Power factor correction systems in steel cabinets

LSFC series

Description

Package automatic power factor correction systems in freestanding sheet steel cabinets. If required, also available with blocking filters for low voltage networks with a high proportion of harmonics.

Power range
100 to 400 kVAr

Design
Cabinet with door and eyebolts for lifting, manufactured in sheet steel painted in DIN shade RAL 7032, ventilation via air inlet filter in cabinet door and outlet in top of cabinet, built-in electric fan if necessary. Modular construction combining up to four Type C capacitor modules.

Components in cabinet:

- Self-healing power capacitors with low-loss polypropylene film dielectric and PCB-free filler, LKT series with discharge resistors to VDE 0560 Parts 46 + 47, IEC 60831-1 and –2 (EN 60831-1 and –2).
- Heavy duty capacitor contactors
- Fuse links, 3-pole, size NH00
- Busbar system
- Control terminal strip with control circuit fuse and thermal trip contact
- RM 9606 or EMR 1100S reactive power control relays (not with LSFCZ units)
- If required, fan at top of cabinet, air inlet filter and temperature controller
- If required, low-loss blocking reactors with thermal trips

Installation site
The location where the cabinet is installed must comply with the requirements of the ingress protection and ambient temperature concerned.

Regulations
VDE 0100, VDE 0105, VDE 0560 Part 46 and VDE 0106 Part 100 (German Association of Electrical Engineers) regulations must be complied with when installing and connecting up power capacitors in Germany. In other countries the equivalent local regulations must be followed.

System expansion
The easy-to-maintain design simplifies the task of extending existing installations, since it is only a matter of installing additional capacitor modules. If the required power rating is more than 400 kVAr, every basic unit can be extended by the addition of LSFCZ... extension units (without control relays).

The basic units are equipped with RM 9606 (suffix –606) or EMR 1100S (suffix –111) reactive power control relays.
All system types can also be supplied with EMR 1100 (suffix –112) control relays.

Connections
The power supply cable and the current transformer cable enter the bottom of the cabinet through a sliding gland plate and a cable clamp rail, the power supply being connected to the busbar system and the current transformer cable to the terminal strip provided.

Note
The harmonics generated within a low voltage network and those fed in from the medium voltage network can be amplified many times over due to resonance with the inductive and capacitive reactances active in the low voltage network. In particular, in industrial installations with loads that generate harmonics, network compatibility should first be checked, and if appropriate, power factor correction systems with blocking filters installed.

Power factor correction systems in steel cabinets

LSFC / LSFCZ series

Nominal voltage	400 V / 50 Hz
Nominal voltage of capacitors	min. 440 V / 50 Hz
Overcurrent capacity of capacitors	min. 2.0 x nominal current at 400 V / 50 Hz continuous and 300 x nominal current for peaks
Protection	IP 30, if required IP 54, to EN 60529
Ambient temperature	-5 to +40 °C to VDE 0660 Part 500 (IEC 60439-1)
Relative humidity	max. 90 %, no condensation
Capacitor discharge	via discharge resistors to VDE 0560, Part 46
Cabinet colour	DIN shade RAL 7032
Construction	sheet steel freestanding cabinet with eyebolts for lifting, door hinged at right

Version	Series resonant frequency	Detuning factor	Remote control by utility company audiofrequency[1)]
-P1	136 Hz	p = 13.5 %	≥ 166 Hz
-P8	177 Hz	p = 8 %	≥ 217 Hz
-P7	189 Hz	p = 7 %	≥ 228 Hz
-P5	210 Hz	p =5.67 %	≥ 270 Hz

[1)] Differing utility company specifications must be taken into account. Please also refer to the project engineering data given in our Manual of Power Factor Correction.

Basic units with RM 9606 or EMR 1100S reactive power control relays (see separate leaflet for description)
Nominal power rating at 400 V / 50 Hz network voltage, other voltages on request

Nominal capacity	Step rating	Switching sequence	Type and order code	Weight approx.	Supply cable cross section	Fuse gL
kVAr	kVAr			kg	mm² [2)]	A
100	12.5	1:1:2:4	**LSFC 100– 12.5– 211–400–64–606**	139.8	3 x 95 / 50	200
100	25	1:1:2	**LSFC 100– 25 – 21 –400–64–606**	139.8	3 x 95 / 50	200
125	12.5	1:1:2:2:4	**LSFC 125– 12.5– 221–400–64–606**	142.4	3 x 120 / 70	250
125	25	1:2:2	**LSFC 125– 25 – 12 –400–64–606**	142.4	3 x 120 / 70	250
150	12.5	1:1:2:4	**LSFC 150– 12.5– 212–400–64–606**	167.7	3 x 185 / 95	315
150	25	1:1:2	**LSFC 150– 25 – 22 –400–64–606**	160	3 x 185 / 95	315
150	25	1:1:1	**LSFC 150– 25 – 6 –400–64–606**	165	3 x 185 / 95	315
175	12.5	1:1:2:2:4	**LSFC 175– 12.5– 222–400–64–606**	178	2 cables 3 x 95 / 50	400
175	25	1:2:2	**LSFC 175– 25 – 13 –400–64–606**	173	2 cables 3 x 95 / 50	400
200	12.5	1:1:2:4	**LSFC 200– 12.5– 213–400–64–606**	193.6	2 cables 3 x 95 / 50	400
200	25	1:1:2	**LSFC 200– 25 – 23 –400–64–606**	187.7	2 cables 3 x 95 / 50	400
200	25	1:1:1	**LSFC 200– 25 – 8 –400–64–111**	209.5	2 cables 3 x 95 / 50	400
225	12.5	1:1:2:2:4	**LSFC 225– 12.5– 223–400–64–111**	221	2 cables 3 x 120 / 70	500
225	25	1:2:2	**LSFC 225– 25 – 14 –400–64–606**	218.5	2 cables 3 x 120 / 70	500
225	25	1:1:1	**LSFC 225– 25 – 9 –400–64–111**	218.7	2 cables 3 x 120 / 70	500
250	12.5	1:1:2:4	**LSFC 250– 12.5– 214–400–64–111**	225	2 cables 3 x 120 / 70	500
250	25	1:1:2	**LSFC 250– 25 – 24 –400–64–606**	221.4	2 cables 3 x 120 / 70	500
250	25	1:1:1	**LSFC 250– 25 – 0 –400–64–111**	222.5	2 cables 3 x 120 / 70	500
250	50	1:1:1	**LSFC 250– 50 – 5 –400–64–606**	220.3	2 cables 3 x 120 / 70	500
300	12.5	1:1:2:4	**LSFC 300– 12.5– 215–400–64–111**	242.5	2 cables 3 x 185 / 95	630
300	25	1:1:2	**LSFC 300– 25 – 25 –400–64–111**	240	2 cables 3 x 185 / 95	630
300	25	1:1:1	**LSFC 300– 25 – 0 –400–64–111**	243.3	2 cables 3 x 185 / 95	630
300	50	1:1:1	**LSFC 300– 50 – 6 –400–64–606**	239	2 cables 3 x 185 / 95	630
350	25	1:1:2	**LSFC 350– 25 – 26 –400–64–111**	260	2 cables 3 x 240 /120	800
350	50	1:1:1	**LSFC 350– 50 – 7 –400–64–111**	259.8	2 cables 3 x 240 /120	800
400	25	1:1:2	**LSFC 400– 25 – 27 –400–64–111**	266	2 cables 3 x 240 /120	800
400	50	1:1:1	**LSFC 400– 50 – 8 –400–64–111**	264.5	2 cables 3 x 240 /120	800

[2)] Recommended cable cross section as per VDE 0298 Part 4, routing type C

Specimen order 1
Power factor correction system in steel cabinet
250 kVAr, switched in 10 steps of 25 kVAr, 400 V / 50 Hz
Type **LSFC 250–25–24–400–64–606**

Every basic unit can be extended by adding extension units without reactive power control relays.
These extension units are given the order code LSFCZ...; the control relay suffix –606 or –111 is omitted.

Specimen order 2
Extension unit in steel cabinet
300 kVAr, switched in 6 steps of 50 kVAr, 400 V / 50 Hz
Type **LSFCZ 300–50–6–400–64**

Power factor correction systems with blocking filters in steel cabinets

LSFC-P / LSFCZ-P series

Nominal voltage	400 V / 50 Hz
Nominal voltage of capacitors	min. 440 V / 50 Hz
Overcurrent capacity of capacitors	min. 2.0 x nominal current at 400 V / 50 Hz continuous and 300 x nominal current for transient peaks
Protection	IP 30, if required IP 54,to EN 60529
Ambient temperature	-5 to +40 °C to VDE 0660 Part 500 (IEC 60439-1)
Relative humidity	max. 90 %, no condensation
Capacitor discharge	via discharge resistors to VDE 0560, Part 46
Cabinet colour	DIN shade RAL 7032
Construction	sheet steel freestanding cabinet with eyebolts for lifting, door hinged at right
Compliance with standards	VDE 0560 Parts 46 + 47, IEC 60831-1 and -2 (EN 60831-1 and -2), type-tested LV switchgear as per VDE 0660 Part 500 and EN 60439-1

Basic units with RM 9606 or EMR 1100S reactive power control relays (see separate leaflet for description)
Nominal power rating at 400 V /50 Hz network voltage, other voltages on request

Nominal capacity	Step rating	Switching sequence	Type and order code	Version for resonant freq.				Weight approx. max.	Supply cable cross section	Fuse gL
kVAr	kVAr							kg	mm² [2]	A
75	6.25	1:1:2:4	**LSFC 75 – 6.25 – 212 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	302	3x 70 /35	160
75	12.5	1:1:2	**LSFC 75 – 12.5 – 22 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	289	3x 70 /35	160
93.75	6.25	1:2:4:8	**LSFC 93.75 – 6.25 – 1111 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	309	3x 95 /50	200
100	25	1:1:2	**LSFC 100 – 25 – 21 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	310	3x 95 /50	200
100	12.5	1:1:2:4	**LSFC 100 – 12.5 – 211 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	316	3x 95 /50	200
125	25	1:2:2	**LSFC 125 – 25 – 12 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	342	3x120/70	250
125	12.5	1:1:2:2:4	**LSFC 125 – 12.5 – 221 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	378	3x120/70	250
150	25	1:1:2	**LSFC 150 – 25 – 22 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	419	3x185/95	315
150	12.5	1:1:2:4	**LSFC 150 – 12.5 – 212 –400–64–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	456	3x185/95	315
175	25	1:2:2	**LSFC 175 – 25 – 13 –400–64–606–P...**	P1	P8	P7	P5	464	2x 3x 95 /50	400
200	12.5	1:1:2:4	**LSFC 200 – 12.5 – 213 –400–64–606–P...**		P8	P7	P5	523	2x 3x 95 /50	400
200	25	1:1:2	**LSFC 200 – 25 – 23 –400–64–606–P...**		P8	P7	P5	504	2x 3x 95 /50	400
200	50	1:1:1	**LSFC 200 – 50 – 4 –400–64–606–P...**	P1	P8	P7	P5	485	2x 3x 95 /50	400
100	12.5	1:1:2:4	**LSFC 100 – 12.5 – 211 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	325	3x 95 /50	200
125	25	1:2:2	**LSFC 125 – 25 – 12 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	361	3x120/70	250
125	12.5	1:1:2:2:4	**LSFC 125 – 12.5 – 221 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	399	3x120/70	250
150	25	1:1:2	**LSFC 150 – 25 – 22 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	451	3x185/95	315
150	12.5	1:1:2:4	**LSFC 150 – 12.5 – 212 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	476	3x185/95	315
175	25	1:2:2	**LSFC 175 – 25 – 13 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	491	2x 3x 95 /50	400
200	25	1:1:2	**LSFC 200 – 25 – 23 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	533	2x 3x 95 /50	400
225	25	1:2:2	**LSFC 225 – 25 – 14 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	552	2x 3x120/70	500
250	25	1:1:2	**LSFC 250 – 25 – 24 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	580	2x 3x120/70	500
250	50	1:1:1	**LSFC 250 – 50 – 5 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	573	2x 3x120/70	500
275	25	1:2:2	**LSFC 275 – 25 – 15 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	632	2x 3x185/95	630
300	25	1:1:2	**LSFC 300 – 25 – 25 –400–84–111–P...**	P1	P8[3]	P7[3]	P5[3]	660	2x 3x185/95	630
300	50	1:1:1	**LSFC 300 – 50 – 6 –400–84–606–P...**	P1[3]	P8[3]	P7[3]	P5[3]	653	2x 3x185/95	630
325	25	1:2:2	**LSFC 325 – 25 – 16 –400–84–111–P...**	P1	P8	P7	P5	683	2x 3x240/120	800
350	25	1:1:2	**LSFC 350 – 25 – 26 –400–84–111–P...**	P1	P8	P7	P5	738	2x 3x240/120	800
350	50	1:1:1	**LSFC 350 – 50 – 7 –400–84–111–P...**	P1	P8	P7	P5	731	2x 3x240/120	800
375	25	1:2:2	**LSFC 375 – 25 – 17 –400–84–111–P...**	P1	P8	P7	P5	824	2x 3x240/120	800
400	25	1:1:2	**LSFC 400 – 25 – 27 –400–84–111–P...**		P8	P7	P5	807	2x 3x240/120	800
400	50	1:1:1	**LSFC 400 – 50 – 8 –400–84–111–P...**	P1	P8	P7	P5	839	2x 3x240/120	800

[2] Recommended cable cross section as per VDE 0298 Part 4, IEC 60831-1 and -2 (EN 60831enrouting type C
[3] Can be installed in the same cabinet.
[4] Systems with p = 13.5 % (-P1) have a cabinet depth of 500 mm (suffix –65 or –85) !
Systems with p = 7 or 8 % (-P7 / -P8) have a cabinet depth of 400 mm (suffix –64 or –84) ! Other dimensions on request.

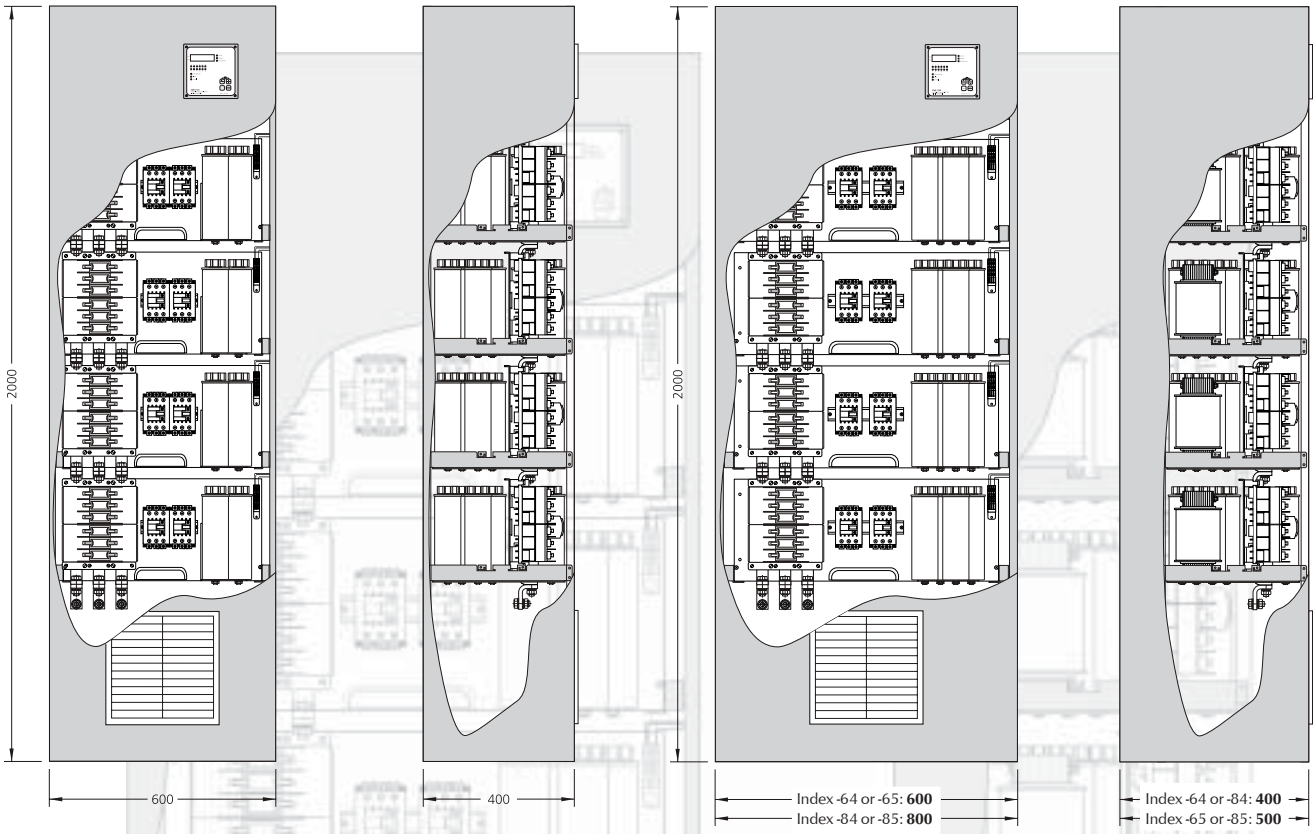
Specimen order 3
Power factor correction system in steel cabinet
250 kVAr, switched in 5 steps of 50 kVAr, 400 V / 50 Hz
with 7 % detuning factor (frequency = 189 Hz)
Type **LSFC 250–50–5–400–84–606–P7**

All types are also available as extension units LSFCZ ... (without control relays; the suffix –606, –111 or –112 is omitted). The capacitor steps can be connected to the control terminal strip in the basic unit using the control cable (supplied with the extension unit).

Power factor correction systems in steel cabinets

LSFC series

Dimensions



LSFC (100 to 400 kVAr)

LSFC-P (100 to 400 kVAr)

Accessories / options

- Bus-compatible reactive power control relay EMR 1100 (12-step) instead of RM 9606 or EMR 1100S (see separate leaflet for description)
- Bus-compatible EMA 1101 mains monitoring unit built in and wired up (see separate leaflet for description)
- 3 ammeters with current transformers built in and wired up
- Voltmeter with changeover switch built in and wired up
- LV HBC switch-disconnector-fuse instead of LV HBC fuse links for group overcurrent protection
- Switch-disconnector-fuse in cable compartment
- Power switch in cable compartment
- Cabinet constructed with IP 54 ingress protection to EN 60529
- Cabinet constructed with alternative dimensions
- Cable entry and connections at top of cabinet
- Cabinet constructed with door hinged at left
- Cabinet interior lighting (18 W fluorescent lamp)
- Customized colour to specified DIN RAL shade
- Additional cable frame (height 100 or 200 mm), not fitted
- System installation in cabinet provided free issue by customer (types on request)
- Built-in audiofrequency rejector circuit (100 to 400 kVAr), dimensions on request
- System installation in Rittal cabinet
  TS8.604, W x H x D: 600 x 2000 x 400 mm (suffix –27-)
  TS8.605, W x H x D: 600 x 2000 x 500 mm (suffix –6-)
- Cabinet top dust protection

Reliable energy solutions.

FRAKO Kondensatoren- und Anlagenbau GmbH
Tscheulinstr. 21a · D-79331 Teningen · Germany
Telefon 07641/453-0 · Telefax 07641/453-545
http://www.frako.de · E-Mail: info@frako.de

ISO 9001
and
ISO 14001

Your representative:

FRAKO 95-00227/08/03 Subject to technical alteration