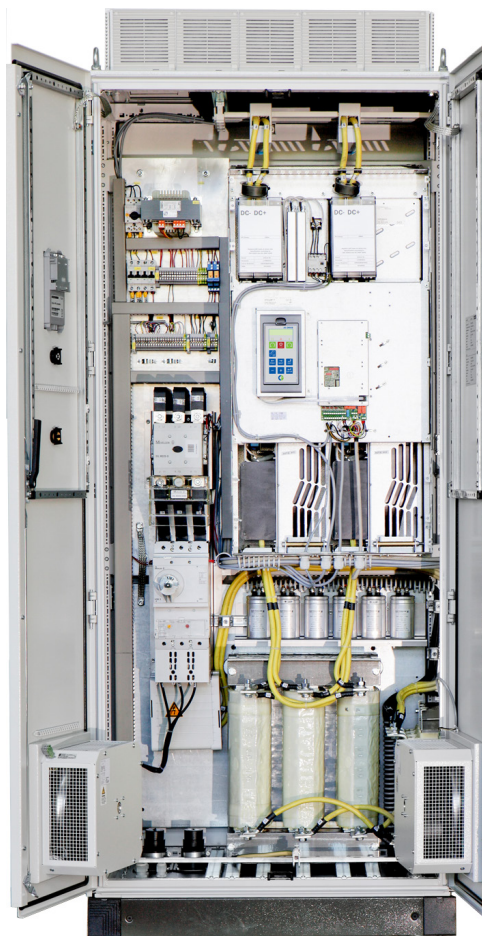




Emotron AFR drives

Regenerative drives
55-1,100 kW, 380-690 V



Technical Guide

General

AFR is a regenerative type AFE DC bus feeder unit.

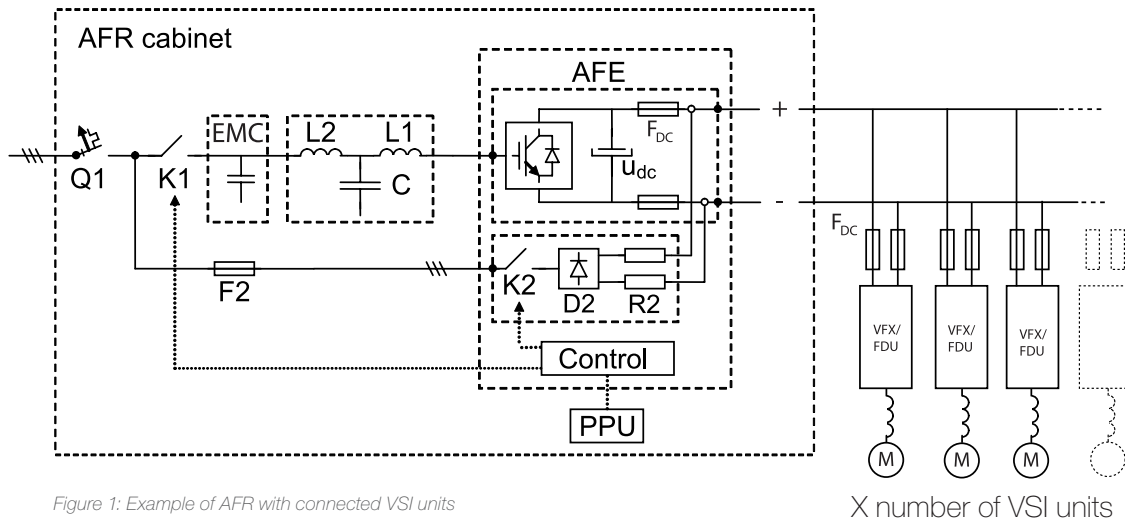


Figure 1: Example of AFR with connected VSI units

Table 1: Emotron AFR46 output DC power at mains voltage 400 V

Model	Max Input current I _{max} [A] *	Normal duty 120%, 1 min every 10 min		Frame	Dimensions Height = 2,250 mm Depth = 600 mm Width [mm]	Weight [kg]
		Rated Input current I _{nom} [A]	Output DC power @400 V AC [kW]			
AFR46-175	210	175	115	E46	600	290
AFR46-250	300	250	165	F46	800	400
AFR46-375	450	375	250	G46	1,000	560
AFR46-500	600	500	330	H46	1,200	660
AFR46-750	900	750	500	I46	1,500	830
AFR46-1K0	1,200	1,000	660	J46	1,800	1,100
AFR46-1K5	1,800	1,500	1,000	K46	2,700	1,600

Table 2: Emotron AFR69 output DC power at mains voltage 690 V

Model	Max Input current I _{max} [A] *	Normal duty 120%, 1 min every 10 min		Frame	Dimensions Height = 2,250 mm Depth = 600 mm Width [mm]	Weight [kg]
		Rated Input current I _{nom} [A]	Output DC power @690 V AC [kW]			
AFR69-175	210	175	200	F69	800	320
AFR69-350	420	350	400	H69	1,200	590
AFR69-525	630	525	600	I69	1,700	860
AFR69-700	840	700	800	J69	On request	
AFR69-1K05	1,260	1,050	1,200	K69	On request	

* Available for a limited time and as long as drive temperature permits.

Table 3: General electrical specifications

General		
Mains voltage:	AFR46 AFR69	380 - 460V +10%/-15% 480 - 690V +10%/-15%
Mains frequency:		48 to 52Hz and 58 to 62Hz
Input total power factor:		1.0
Output DC voltage:	AFR46/AFR69	$(1.0 - 1.2) * \sqrt{2} * \text{Mains supply voltage}$
Switching frequency:	AFR46/AFR69	3 kHz (adjustable 3-6 kHz)
Efficiency at nominal load:	AFR46/AFR69	98%
Harmonics to supply, THDI		< 5%

All AFR units assembled in an IP54 cabinet including main switch + main contactor or motorized circuit breaker, LCL filter and charging unit.

AFR fuse data

Table 4: DC fuses used for AFR output

AFR Model	Frame	Installed DC fuses F_{DC} [A]	Bussman type	Installed AC fuses F_{AC} [A]	Bussman type
AFR46-175	E48	400	170M2621	315	170M4815
AFR46-250	F48	400	170M2621	400	170M2621
PEBB46-175/AFE	"E48"	400	170M2621	315	170M4815
PEBB46-250/AFE	"F48"	400	170M2621	400	170M2621
AFR69-175	F69	315	170M4815	315	170M4815
PEBB69-175/AFE	"F69"	315	170M4815	315	170M4815

DC fuses for VSI units

For VSI drive units connected to the DC bus, use standard Emotron FDU/VFX 2.0 drive units equipped with optional DC+/DC- terminals. See FDU/VFX Technical Catalogue 01-4948-01 for drive unit selection.

Each VSI drive unit connected to the DC-bus should be fed via DC fuses. No DC switches to be used. For selection of correct DC fuse type and size, see Table 5 below.

Table 5: Recommended DC fuses for for connected VSI drive units

VSI Model	Frame	Recommended DC fuses F_{DC} [A]	Bussman type
FDU/VFX48/52-003	B	25	170M4803
FDU/VFX48/52-004, 006	B	25	170M4803
FDU/VFX48/52-008, 010	B	25	170M4803
FDU/VFX48/52-013, 018	B	40	170M4806
FDU/VFX48/52-026, 031	C	80	170M4809
FDU/VFX48-025, 030	C2	80	170M4809
FDU/VFX48/52-037, 046	C	80	170M4810
FDU/VFX48-036, 045	C2	100	170M4810
FDU/VFX48/52-061, 074	D	160	170M4812
FDU/VFX48-060, 072	D2	160	170M4812
FDU/VFX48-088	D2	200	170M4813
FDU/VFX48-090, 109	E	200	170M4813
FDU/VFX48-106	E2	200	170M4813
FDU/VFX48-146, 175	E	315	170M4815
FDU/VFX48-142, 171	E2	315	170M4815
FDU/VFX48-210, 250	F	400	170M4821
FDU/VFX48-205, 244	F2	400	170M4821
PEBB48-175/VSI	"E"	315	170M4815
PEBB48-250/VSI	"F"	400	170M4821
FDU/VFX69-090	F69	200	170M4813
FDU/VFX69-109	F69	200	170M4813
FDU/VFX69-146	F69	315	170M4815
FDU/VFX69-175	F69	315	170M4815
FDU/VFX69-200	F69	400	170M4821
PEBB69-200/VSI	"F69"	400	170M4821

Precharging circuit

The power-on precharging of the DC link capacitors in AFR inverters as well as in VSI drive unit inverters, is handled by one or more charging units located in the AFR module(s). Each charging unit can handle a limited amount of DC link capacitance, due to thermal limitation. To verify if the charging circuit of the selected AFR size is sufficient, you simply need to add up the DC link capacitance values for all VSI drive units connected to the DC bus. Compare this value to the maximum capacitance value of the AFR unit used, stated in Table 6 below. Capacitance values for the different sizes of VSI drive units are shown in Table 7.

Table 6: Max. total VSI capacitance value

AFR Model	Frame	Charging Units Included	VSI C_{DC} max [μ F]
AFR46-175	E46	1	42,000
AFR46-250	F46	1	40,000
AFR46-375	G46	1	36,000
AFR46-500	H46	1	32,000
AFR46-750	I46	2	72,000
AFR46-1K0	J46	2	64,000
AFR46-1K5	K46	3	96,000
AFR69-175	F69	1	26,667
AFR69-350	H69	1	21,334
AFR69-525	I69	2	48,000
AFR69-700	J69	2	42,668
AFR69-1K05	K69	3	64,000

NOTE: If total DC link capacitance is greater than the maximum value for the selected AFR, it is possible to specify increased size of AFR charging unit. This is also possible if a shorter charging time ("ready to start time") is required.

460 V charging unit = 48,000 μ F capacity
 690 V charging unit = 32,000 μ F capacity

Table 7: Capacitance values for VSI units

FDU/VFX Model	Frame	C_{DC} [μ F]
FDU/VFX48/52-003	B	195
FDU/VFX48/52-004, 006	B	195
FDU/VFX48/52-008, 010	B	195
FDU/VFX48/52-013, 018	B	375
FDU/VFX48/52-026, 031	C	750
FDU/VFX48-025, 030	C2	750
FDU/VFX48/52-037, 046	C	1,125
FDU/VFX48-036, 045	C2	1,125
FDU/VFX48/52-061, 074	D	2,250
FDU/VFX48-060, 072	D2	2,250
FDU/VFX48-090, 109	E	4,000
FDU/VFX48-106	E2	4,000
FDU/VFX48-146, 175	E	6,000
FDU/VFX48-142, 171	E2	6,000
FDU/VFX48-210, 250	F	8,000
FDU/VFX48-205, 244	F2	8,000
PEBB48-175/VSI	F	6,000
PEBB48-250/VSI	F	8,000
FDU/VFX69-090	F69	4,000
FDU/VFX69-109	F69	4,000
FDU/VFX69-146	F69	5,333
FDU/VFX69-175	F69	5,333
FDU/VFX69-200	F69	5,333
PEBB69-200/VSI	F69	5,333

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