Detuned Filter Reactors

Detuned Harmonic Filter Reactors are used in series with capacitor banks in power factor correction units. Main purpose of these reactors is protection of power factor correction capacitors against negative effects of the harmonics in the system.

Reactors are designed in compliance with EN 61558-2-20. Vacuum impregnated varnish ensures moisture-immune and silent operation. All models are equipped with thermal switch for overload protection.

While designing the system, correct resonance frequency must be chosen according to harmonic analysis of the system, where total THDV as well as individual harmonics level is concern. Most typical resonance frequencies are 189Hz (p=7%) and 134Hz (p=14%) but others are also available on request.

Key features:

- protects PFC capacitors against harmonics
- thermal switch for overload protection
- vacuum impregnated varnish for silent operation

Designing the protected PFC system

First is to determine total reactive power of the PFC system and steps which is done similarly to standard unprotected system. Then it's good to make harmonic analysis of the system which gives us levels of individual harmonics and total THDU. Based on the results we have to select proper detuning factor (p)/resonance frequency of the reactor. Most typically reactors with p = 7% are used, it resonates at 189Hz which is bellow most common 5th harmonics (250Hz) and possible resonance between capacitor and network inductance is therefore prevented. In case of high content of 3rd harmonics (150Hz) in the system it might be necessary to use reactor with p = 14% which resonates at 134Hz (bellow 3rd harmonic). 7% type reactor might have negative effect on stability of the system because it will greatly raise levels of 3rd harmonic. When proper reactor type is selected we need to choose appropriate capacitor based on its capacitance, when it's paired wrongly it can resonate on different frequency and cause serious problems. Furthermore voltage of fundamental harmonic (50Hz) is raised by resonance behind the reactor, therefore higher voltage rated capacitors have to be selected. Typically in 400V systems with 7% reactors we use 440V rated capacitor, because voltage is raised up to 430V. When 14% reactor is used voltage raise over 460V and most typically 480V or 525V rated capacitors are used.

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                    50-ERH 7/400/440/44,4-al
Nominal power of the capacitor                  Nominal power of the block
Reactor type                          Nominal voltage of the capacitor
Detuning factor (p)                     Nominal voltage of the network
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7% Harmonic filter reactors, 189Hz							
Type	Inductance [mH]	Power of step at 400V [kvar]	Suitable capacitor		I_{nom} [A]	I_{lin} [A]	Weight [kg]
			Power at 440V [kvar]	Capacitance [uF]			
1,5 – ERH 7/400/440/1,3-al	28,82	1,3	1,5	3 × 8,2	2,14	4,47	2,5
2,5 – ERH 7/400/440/2,22-al	17,42	2,2	2,5	3 × 13,7	3,60	7,40	3,0
3,15 – ERH 7/400/440/2,8-al	12,17	2,8	3,15	3×17,3	4,62	10,08	3,5
5 – ERH 7/400/440/4,44-al	8,70	4,4	5,0	3 × 27,4	7,13	14,7	4,0
6,25 – ERH 7/400/440/5,6-al	6,85	5,6	6,25	3 × 34,3	8,93	18,78	5,0
10 – ERH 7/400/440/8,89-al	4,31	8,9	10,0	3 × 54,8	14,28	29,82	8,0
12,5 – ERH 7/400/440/11,1-al	3,45	11,1	12,5	3 × 68,5	17,85	37,26	8,0
15 – ERH 7/400/440/13,3-al	2,87	13,3	15,0	3 × 82,2	21,42	44,73	10,0
20 – ERH 7/400/440/17,77-al	2,16	17,7	20,0	3 × 109,6	28,55	59,63	11,5
25 – ERH 7/400/440/22,2-al	1,72	22,2	25,0	3 × 137,0	35,69	74,54	16,5
28,2 – ERH 7/400/440/25-al	1,53	25,0	28,2	3 × 154,5	40,25	84,00	18,0
30 – ERH 7/400/440/26,7-al	1,43	26,7	30,0	3 × 164,4	42,83	89,45	14,0
40 – ERH 7/400/440/35,5	1,08	35,5	40,0	3 × 219,2	57,12	100,00	15,3
45 – ERH 7/400/440/40-al	0,96	40,0	45,0	3 × 246,6	64,25	134,18	18,1
50 – ERH 7/400/440/44,3-al	0,86	44,4	50,0	3 × 274,0	71,39	149,08	20,0
56,4 – ERH7/400/440/50-al	0,77	50,0	56,4	3 × 309,0	80,50	168,00	26,0
60 – ERH 7/400/440/53,5-al	0,72	53,6	60,0	3 × 328,0	85,67	178,90	22,0
75 – ERH 7/400/440/66,6-al	0,58	66,6	75,0	3 × 411,0	107,08	223,63	34,0
100 – ERH 7/400/440/88,8-al	0,43	88,8	100	3 × 548,0	142,78	298,17	38,0

14% Harmonic filter reactors, 134Hz							
Type	Inductance [mH]	Power of step at 400V [kvar]	Suitable capacitor		I_{nom} [A]	I_{lin} [A]	Weight [kg]
			Power at 440V [kvar]	Capacitance [uF]			
2.5 – ERH 14/400/480/2-al	41,45	2,0	2,5	3 x 11,5	3,20	5,60	2,2
5 – ERH 14/400/480/4-al	20,73	4,0	5,0	3 × 23,0	6,30	11,10	3,5
7,5 – ERH 14/400/480/6,25-al	13,82	6,25	7,0	3 × 34,5	9,60	16,90	4,5
10 – ERH 14/400/480/8,1-al	10,36	8,1	10,0	3 x 46,1	12,44	22,67	5,5
12,5 – ERH 14/400/480/10,1-al	8,21	10,1	12,5	3 x 57,6	15,55	28,34	10,0
15 – ERH 14/400/480/12,1-al	6,84	12,1	15,0	3 x 69,1	18,64	34,00	12,0
20 – ERH 14/400/480/16,2-al	5,13	16,2	20,0	3 x 92,1	24,85	45,30	16,0
25 – ERH 14/400/480/20,2-al	4,11	20,2	25,0	3 x 115,1	31,05	56,60	18,0
31,05 – ERH 14/400/480/25-al	3,32	25,00	31,05	3 x 143,0	38,60	70,38	25,0
50 – ERH 14/400/480/40,38-al	2,05	40,38	50,0	3 x 230,3	62,10	113,30	33,0
60 – ERH 14/400/480/48,4-al	1,71	48,4	60,0	3 x 276,0	74,50	136,00	37,0
62.1 – ERH 14/400/480/50-al	1,65	50,0	62,1	3 x 286,0	77,15	140,70	38,0
75 – ERH 14/400/480/60,6-al	1,37	60,6	75,0	3 x 345,4	93,17	170,00	48,0
100 – ERH 14/400/480/80,7-al	1,03	80,7	100,0	3 x 460,5	124,20	227,00	60,0
123.8 – ERH 14/400/480/100-al	0,83	100,0	123,8	3x570,3	153,90	280,70	71,0

Other types available on request.