESLII-44040 KT		548	40		90.9	52.5	220	60	320	395	260	250	5
ESLII-44050 KS	ESLII-44050 KT		685	50		113.6	65.6	240	85	230	305	280	270	6
	ESLII-44075 KT		1028	75	3		98.4	240	85	300	375	280	270	
	ESLII-44100 KT		1370	100			131.2	240	85	380	455	280	270	

※ This dimension is able to change without notice for better quality.

※ 상기 치수는 품질 개선으로 변경될 수 있으므로 주문시 당사로 확인 바랍니다.



PRODUCT DESCRIPTIONS

For EXPORT | 수출용



PRODUCT DESCRIPTIONS

For EXPORT | 수출용 | 50Hz

▶ 230V, 50Hz, 3 Phase

24 Hr	 230 VAC
Less than 8 hours during 24 hours	 253 VAC
Less than 30 minute during 24 hours	 265 VAC
Less than 2 times during 5 minute for 1 month	 276 VAC
Less than 2 times during 1 minute for 1 month	 299 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL5-2302.5 KT	2.5	150	6.3	50	150	195	53	80	70	1
ESL5-2305 KT	5	301	12.6	63	165	220	66	95	80	
ESL5-2307.5 KT	7.5	451	18.8	76	195	255	79	105	95	2
ESL5-23010 KT	10	602	25.1	76	225	285	79	105	95	
ESL5-23012.5 KT	12.5	752	31.4	76	280	340	79	105	95	
ESL5-23015 KT	15	903	37.7	76	280	340	79	105	95	
ESL5-23020 KT	20	1203	50.2	86	355	385	89	-	-	3
				170	60	260	295	210	195	4
ESL5-23025 KT	25	1504	62.8	86	355	385	89	-	-	3
				220	60	260	310	255	235	5
ESL5-23030 KT	30	1805	75.3	220	60	320	385	255	235	6
ESL5-23040 KT	40	2407	100.4	240	85	280	345	275	260	
ESL5-23050 KT	50	3009	125.5	240	85	300	365	275	260	

▶ 415V, 50Hz, 3 Phase

24 Hr	415 VAC
Less than 8 hours during 24 hours	457 VAC
Less than 30 minute during 24 hours	477 VAC
Less than 2 times during 5 minute for 1 month	498 VAC
Less than 2 times during 1 minute for 1 month	540 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL5-4202.5 KT	2.5	46.2	3.5	50	150	195	53	80	70	1
ESL5-4205 KT	5	92.4	7.0	63	165	220	66	95	80	
ESL5-4207.5 KT	7.5	139	10.4	63	165	220	66	95	80	2
ESL5-42010 KT	10	185	13.9	76	165	225	79	105	95	
ESL5-42012.5 KT	12.5	231	17.4	76	195	255	79	105	95	
ESL5-42015 KT	15	277	20.9	76	225	285	79	105	95	
ESL5-42020 KT	20	370	27.8	76	280	340	79	105	95	3
				86	280	310	89	-	-	
ESL5-42025 KT	25	462	34.8	170	60	220	255	210	195	4
				86	355	385	89	-	-	3
ESL5-42030 KT	30	554	41.7	170	60	260	295	210	195	4
				86	355	385	89	-	-	3
ESL5-42040 KT	40	739	55.6	220	60	320	370	255	235	5
ESL5-42050 KT	50	924	69.6	240	85	230	295	275	260	6

▶ 400V, 50Hz, 3 Phase

24 Hr	 400 VAC
Less than 8 hours during 24 hours	 440 VAC
Less than 30 minute during 24 hours	 460 VAC
Less than 2 times during 5 minute for 1 month	 480 VAC
Less than 2 times during 1 minute for 1 month	 520 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL5-4002.5 KT	2.5	49.7	3.6	50	150	195	53	80	70	1
ESL5-4005 KT	5	99.5	7.2	63	165	220	66	95	80	
ESL5-4007.5 KT	7.5	149	10.8	76	165	225	79	105	95	2
ESL5-40010 KT	10	199	14.4	76	165	225	79	105	95	
ESL5-40012.5 KT	12.5	249	18.0	76	195	255	79	105	95	
ESL5-40015 KT	15	298	21.7	76	225	285	79	105	95	
ESL5-40020 KT	20	398	28.9	76	280	340	79	105	95	3
				86	280	310	89	-	-	
ESL5-40025 KT	25	497	36.1	170	60	260	295	210	195	4
				86	355	385	89	-	-	3
ESL5-40030 KT	30	597	43.3	220	60	240	290	255	235	5
				220	60	240	290	255	235	
ESL5-40040 KT	40	796	57.7	220	60	320	370	255	235	6
ESL5-40050 KT	50	995	72.2	240	85	260	325	275	260	

▶ 440V, 50Hz, 3 Phase

24 Hr	440 VAC
Less than 8 hours during 24 hours	484 VAC
Less than 30 minute during 24 hours	506 VAC
Less than 2 times during 5 minute for 1 month	528 VAC
Less than 2 times during 1 minute for 1 month	572 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL5-4402.5 KT	2.5	41.1	3.3	50	150	195	53	80	70	1
ESL5-4405 KT	5	82.2	6.6	63	165	220	66	95	80	
ESL5-4407.5 KT	7.5	123	9.8	76	165	225	79	105	95	2
ESL5-44010 KT	10	164	13.1	76	195	255	79	105	95	
ESL5-44012.5 KT	12.5	206	16.4	76	225	285	79	105	95	
ESL5-44015 KT	15	247	19.7	76	280	340	79	105	95	
ESL5-44020 KT	20	329	26.2	86	280	310	89	-	-	3
				170	60	220	255	210	195	4
ESL5-44025 KT	25	411	32.8	86	355	385	89	-	-	3
				170	60	260	295	210	195	4
ESL5-44030 KT	30	493	39.4	86	355	385	89	-	-	3
				220	60	260	310	255	235	5
ESL5-44040 KT	40	658	52.5	240	85	230	295	275	260	6
ESL5-44050 KT	50	822	65.6	240	85	280	345	275	260	

※ 상기 치수는 품질 개선으로 변경될 수 있으므로 주문시 당사로 확인 바랍니다.

※ This dimension is able to change without notice for better quality.



▶ 230V, 60Hz, 3 Phase

24 Hr	 230 VAC
Less than 8 hours during 24 hours	 253 VAC
Less than 30 minute during 24 hours	 265 VAC
Less than 2 times during 5 minute for 1 month	 276 VAC
Less than 2 times during 1 minute for 1 month	 299 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL6-2302.5 KT	2.5	125	6.3	50	150	195	53	80	70	1
ESL6-2305 KT	5	251	12.6	63	165	220	66	95	80	
ESL6-2307.5 KT	7.5	376	18.8	76	165	225	79	105	95	
ESL6-23010 KT	10	501	25.1	76	195	255	79	105	95	2
ESL6-23012.5 KT	12.5	627	31.4	76	225	285	79	105	95	
ESL6-23015 KT	15	752	37.7	76	280	340	79	105	95	
ESL6-23020 KT	20	1003	50.2	86	280	310	89	-	-	3
				170	60	220	255	210	195	4
ESL6-23025 KT	25	1254	62.8	86	355	385	89	-	-	3
				170	60	260	295	210	195	4
ESL6-23030 KT	30	1504	75.3	86	355	385	89	-	-	3
				220	60	260	325	255	235	5
ESL6-23040 KT	40	2006	100.4	240	85	230	295	275	260	6
ESL6-23050 KT	50	2507	125.5	240	85	280	345	275	260	

▶ 415V, 60Hz, 3 Phase

24 Hr	415 VAC
Less than 8 hours during 24 hours	457 VAC
Less than 30 minute during 24 hours	477 VAC
Less than 2 times during 5 minute for 1 month	498 VAC
Less than 2 times during 1 minute for 1 month	540 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL6-4202.5 KT	2.5	38.5	3.5	50	150	195	53	80	70	1
ESL6-4205 KT	5	77	7.0	63	165	220	66	95	80	
ESL6-4207.5 KT	7.5	116	10.4	63	165	220	66	95	80	
ESL6-42010 KT	10	154	13.9	76	165	225	79	105	95	2
ESL6-42012.5 KT	12.5	193	17.4	76	165	225	79	105	95	
ESL6-42015 KT	15	231	20.9	76	195	255	79	105	95	
ESL6-42020 KT	20	308	27.8	76	225	285	79	105	95	3
ESL6-42025 KT	25	385	34.8	76	280	340	79	105	95	
ESL6-42030 KT	30	462	41.7	86	280	310	89	-	-	
				170	60	220	255	210	195	4
ESL6-42040 KT	40	616	55.6	86	355	385	89	-	-	3
				220	60	260	310	255	235	5
ESL6-42050 KT	50	770	69.6	220	60	320	385	255	235	

▶ 400V, 60Hz, 3 Phase

24 Hr	 400 VAC
Less than 8 hours during 24 hours	 440 VAC
Less than 30 minute during 24 hours	 460 VAC
Less than 2 times during 5 minute for 1 month	 480 VAC
Less than 2 times during 1 minute for 1 month	 520 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL6-4002.5 KT	2.5	41.4	3.6	50	150	195	53	80	70	1
ESL6-4005 KT	5	82.9	7.2	63	165	220	66	95	80	
ESL6-4007.5 KT	7.5	124	10.8	63	165	220	66	95	80	
ESL6-40010 KT	10	166	14.4	76	165	225	79	105	95	2
ESL6-40012.5 KT	12.5	207	18.0	76	195	255	79	105	95	
ESL6-40015 KT	15	249	21.7	76	195	255	79	105	95	
ESL6-40020 KT	20	332	28.9	76	280	340	79	105	95	3
ESL6-40025 KT	25	414	36.1	86	280	310	89	-	-	
				170	60	220	255	210	195	
ESL6-40030 KT	30	497	43.3	86	280	310	89	-	-	3
				170	60	260	295	210	195	4
ESL6-40040 KT	40	663	57.7	86	355	385	89	-	-	3
				220	60	260	310	255	235	5
ESL6-40050 KT	50	829	72.2	240	85	230	295	275	260	6

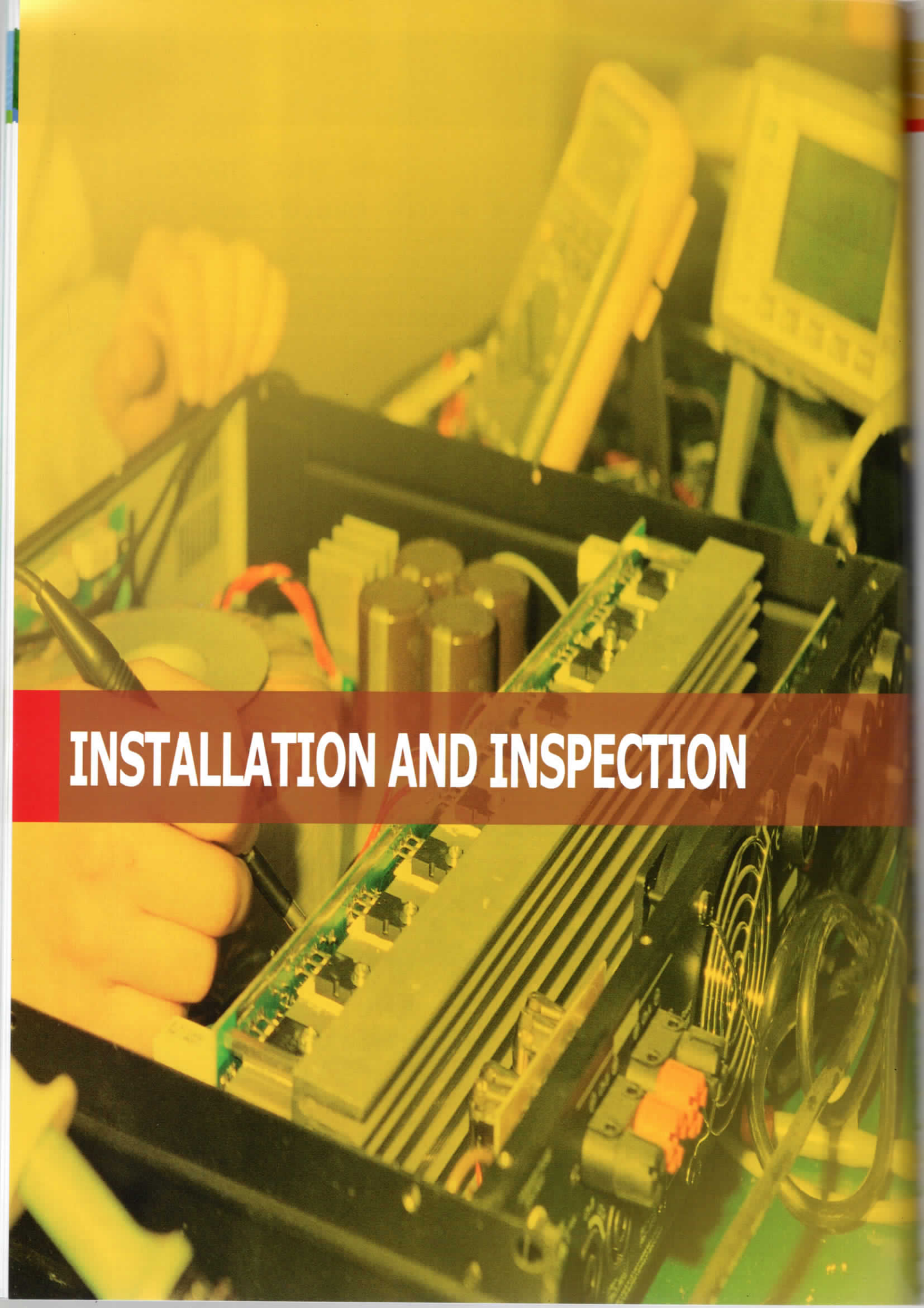
▶ 440V, 60Hz, 3 Phase

24 Hr	440 VAC
Less than 8 hours during 24 hours	484 VAC
Less than 30 minute during 24 hours	506 VAC
Less than 2 times during 5 minute for 1 month	528 VAC
Less than 2 times during 1 minute for 1 month	572 VAC

TYPE NO.	Rated Capacity		Ic (A)	Dimension (mm)						Fig
	3Ø	KVAR	μF	A	B	C	D	E	F	
ESL6-4402.5 KT	2.5	34.3	3.3	50	150	195	53	80	70	1
ESL6-4405 KT	5	68.5	6.6	63	165	220	66	95	80	
ESL6-4407.5 KT	7.5	103	9.8	63	165	220	66	95	80	
ESL6-44010 KT	10	137	13.1	76	165	225	79	105	95	2
ESL6-44012.5 KT	12.5	171	16.4	76	195	255	79	105	95	
ESL6-44015 KT	15	206	19.7	76	225	285	79	105	95	
ESL6-44020 KT	20	274	26.2	76	280	340	79	105	95	3
ESL6-44025 KT	25	343	32.8	86	280	310	89	-	-	
				170	60	220	255	210	195	
ESL6-44030 KT	30	411	39.4	86	355	385	89	-	-	3
				170	60	260	295	210	195	4
ESL6-44040 KT	40	548	52.5	220	60	320	370	255	235	5
ESL6-44050 KT	50	685	65.6	240	85	230	295	275	260	6

※ 상기 치수는 품질 개선으로 변경될 수 있으므로 주문시 당사로 확인 바랍니다.

※ This dimension is able to change without notice for better quality.

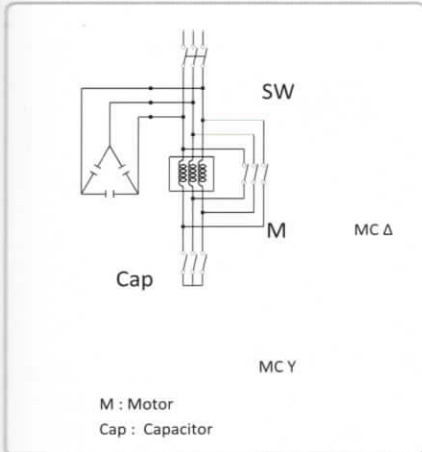
A photograph showing a person's hands working on a piece of electronic equipment, likely a power supply unit. The person is using a black probe to test a component on a green circuit board. The equipment has several large cylindrical capacitors and a fan. In the background, there are other electronic devices, including a monitor and a power supply unit. A red banner is overlaid on the image with the text "INSTALLATION AND INSPECTION" in white capital letters.

INSTALLATION AND INSPECTION

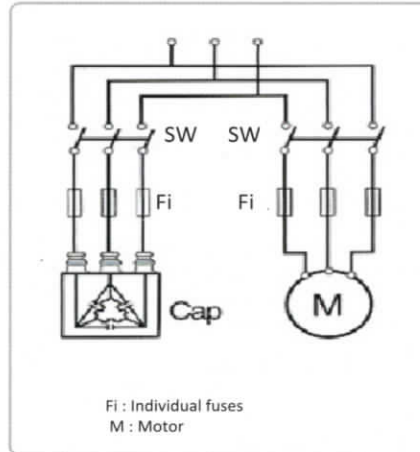
INSTALLATION AND INSPECTION

Installation of capacitor | 콘덴서 설치

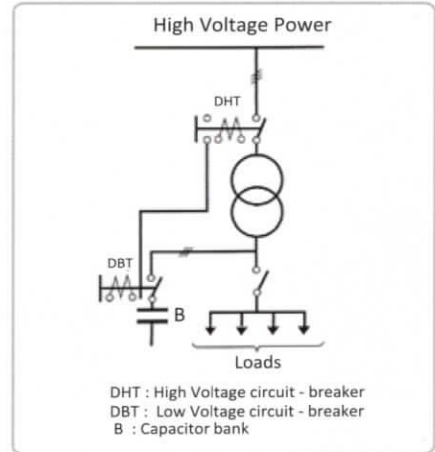
■ Connection



Power factor correction of Y-Δ starting motors
Y-Δ 기동 전동기의 역률개선시



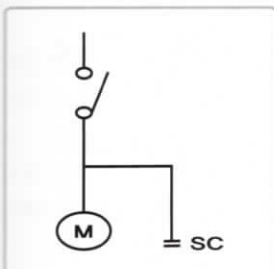
Power factor correction of motor
전동기의 역률 개선시



Power factor correction of transformer
변압기 역률 개선시

※ As installed capacitor location in Y-Δ operation system of motor, conflict phase voltage can be given to capacitor so should be installed as above picture.

※ 전동기의 Y-Δ 기동방식에서 설치된 콘덴서의 위치에 따라 콘덴서에 서로 상반되는 위상 전압이 인가 될수 있으므로 위 그림의 방식대로 설치 하셔야만 합니다.



※ When power opened on capacitor as above picture, in case serial connected with induction motor, please select capacitor to be same current as magnetizing current of induction motor.

※ 상기 그림과 같이 콘덴서가 전원 개방시 유도 전동기에 직렬로 연결 될 경우 콘덴서 전류≤유도전동기의 무부하 여자전류와 같도록 콘덴서 용량을 선정 하십시오. (자기 여자현상에 의한 전압 상승 방지)

Capacitor optimum install location | 콘덴서 적정 설치 위치

An effect of power factor correction by capacitor is appeared to power supply side in capacitor install location. Then which method can be better for capacitor install location among side of high voltage or low voltage ?

1. In high voltage side

Capacitor takes capacitive current in high voltage side and what countervail of lagging current of load is in high voltage side, power factor correction effect can be only in high voltage side where power loss or voltage drop can be appeared and such effect can't be appeared in low voltage side. But in case capacitor install in high voltage side then economically better as capacitance can be smaller as long as voltage is higher because capacitance is in proportion again square of voltage.

2. In low voltage side

Install method of capacitor in low voltage side can get effect of power factor correction in both high and low voltage sides. Specially, among passive equipments, the power factor correction of transformer output can be improved (improvement of transformer utilization ration due to drop of apparent power) but no effect even the power factor correction is done in high voltage side. More expensive as bigger size even same capacitance in low voltage side, comparing install in high voltage side.

콘덴서의 의한 역률 개선 효과는 콘덴서 설치점에서 전원측으로 나타난다. 그렇다면 콘덴서를 설치하는 경우 설치하는 위치는 고압측, 저압측 중 어느 방법이 유리한가?

1. 고압측에 설치시

콘덴서는 고압측에서 진상전류를 취하므로 부하의 지상전류를 상쇄하는 것은 고압측이므로, 역률 개선의 효과는 고압측에 국한되어 고압측에서만 전력 손실이나 전압강하가 저감되고, 저압측의 역률 개선 효과를 얻을수 없다. 그러나 고압측에 콘덴서를 설치하는 경우에는 콘덴서 용량은 전압의 제곱에 비례 하므로 전압이 높을수록 소형이 되어 경제적으로도 유리해 진다.

2. 저압측에 설치시

콘덴서를 저압측에 설치하는 방법은 역률 개선의 효과가 고압측과 저압측에 모두 미친다. 특히, 수전 설비중 변압기의 출력측 역률을 개선(피상 전력의 감소에 의한 변압기 이용률 향상)함으로써 얻어지는 것으로 고압측의 역률을 개선하여도 효과는 없다.

고압측에 설치하는 것과 비교하여 저압측에서는 같은 용량일지라도 대형이 되어 가격이 비싸진다.

INSTALLATION AND INSPECTION

Capcitor location advantage / disadvantage

Capacitor location	Advantage	Disadvantage	Remark
High voltage side	① Power factor correction in high voltage side (Decrease of power loss, voltage drop in high voltage side) ② Discount for electricity charge per power factor correction ③ Capacitor can be compact, save facility cost.	① No power factor correction in low voltage side (Decrease of transformer utilization) ② High cost for safety by high voltage facility(necessary for exclusive switch) ③ Necessary for serious rector to suppress harmonics.	
Low voltage side	① Power factor correction both in high and low voltage side (power loss and decrease of voltage drop in the both sides) ② Improvement of transformer utilization (Decrease of apparent power) ③ Discount for electricity charge per power factor correction ④ Common use of each circuit breaker	① Bigger capacitor size ② Increase of capacitor installation cost	Higher cost for capacitor dispersed installation in low voltage side than integrated one.

Capacitor maintenance and inspection

When capacitor is disconnected for capacitor maintenance or inspection from power supply, expose the disconnection for 5 minutes and wait until residual voltage can be less than 50V then only start the maintenance or inspection after complete discharge of the residual voltage by an earth bar.

1) Maximum allowable overvoltage of capacitor is 110% against rated voltage, each phase should be parallel. Also please pay attention that circuit voltage can be increased by light-load in night and life can be shorter due to heating of internal loss increase in case continued overvoltage is impressed.

2) The capacitor is designed for maximum temperature on case outside to be in less 55°C.
If it could be more than this, ambient temperature should be decreased by forced air-cooling.

3) Insulation oil in the capacitor can be expanded or shrunk by temperature change, so capacitor case can be also expanded or shrunk. In operation, the case can be expanded or shrunk in one side about 10 ~ 15mm and this is due to above reason but no meaning of the capacitor defect. If the defect can be doubt, please check current. If the current of each phase is within rated current and 3 phases are in parallel, it means the capacitor is still in good function.

4) Required regular inspection for voltage and current of capacitor circuit.

5) Required one time measurement for capacitance and insulation resistance in every year, also required to confirm insulation resistance is more than 500M Ω in terminal and case checked by Mega-Ohm Tester.

6) Required one time inspection per year for contact point of breaker or switch which is used for capacitor circuit. If the contact is not stable, the capacitor can be run in single phase or noise is appeared by bad

7) Please open capacitor in circuit when it becomes to be power factor of phase advance in night light-load.

콘덴서 설치 위치 별 장단점

콘덴서 설치 위치	장 점	단 점	비 고
고 압 측	① 고압측의 역률 개선 (고압측의 전력손실, 전압 강하 감소) ② 전기요금의 역률 할인적용 ③ 콘덴서 소형, 설비비용 감소	① 저압측 역률 개선불가 (변압기 이용률 감소) ② 고압으로 보호장치 설비비가 큼 (고압 콘덴서 전용 개폐기 필요) ③ 고조파 장애용 직렬 리액터 필요	
저 압 측	① 고압측, 저압측 모두 역률개선 (고.저압측 모두 전력손실, 전압강하 감소) ② 변압기 이용률 향상(피상전력 감소) ③ 전기요금 역률 할인적용 ④ 각각의 부하용 개폐기(CB) 공용 가능.	① 콘덴서 대형 ② 설치 비용증가	저압측 콘덴서 분산 설치시는 집중 설치 보다 비용이 많이 듦

○ 콘덴서 보수 점검

콘덴서 보수 점검을 위하여 콘덴서를 전원에서부터 개방시에는 개방 후 5분이상 방치하여 잔류 전압이 50V 이하로 될 때 까지 기다린 후 접지봉을 이용 잔류 전압을 완전히 방전 시킨 후 점검을 시작 하십시오.

- 1) 콘덴서의 최고 허용 과전압은 정격전압의 110%이며, 각 상(相)이 평형이 되어야 합니다. 또한 야간 경 부하시에 회로 전압이 상승하는 문제가 발생될수 있으니 주의 하여 주시기 바라며, 과전압이 지속적으로 인가되면 내부 손실의 증가로 인한 발열로 수명이 단축 됩니다.
- 2) 콘덴서의 케이스 외부 최고 온도부의 온도는 55℃ 이하가 되도록 설계 되어 있습니다. 만약 이것을 초과할 경우에는 강제 풍냉에 의해서 주위 온도를 감소 시켜야 합니다.
- 3) 콘덴서는 온도 변화에 의하여 내부 절연유가 팽창 수축 하므로 케이스 표면이 팽창 수축 할수 있습니다.
운전중 콘덴서의 케이스는 편측으로 10~15mm 팽창 할수 있는데 이는 상기의 이유에 의하여 발생하는 것으로 콘덴서의 이상이 아닙니다. 만약 콘덴서의 기능이 의심 된다면 전류를 측정하여 주시고, 각상의 전류가 정격전류의 허용 범위 이내 이면서 삼상이 평형을 이루고 있다면 콘덴서는 이상이 없습니다.
- 4) 콘덴서 회로의 전류, 전압은 상시 점검 하여 주십시오.
- 5) 용량 및 절연저항은 년 1회 측정, 단 절연저항 측정의 경우 단자와 케이스간을 MEGA OHM 미터로 측정(DC 500V) 하였을 경우 500M Ω 이상 측정 되는지 확인 해 주십시오.
- 6) 콘덴서 회로에 사용되는 차단기나 개폐기는 년 1회 접촉부분을 점검하여 주십시오. 이 접촉이 불완전하면 콘덴서가 단상 운전 되거나 접촉 불량으로 이상음을 발생하며, 고주파 진동전압이 콘덴서에 인가되어 수명을 현저하게 저하 시킬수 있습니다.
- 7) 야간 경부하시에 전상의 역률이 될 때에는 콘덴서를 회로에서 개로하여 주십시오.

SPECIFICATIONS

Detail of capacitor maintenance and action

Item	Inspection detail	Reason	Action
Oil leakage and loss	Bushing	Over joint of terminal contact	Replace as possibility of dielectric breakdown
	Case welding	1) Case damage by external force 2) Case corrosion 3) Capacitor inside defection 4) Case grounding by external	Clean oil leakage, replace if it is appeared again after some days
	Case corrosion or paint peeling	1) Damage on installation or transportation 2) Corrosion by long-term usage	Clean leaked oil and corrosion, anticorrosion treatment
Case strain	Case strain	1) Too much high ambient temperature 2) Inflow harmonic current 3) Case damage by external force 4) Defection in capacitor inside	1) Treat as defection if it can't be recovered to original condition inspite cooling after operation stop 2) Check defect or not by checking of phase current, replace in case defect 3) In case of unknown, please call to our company
Circuit voltage	Voltage	1) Overload voltage by adjustment of trasformer tab 2) Voltage increase by reactor	1) Open capacitor when underload 2) Down circuit voltage by adjustment of transformer tab 3) Change higher rated voltage of capacitor
Temperature defect		1) High ambient temperature 2) Overload voltage 3) Harmonic current is inflowed 4) Overheat by bad contact of terminal 5) Capacitor inside defection	1) Install ventilation fan if ventilation is not enough 2) Improvement measure in case of overload voltage or current 3) Improvement of terminal joint
Current	Confirmation for current and harmonic current	1) Harmonic inflow by nonlinear load 2) Overload voltage inflow 3) Capacitor inside defection	1) Add serious reactor or change reactor in case caused by harmonic 2) Confirm capacitor if not caused by harmonic and change if defect
Noise (Humming)		1) Insufficient terminal joint 2) Inflow of harmonic current 3) Over inrush current 4) Switch status unstable 5) Capacitor inside defection	1) Improvement measure in case of harmonic inflow by confirmation of harmonic current 2) Install serious reactor 3) Replace capacitor
		Capacitor dosen't make noise in general usage. Recently, more inquiry for the noise on capacitor. This is due to resonance of inside component but it dosen't influence to capacitor quality. If power quality is bad (As many harmonic inflow), the noise can be increased due to of frequency. As long as inflow current and voltage still in allowed range, the capacitor is no problem to be used.	
Smell	Smell appearance	1) Degradation of insulation oil 2) Degradation of cable casued by bad terminal joint 3) Capacitor inside defection	1) Confirm oil leakage 2) Confirm terminal joint 3) Replace capacitor

SPECIFICATIONS

○ General conditions for storage and operating | 사용 및 보관

1. Do not use or store Capacitors in corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or similar substance are present.

2. In dusty environment, regular maintenance and cleaning, especially of the terminals, is required to avoid conductive path between phase and/or phases and ground.

3. The ambient temperature category is -25°C to 45°C . This means up to a max. temperature of 45°C , an average one year should not exceed 35°C . The maximum casing temperature of 55°C must not exceeded.
Temperlature is one of the main stress factors for polypropylene type capacitors. Temperature has major influence on the useful life expectancy of the capacitor.

4. Capacitors must be installed in a cool and well ventilated place, and should not be installed close to heat radiating objects, e.g.filter circuit, reactors, furnaces, direct sunlight.

5. Recommended torque for capacitor terminals.
(Acoording to IEC 60068-2-21)

Below M6 : 3Nm M12 : 15.5Nm

Check the terminals connection state in once a month at the least.

1. 부식성 환경, 특히 염소 가스, 황화 가스, 산성, 알칼리, 염분 및 유사한 성분이 존재 하는 곳에서는 사용 하지 마십시오.

2. 먼지가 있는 장소에서는 청소 및 정기적 점검을 하여야 하며, 특히, 단자들, 상간 및 상과 접지에 대하여는 더욱 청결하여야 합니다.

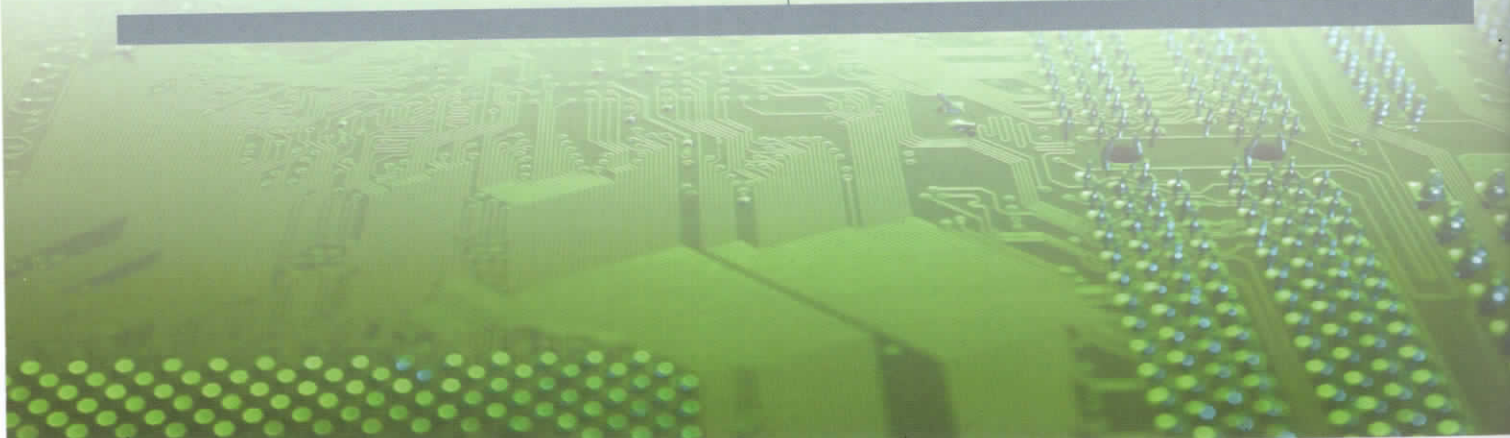
3. 사용 주변 온도는 $-25^{\circ}\text{C} \sim 45^{\circ}\text{C}$ 이고, 년 평균 기온 35°C 를 초과 하지 않는 최대 45°C 까지 라는 의미로써, Case 표면 온도는 최고 55°C 를 초과 하면 안됩니다.
온도는 Polypropylene Capcitor의 사용 수명을 단축하는 주된 원인 입니다.
(수명 단축의 주 원인 : 고조파, 온도)

4. Capacitor는 시원하고, 통풍이 잘되는 곳에 설치 하셔야 하며, 발열하는 물체 (예, 필터 회로, 직렬 리액터 및 용광로, 직사 광선)와 근접하여 설치 하시면 안됩니다.

5. 전선과 Capacitor 단자를 접속 하실때에는 아래의 Torque 강도로 접속 하여 주십시오.
(IEC 60068-2-21에 따름)

M6 이하 : 3Nm M12 : 15.5Nm

단자 접속 상태를 적어도 1개월에 1회이상 점검하여 조여 주십시오.





ISO 9001 인증서



ISO 14001 인증서



한국산업규격 표시인증서



환경경영체제인증서



TUV Certification



TUV Certification

It will open for the future with professional Know-how of the capacitor industry in 30 years.

30여년의 콘덴서 산업의 전문 노하우로 내일을 열어갑니다.