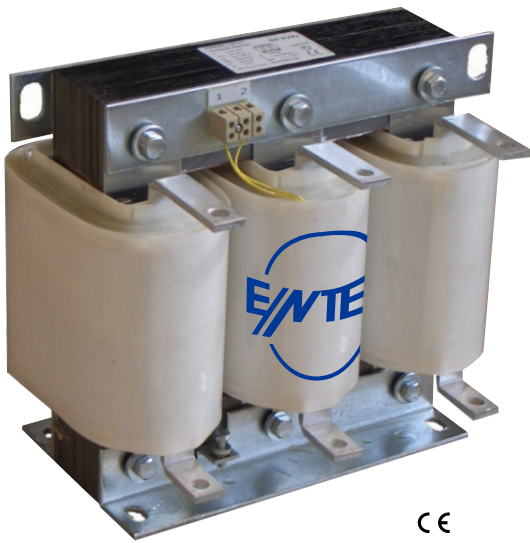


Harmonic Filter Reactors

ENT.ERH Series



CE

Technical Features:

- Single phase and three phase, high permeable iron core, air gapped design,
- High quality copper or aluminium windings,
- Design against harmonic loading in accordance with EN 61000-2-2,
- Thermic protection switch on middle coil against overloading and overheating,
- Terminal, lug or busbar connection depending on current value,
- Impregnated with varnish under vacuum to ensure silent and moisture-immune operation
- CE marked and in accordance with EN 61558 2-20

General

ENTES harmonic filter reactors are designed to be used in reactive power control systems in order to protect compensation capacitors by suppressing harmonics and additionally, to decrease harmonics throughout the facility.

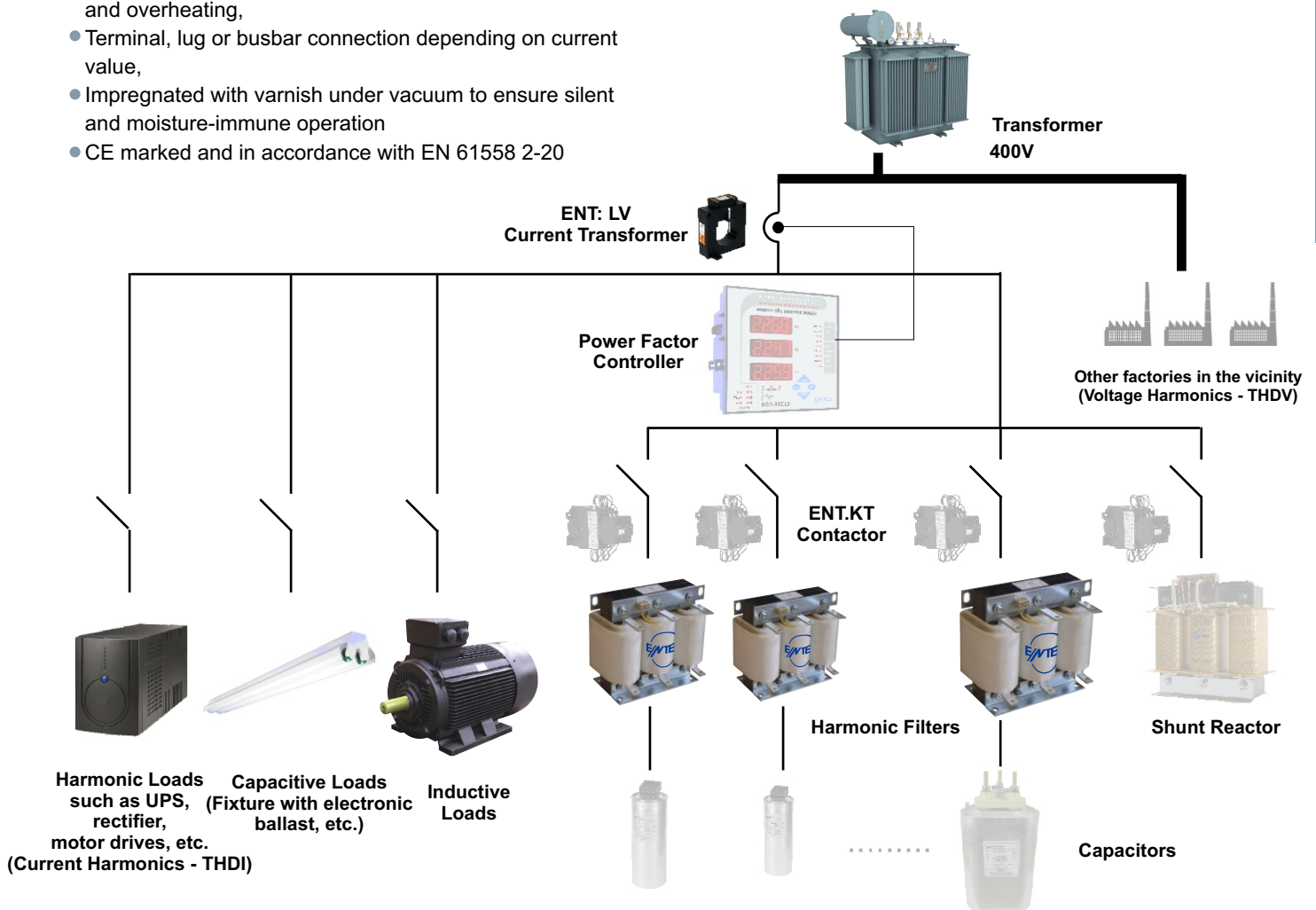
Harmonic Filter Reactors are used in series with capacitor banks in reactive power compensation systems. By using harmonic filter reactors, unfavourable effects on the system can be prevented. When harmonic filter capacitors are used, currents flowing through capacitors at harmonic frequencies (250 Hz for 5th harmonic, 350 Hz for 7th harmonic) are decreased by creating additional impedance to capacitor impedances.

Thereby:

- When capacitor is switched on, currents flowing through capacitor at harmonic frequencies are decreased and capacitor temperature stays low.
- High currents during capacitor switch-on are prevented.
- Probable overload risk because of resonance is eliminated.

As a result, capacitor service life is increased because heating and insulation breakdown possibilities are decreased. On the other hand; since harmonics throughout the facility will be decreased, sensitive devices such as computers, medical instruments, PLCs will be partially protected from distortive effects created by harmonics.

Power Factor Correction



Harmonic Filter Reactor Selection

For Harmonic Filter reactor selection, harmonic (THD-V and THD-I) measurements must be made under different load conditions while the reactive power compensation system is deactivated.

Voltage on capacitor increases by a factor of $1/(1-P)$ on filtered power compensation system.

P factor depending on THDV and THDI values is selected as shown on the table below.

fr=P factor	THDV	THDI
%5,67	< %2	>%25
%7	All other cases	
%14	>%4	<%15

Minimum voltages of capacitors depending on P factor are listed on the table below.

Reactors' Serial Resonance Frequency Table:

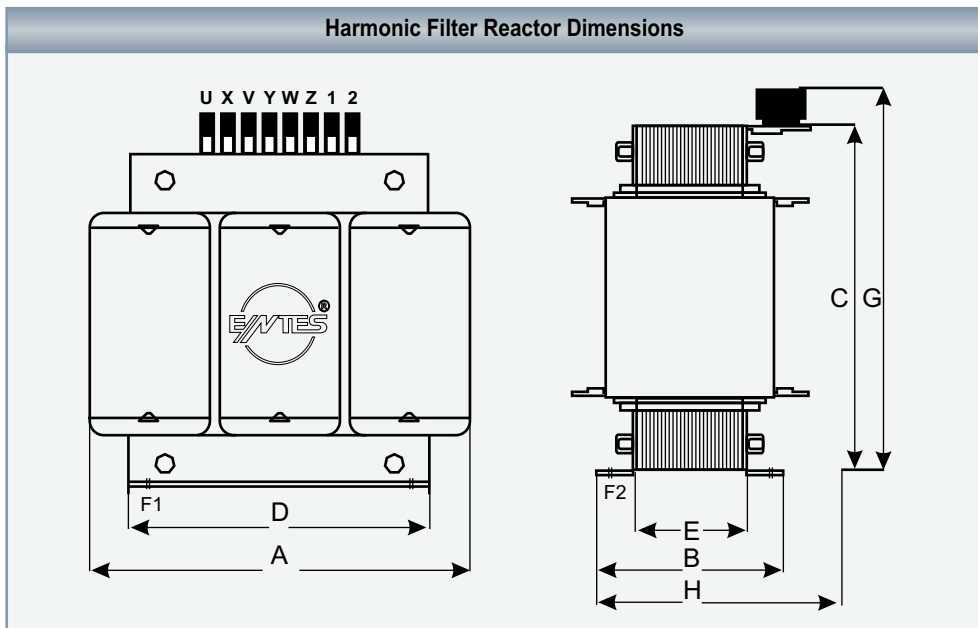
fr=P factor	Resonance Frequency for 50Hz	C Min. Voltage Value
%5,67	210Hz	424V
%7	189Hz	430V
%14	134Hz	465V

According to this; capacitors with a minimum 440V should be used for P factors of 5,67% and 7%, 500V capacitors should be used for a P factor of 14%.

For detailed information, please see the Harmonic Filter Reactor Selection Table on page 49.

Size	Size (mm)				
	A	B	C	G	H
0	120	45	100	120	-
1	150	67	125	195	-
2	150	82	125	195	-
3	180	92	150	220	-
4	180	102	150	220	-
5	225	100	190	-	200
6	225	124	190	-	224
7	240	130	200	-	230
8	265	126	220	-	226
9	265	140	220	-	240
10	265	152	220	-	252
11	300	132	250	-	232
12	300	140	250	-	240
13	360	163	300	-	263
14	420	168	350	-	288

Note: Dimensions may vary depending on design.



Reactors with filtering factors other than 5,67%, 7%, 14% and reactors for 60 Hz grids are manufactured on special order.

Harmonic Filter Reactors

ENT.ERH Series

Harmonic Filter Reactor Selection Table

400V 50Hz Mains Voltage, 210Hz Resonance Frequency (p=5,67%)

Type	kVAr	L (mH)	I _{rms} (A)	I _{th} (A)	I _{lin} (A)	C* (uF)	Size	Weight (kg)	Suitable Capacitor
ENT.ERH-5,67-400-4	4	7,65	7,02	7,72	15,92	25,02	0	4	ENT.CXD-450-5
ENT.ERH-5,67-400-5	5	6,12	8,77	9,65	19,90	31,28	0	4,5	ENT.CXD-450-5+ENT.CXD-450-1,5
ENT.ERH-5,67-400-6,25	6,25	4,90	10,97	12,06	24,87	39,1	0	5	ENT.CXD-450-7,5
ENT.ERH-5,67-400-7,5	7,5	4,08	13,16	14,48	29,85	46,92	1	7	ENT.CXD-450-7,5+ENT.C10-450-1,5
ENT.ERH-5,67-400-10	10	3,06	17,55	19,30	39,79	62,55	1	8	ENT.CXD-450-12,5
ENT.ERH-5,67-400-12,5	12,5	2,45	21,93	24,13	49,74	78,19	2	10	ENT.CXD-450-15
ENT.ERH-5,67-400-15	15	2,04	26,32	28,95	59,69	93,83	2	11	ENT.CXD-450-10+ENT.CXD-450-7,5
ENT.ERH-5,67-400-20	20	1,53	35,09	38,60	79,59	125,11	3	12	ENT.CXD-450-25
ENT.ERH-5,67-400-22,4	22,4	1,37	39,31	43,24	89,14	140,12	4	15,5	ENT.C100-440-25
ENT.ERH-5,67-400-25	25	1,22	43,87	48,26	99,49	156,39	4	16	ENT.CXD-450-30
ENT.ERH-5,67-400-30	30	1,02	52,64	57,91	119,38	187,66	5	20	ENT.CXD-450-15+ENT.CXD-450-20
ENT.ERH-5,67-400-40	40	0,77	70,19	77,21	159,18	250,22	5	23	2xENT.CXD-450-25
ENT.ERH-5,67-400-44,4	44,4	0,69	77,91	85,70	176,69	277,74	5	28	ENT.C100-440-50
ENT.ERH-5,67-400-50	50	0,61	87,74	96,51	198,97	312,77	5	30	2xENT.CXD-450-30
ENT.ERH-5,67-400-60	60	0,51	105,28	115,81	238,77	375,33	5	30	3xENT.CXD-450-25
ENT.ERH-5,67-400-80	80	0,38	140,38	154,42	318,36	500,44	6	34	4xENT.CXD-450-25
ENT.ERH-5,67-400-100	100	0,31	175,47	193,02	397,95	625,55	6	36	4xENT.CXD-450-30

400V 50Hz Mains Voltage, 189Hz Resonance Frequency (p=7%)

Type	kVAr	L (mH)	I _{rms} (A)	I _{th} (A)	I _{lin} (A)	C* (uF)	Size	Weight (kg)	Suitable Capacitor
ENT.ERH-7-400-2,5	2,5	15,3	4	4,4	8,4	15	0	2,5	2xENT.CXD-450-1,5
ENT.ERH-7-400-4	4	9,58	6,4	7	13,4	24,7	0	3	ENT.CXD-450-5
ENT.ERH-7-400-5	7,6	7,67	8	8,85	17	30,8	0	5	ENT.CXD-450-5+ENT.CXD-450-7,5
ENT.ERH-7-400-6,25	6,25	6,13	10,04	11,05	20,97	39,30	3	6	ENT.CXD-450-7,5
ENT.ERH-7-400-7,5	7,5	5,11	12,05	13,26	25,16	47,16	1	7	ENT.CXD-450-7,5+ENT.C10-450-1,5
ENT.ERH-7-400-10	10	3,83	16,07	17,67	33,55	65,50	2	8	ENT.CXD-450-12,5
ENT.ERH-7-400-12,5	12,5	3,07	20,08	22,09	41,94	78,60	2	9	ENT.CXD-450-15
ENT.ERH-7-400-15	15	2,56	24,10	26,51	50,33	91,69	2	10	ENT.CXD-450-10+ENT.CXD-450-7,5
ENT.ERH-7-400-20	20	1,92	32,13	35,35	67,11	130,99	3	13	ENT.CXD-450-25
ENT.ERH-7-400-22,2	22,2	1,72	35,7	39,3	75	137	4	15	ENT.C100-440-25
ENT.ERH-7-400-25	25	1,53	40,17	44,18	83,88	157,19	4	17,5	ENT.CXD-450-30
ENT.ERH-7-400-30	30	1,28	48,20	53,02	100,66	183,39	4	19	ENT.CXD-450-15+ENT.CXD-450-20
ENT.ERH-7-400-40	40	0,96	64,27	70,69	134,21	261,98	5	21	2xENT.CXD-450-25
ENT.ERH-7-400-44,4	44,4	0,86	71,4	78,6	141	274	5	23	ENT.C100-440-50
ENT.ERH-7-400-50	50	0,77	80,33	88,37	167,76	314,38	5	25	2xENT.CXD-450-30
ENT.ERH-7-400-60	60	0,64	96,40	106,04	201,32	392,98	5	30	3xENT.CXD-450-25
ENT.ERH-7-400-80	80	0,48	128,53	141,39	268,42	523,97	6	43	4xENT.CXD-450-25
ENT.ERH-7-400-100	100	0,38	160,67	176,73	335,53	628,76	6	45	4xENT.CXD-450-30

400V 50Hz Mains Voltage, 134Hz Resonance Frequency (p=14%)

Type	kVAr	L (mH)	I _{rms} (A)	I _{th} (A)	I _{lin} (A)	C* (uF)	Size	Weight (kg)	Suitable Capacitor
ENT.ERH-14-400-4	4	20,73	6,15	6,77	11,23	22,81	1	5	ENT.CXD-500-5
ENT.ERH-14-400-5	5	16,58	7,69	8,46	14,03	28,52	1	6,5	ENT.CXD-500-10
ENT.ERH-14-400-6,25	6,25	13,27	9,62	10,58	17,54	35,64	2	7,5	ENT.C50-525-15
ENT.ERH-14-400-7,5	7,5	11,05	11,54	12,69	21,05	42,77	2	9	ENT.CXD-500-10
ENT.ERH-14-400-10	10	8,29	15,38	16,92	28,07	57,03	2	10	ENT.C50-525-15
ENT.ERH-14-400-12,5	12,5	6,63	19,23	21,15	35,08	71,29	3	12	ENT.C25-525-20
ENT.ERH-14-400-15	15	5,53	23,08	25,38	42,10	85,55	4	13	ENT.C50-525-10+ENT.C50-525-12,5
ENT.ERH-14-400-20	20	4,15	30,77	33,85	56,13	114,06	5	21	ENT.C25-525-30
ENT.ERH-14-400-22,2	22,2	3,70	34,46	37,91	62,87	127,75	5	22	ENT.C25-525-30
ENT.ERH-14-400-25	25	3,32	38,46	42,31	70,17	142,58	5	25	ENT.C25-525-25+ENT.C50-525-12,5
ENT.ERH-14-400-30	30	2,76	46,15	50,77	84,20	171,09	5	27	ENT.C25-525-30+ENT.C50-525-15
ENT.ERH-14-400-40	40	2,07	61,54	67,69	112,27	228,12	5	32	2xENT.C25-525-30
ENT.ERH-14-400-44,4	44,4	1,87	68,31	75,14	124,62	253,22	5	32	2xENT.C25-525-30
ENT.ERH-14-400-50	50	1,66	76,92	84,62	140,33	285,15	5	40	2xENT.C25-525-25
ENT.ERH-14-400-60	60	1,38	92,31	101,54	168,40	342,18	6	48	3xENT.C25-525-30
ENT.ERH-14-400-80	80	1,04	123,08	135,38	224,54	456,24	6	55	4xENT.C25-525-30
ENT.ERH-14-400-100	100	0,83	153,85	169,23	280,67	570,31	7	62	5xENT.C25-525-30

