Electrical Components Selection Guide For PESS Single Phase Rectifier Module's

PESS company has two different type production method. First method is build complete Industrial Battery Charger and Rectifier with all necessary components. Second method type production method is produce just only power electronic control module.

Modular production provide an excellent flexibility for the company, distrubutors and customers

Power electronic control module need some electrical parts for being a complete device like high power LC filter, Isolation transformer, mcb etc.

In this application note we will explain necessary components and how to select them for PESS 1Φ 48 VDC 20 A and 110 VDC 30 A Rectifier modules.

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1. List of the Electrical Components

In this capter we will share a list for 1 phase 48 VDC 20 A and 110 VDC 30 A rectifier module necessary electrical component list.

1 Phase 48 VDC 20 A rectifier module needs		
NO	Description	Quantity
1	C16 1P 6kA Input breaker mcb	1
2	C20 2P 6kA Battery breaker mcb	1
3	C20 2P 6kA Load breaker mcb	1
4	275 VAC Varistor for over voltage protection	1
5	2.5 kVAR PF corrector capacitor [1]	1
6	9 mH 20 A iron core inductor	1
7	10000uF 100 VDC Capacitor [2]	1-4
8	Enclosure cabinet [3]	1
9	Power and signal cables[4]	-
10	2 kVA 220 VAC/ 76 VAC Power transformer	1

[1] PF capacitor value depend on the desired power factor without PFC cap, pf > 0.7 with pf cap pf>0.85)
[2] It's effecting the dc voltage ripple. 1 is worst 4 is the best ripple performance
we are recommend at least 3 capacitor for optimum ripple performance
[3] Enclosure cabinet and cabinet IP level is depend on the application, available space and cost parameters

[4] Power and signal line cables is also necessary for connection the components.
Cros section area and length is depend on the application

1 Phase 110 VDC 30 A rectifier module needs		
NO	Description	Quantity
1	C25 1P 6kA Input breaker mcb	1
2	C32 2P 6kA Battery breaker mcb	1
3	C32 2P 6kA Load breaker mcb	1
4	275 VAC Varistor for over voltage protection	1
5	2.5 kVAR PF corrector capacitor [1]	1
6	6 mH 30 A iron core inductor	1
7	10000uF 200 VDC Capacitor [2]	1-4
8	Enclosure cabinet [3]	1
9	Power and signal cables[4]	-
10	5 kVA 220 VAC / 176 VAC Power transformer	1

[1] PF capacitor value depend on the desired power factor without PFC cap, pf > 0.7 with pf cap pf>0.85)
[2] It's effecting the dc voltage ripple. 1 is worst 4 is the best ripple performance
we are recommend at least 3 capacitor for optimum ripple performance
[3] Enclosure cabinet and cabinet IP level is depend on the application, available space and cost parameters

[4] Power and signal line cables is also necessary for connection the components.
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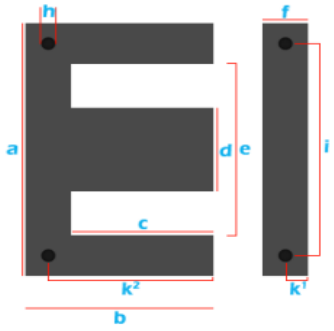
2. Inductor and Capacitor Selection

Inductor is an important part of the DC bus filter. It's directly affecting the DC bus voltage ripple.
Higher voltage ripple more than %1 cause the batteries fail. For provide a clean DC voltage and better battery health inductor value must be chosen wisely. It is recommended to use the inductor whose technical information is shared below.

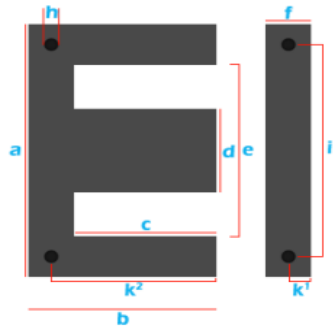
1 Phase 48 VDC 20 A rectifier inductor parameters		
Inductance	9	mH
Current	20	A
Wire cross section	7	mm2
Wire diameter	3	mm
Air gap	4	mm
Wire type	Copper	-
Turn	70	-
Core type	Iron	-
Core package	EI146	-
B(max)	10000	gauss
Ae (dxthickness)	41.4x55	mm
B(max)	10000	gauss
core dimensions	146x89x55 ax(b+gap+f)xthickness	mm



MONOFAZE EI Teknik Özellikleri

	a	b	c	d	e	f	h	i	k1	k2	kg/1000 0.5mm
EI 146	146	87.3	66.7	41.4	104.8	20.6	5.5	125.4	10.3	77	44.4

1 Phase 110 VDC 30 A rectifier inductor parameters		
Inductance	6	mH
Current	30	A
Wire cross section	10	mm2
Wire diameter	3,57	mm
Air gap	4	mm
Wire type	Copper	-
Turn	60	-
Core type	Iron	-
Core package	EI146	-
B(max)	10000	gauss
Ae (dxthickness)	41.4x55	mm
B(max)	10000	gauss
core dimensions	146x89x55 ax(b+gap+f)xthickness	mm



MONOFAZE EI Teknik Özellikleri

	a	b	c	d	e	f	h	i	k1	k2	kg/1000 0.5mm
EI 146	146	87.3	66.7	41.4	104.8	20.6	5.5	125.4	10.3	77	44.4

Capacitor is another important part of the DC filter and it has a ripple effect on the DC bus voltage like inductor. The number of the capacitor depend on the desired quality of the output voltage of the rectifier. We are recommend use at least 3 capacitor in rectifier but it can be change between 1 and 4.
One capacitor has worst ripple factor and four capacitor has best ripple factor.

So in this we will share an example one unit capacitor technical specs and the quantity of the capacitor is depent on your desire

48VDC 20A rectifer and 110 VDC 30A rectifier has same quantity capacitor so the explanation at the above is still valid for both of the rectifiers.

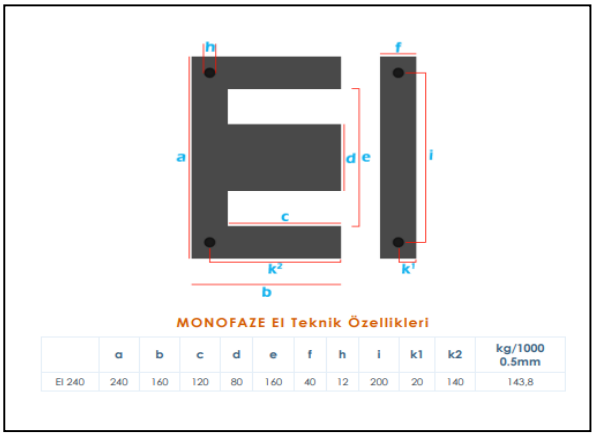
An example capacitor parameters

Kendeil 10000uF 200VDC		
Capacity	10000	uF
Max voltage	200 VDC	VDC
Tolerance	±20	%
Diameter	76	mm
Length	105	mm
Terminal type	screw	-
screw type	m5	-
Temperature	-40C +85C	C
ESR	10	mOHM

3. Transformer Design

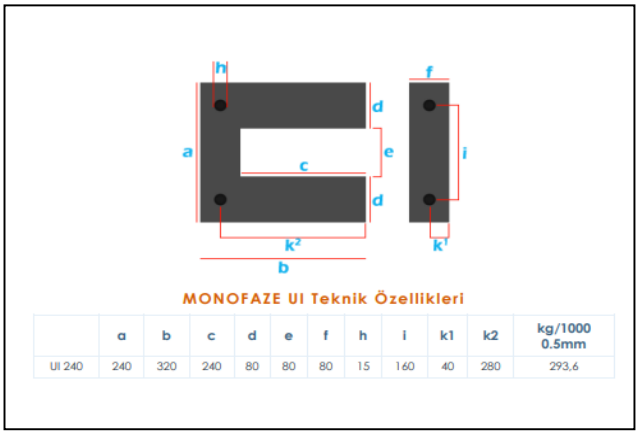
Transformer has crital role in system. Good designed transformer helps to reduce noise, reduce THD , improves the efficiency and provide galvanic isolation between input and output. Recommended transformer technical paramaters is located in the following tables.

1 Phase 48 VDC 20 A rectifier transformer			1 Phase 110 VDC 30 A rectifier transformer		
Primary			Primary		
Primary voltage	220	VAC	Primary voltage	220	VAC
Power	2	kVA	Power	5	kVA
Wire cross section	8	mm2	Wire cross section	16	mm2
Wire diameter	3,19	mm	Wire diameter	4,4	mm
Wire type	Alumium	-	Wire type	Alumium	-
Turn	175	-	Turn	160	-
Secondary			Secondary		
Secondary voltage	76	VAC	Secondary voltage	176	VAC
Power	2	kVA	Power	5	kVA
Wire cross section	23	mm2	Wire cross section	20	mm2
Wire diameter	5,40	mm	Wire diameter	5	mm
Wire type	Alumium	-	Wire type	Alumium	-
Turn	60	-	Turn	126	-
Core type	Iron	-	Core type	Iron	-
Core package	EI240	-	Core package	UI180	-
B(max)	10000	gauss	B(max)	10000	gauss
Ae (dxthickness)	80x70	mm	Ae (dxthickness)	60x100	mm
B(max)	10000	gauss	B(max)	10000	gauss
core dimensions	240x200x70 ax(b+gap+f)xthickness	mm	core dimensions	180x300X100 ax(b+gap+f)xthickness	mm



MONOFAZE EI Teknik Özellikleri

	a	b	c	d	e	f	h	i	k1	k2	kg/1000 0.5mm
EI 240	240	160	120	80	160	40	12	200	20	140	143,8



MONOFAZE UI Teknik Özellikleri

	a	b	c	d	e	f	h	i	k1	k2	kg/1000 0.5mm
UI 240	240	320	240	80	80	80	15	160	40	280	293,6

4. Cable and MCB Selection

Cable and MCB selection is also important part of the system. Required cable cross sectional area and mcb current rating listed at following tables. All cables copper and NYAF type and MCB's has a C type trip curve. The length of cable depend on the application cabinet dimensions. PESS company recommend the signal cables should be kept as short as possible.

1 Phase 48 VDC 20 A rectifier power cables and MCB's					
	Primary 220VAC	Secondary 76VAC	IND CAP	BATT OUTPUT	LOAD OUTPUT
Power Cables (NYAF COPPER)	6 mm2	10 mm2	10 mm2	10 mm2	10 mm2
MCB	1X16 A	-	-	2X20 A	2X20 A

1 Phase 110 VDC 30 A rectifier power cables and MCB's					
	Primary 220VAC	Secondary 176VAC	IND CAP	BATT OUTPUT	LOAD OUTPUT
Power Cables (NYAF COPPER)	10 mm2	10 mm2	10 mm2	10 mm2	10 mm2
MCB	1X25 A	-	-	2X32 A	2X32 A

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