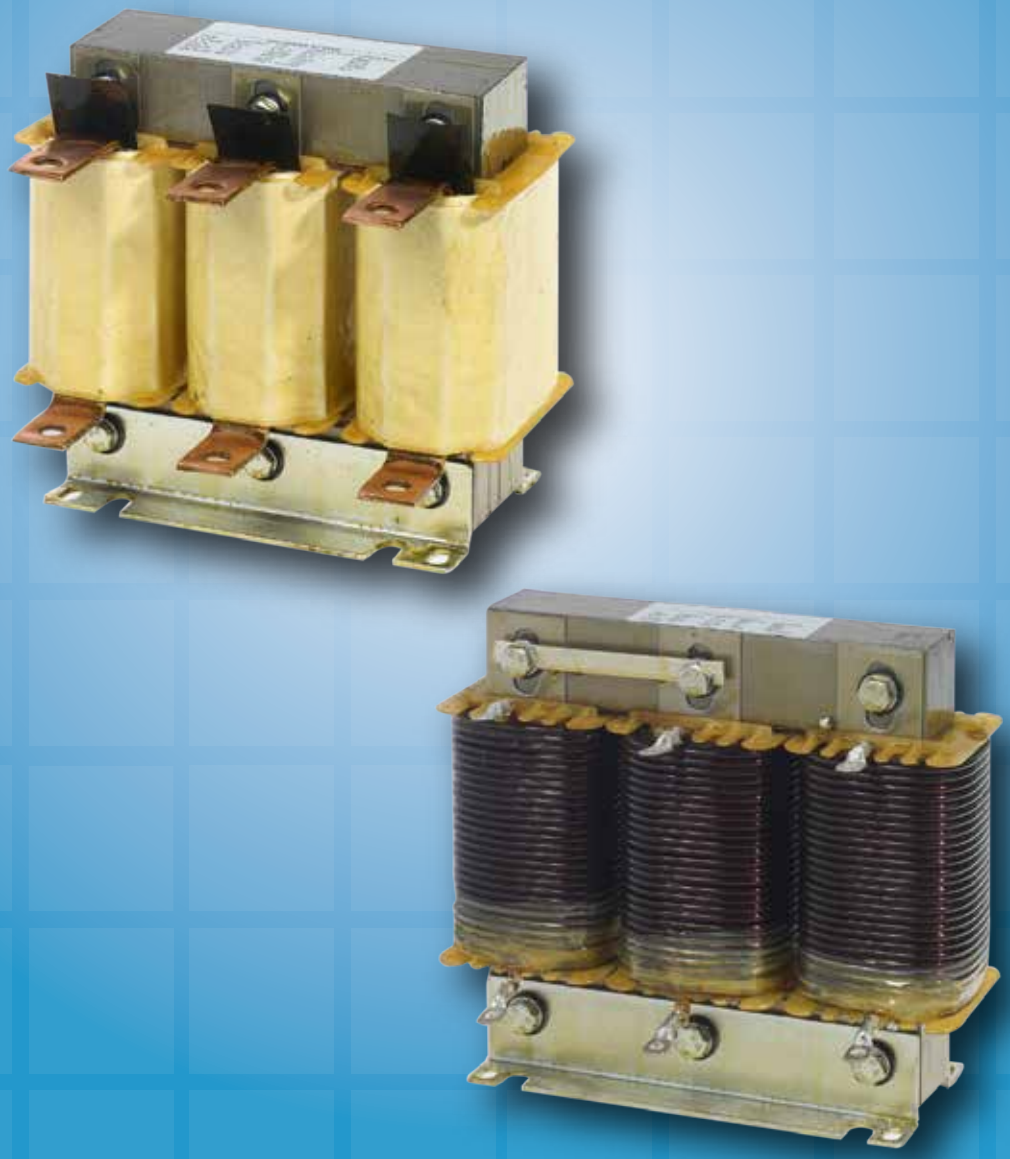


LOW VOLTAGE DETUNED FILTER REACTORS

Meher Mangoldt™

MEHER MANGOLDT INDUCTORS PVT. LTD.

A MEHER + HANS VON MANGOLDT Joint Venture

Company Profile

Meher Mangoldt Inductors Pvt. Ltd., located in Bangalore, is a joint venture between **HANS VON MANGOLDT, Germany (www.mangoldt.com) and the MEHER Group, India (www.meher.com)** for the design and manufacture of iron-core and air-core Reactors. The joint venture focuses on addressing the Indian market needs and will expand into other targeted regions.

The combination of R&D activities across Europe and India will reinforce capabilities that are critical for developing contemporary products and will enhance long-term competitiveness. The unique experience of over four decades of Mangoldt combined with three decades of Meher's strong presence in this field in India will offer a distinctly superior long-term value proposition to customers in India and across selected geographies.

Visit our website: www.meher-mangoldt.com

Selection of Detuned Filter Reactors

For proper selection of reactors, the effect of harmonic voltage spectrum on the current flowing through the reactors needs to be understood, to minimise heat generated and to avoid saturation at operating levels.

For example, a 440V, 7%, 50 kVAr detuned reactor of 0.928mH will carry the harmonic currents as given in the table below for different harmonic voltage levels at the bus.

Parameter	Bus Voltage with Low Harmonic Content		Bus Voltage with Medium Harmonic Content		Bus Voltage with High Harmonic Content	
Harmonic Voltage/Resultant Harmonic Current	**Vh (%)**	**Ih (A)**	**Vh (%)**	**Ih (A)**	**Vh (%)**	**Ih (A)**
Fundamental	106%	69.54	106%	69.54	115%	75.45
Third	0.5%	2.47	0.5%	2.47	0.5%	2.47
Fifth	3.5%	14.24	5.0%	20.34	9.0%	36.61
Seventh	3.5%	6.15	5.0%	8.79	6.5%	11.43
Eleventh	0.0%	0.0	0.0%	0.0	4.5%	4.04
Thirteenth	0.0%	0.0	0.0%	0.0	4.0%	2.93
THD %	4.97%	24%	7.09%	34%	12.64%	59%
Irms (Amps)	71.3		73		84.8	
I linearity limit (Amps)	110		121		160	
Fundamental Watt loss (Watts)	170		170		170	
Total Watt loss (Watts)	210		230		330	

Observations & Conclusions

1) Voltage harmonics of the bus decide the harmonic currents flowing into the reactors

2) The harmonic currents increase for the increase in voltage harmonic distortion at the bus (Vthd). RMS Current (Irms) is increasing from 71.3 A to 84.8 A as the voltage distortion Vthd increases.

3) Losses (both Cu and Fe loss) due to fundamental currents remain the same at 170 W. But the total losses (both Cu and Fe loss) due to fundamental and harmonic currents increase from 210 W to 330 W. This is because the frequency dependent iron losses increase exponentially as the harmonic currents increase.

4) The total losses in the reactors increase dramatically with the increase in the harmonic currents flowing into the reactors.

5) The reactors must be designed to withstand the worst-case current distortion. Otherwise it will either have a dramatically reduced lifetime or may fail if the saturation current is overstepped.

6) Therefore, the reactors must be selected based on the voltage harmonic distortion at the bus to minimise heat generated and to avoid saturation at operating levels.

Classification of Detuned Reactors

1) Standard Duty Detuned Reactors:

These reactors are designed for a bus voltage with low THD Voltage like V3 = 0.5 % and V5 = V7 = 3.5 %.

Application: Buildings and Small-scale industries with a low percentage of non-linear loads

2) Heavy Duty Detuned Reactors:

These reactors are designed for a bus voltage with medium THD Voltage like V3 = 0.5 % and V5 = V7 = 5 %.

Application: Medium-scale industries like Textile and Automobile ancillaries

3) Super Heavy Duty Detuned Reactors:

These reactors are designed for a bus voltage with very high THD Voltage like V3 = 0.5 %, V5 = 9 %, V7 = 6.5 %, V11 = 4.5% and V13 = 4%.

Application: Large-scale industries like Steel, Automobile and Cement industries with a high percentage of non-linear loads

Unique Expertise of Meher Mangoldt Inductors

1) Sound and Detailed Engineering

Four decades of application experience have been consolidated within our internal software. This software enables the design engineers to optimize reactor design to provide customers with a tailor-made product, in which their requirements with regard to losses, dimensions and environmental conditions are given perfect attention.

2) Imaginative Manufacturing

High-precision core lamination punching for elimination of inductance tolerances between the three phases is utilized to enable accurate reactor tuning. Copper or aluminium band coils are produced using computer controlled winding machines which use cold pressure welding for the connection of copper bar terminals.

The coils are mounted on PolyGap® cores and the complete units are impregnated under high vacuum and overpressure with a high-grade thermosetting varnish.

All production phases have been fine-tuned to a standard of excellence, ensuring that superior quality standards are maintained.

3) Unique Innovative Measuring Equipment

All reactors are tested with computerized test equipment for testing at nominal current with database storage.

For type-testing, our facilities at Germany have a unique three-phase harmonic current generator enabling us to test reactors in a realistic environment, i.e. simultaneously loaded with fundamental and specified harmonic currents (which can also be modified in respect of amplitude and angle of shift). Thus heat-run and noise dissipation tests are conducted on the reactors.

LV Detuned Filter Reactors

1) TYPE of LV Detuned Filter Reactors

Copper or Aluminium Strip-Wound

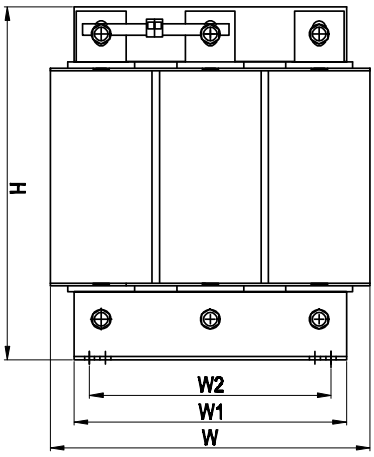
Copper or Aluminium Foil-Wound

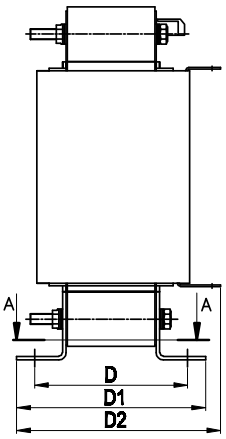
2) RANGE of LV Detuned Filter Reactors

- From 5 KVAR to 100 KVAR
- Reactance factors of 5.67 %, 7 %, and 14 %
- System voltage – 400 V, 415 V, and 440V
- Custom products for any filter power or reactance factor or voltage level available

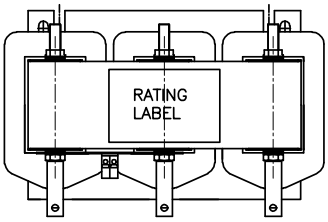
3) TECHNICAL SPECIFICATION of LV Detuned Filter Reactors

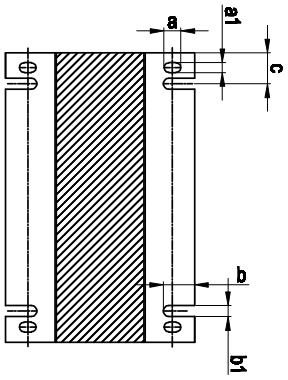
- Standard followed IS-5553-1990 / IEC 60076-6
- Insulation Class: Class H
- Termination: Copper terminals for Aluminium/Copper Foil-wound reactors
- Aluminium lugs/Copper lugs for Aluminium/Copper Strip-wound reactors
- Noise level less than 60 dB at rated load at 1 meter distance
- Tolerance on Inductance +/- 3 %





a=13. a1=7, b=16. b1=11, c=19.5 (12.5, 15, 20, 25 kVAr)
a=18. a1=10, b=24. b1=11, c=37 (50, 75, 100kVAr)





VIEW A–A

THE DETAILS GIVEN ARE FOR ALUMINIUM FOIL HEAVY DUTY REACTORS.
STANDARD DUTY AND SUPER HEAVY DUTY REACTOR DETAILS ARE GIVEN BASED ON REQUEST.

Note: Tolerance On Dimensions ±5%
Tolerance On Inductance ±3%

Production Description				Dimensions (In mm)							Technical Data					
Rated Voltage(V) & Rated Frequency(Hz)	Reactance Factor (%)	Step Power (kVAr)	Reference Number	W	W1	W2	D	D1	D2	H	Inductance(mH)	Rated Current I1(A)	RMS CURRENT IRMS(A)	Limit of Linearity ILin(A)	Total loses (W)	Approx. Weight (kg)
440V & 50Hz	5.67%	12.5	MM440HD05P012AF5	220	189	176	95	114	140	165	2.963	16.4	19.9	36	110	16
		15	MM440HD05P015AF0	220	189	176	95	114	145	165	2.469	19.7	23.9	44	130	15
		20	MM440HD05P020AF0	225	189	176	95	114	145	205	1.852	26.2	31.9	58	140	19
		25	MM440HD05P025AF0	225	189	176	95	114	145	205	1.482	32.8	39.9	72	170	19
		50	MM440HD05P050AF0	260	224	200	102	132	160	235	0.741	65.6	79.8	145	270	29
		75	MM440HD05P075AF0	300	224	200	122	152	185	265	0.494	98.4	119.6	223	340	46
		100	MM440HD05P100AF0	290	224	200	122	152	190	325	0.370	131.2	159.2	297	440	55
440V & 50Hz	7%	12.5	MM440HD07P012AF5	230	176	150	95	114	131	160	3.711	16.4	18.3	30	80	16
		15	MM440HD07P015AF0	225	189	176	95	114	145	165	3.092	19.7	21.9	36	100	16
		20	MM440HD07P020AF0	225	189	176	95	114	145	205	2.319	26.2	29.2	49	110	18
		25	MM440HD07P025AF0	225	189	176	95	114	140	205	1.855	32.8	36.5	61	160	19
		50	MM440HD07P050AF0	260	219	200	104	132	160	235	0.928	65.6	73	121	230	28
		75	MM440HD07P075AF0	300	224	200	122	152	185	235	0.618	98.4	109.5	186	290	41
		100	MM440HD07P100AF0	295	224	200	123	153	190	290	0.464	131.2	146.1	247	380	50
440V & 50Hz	14%	12.5	MM440HD14P012AF5	260	224	200	102	132	160	175	8.026	16.4	17.5	25	100	23
		15	MM440HD14P015AF0	260	224	200	102	132	160	175	6.688	19.7	21	30	130	22
		20	MM440HD14P020AF0	265	224	200	102	132	160	175	5.016	26.2	28.0	39	140	28
		25	MM440HD14P025AF0	265	224	200	103	133	165	235	4.013	32.8	35.0	49	190	28
		50	MM440HD14P050AF0	295	224	200	123	153	180	260	2.006	65.6	69.9	98	310	43
		75	MM440HD14P075AF0	300	224	200	122	152	185	325	1.338	98.4	104.9	147	380	57
		100	MM440HD14P100AF0	295	224	200	154	184	215	325	1.003	131.2	139.9	200	520	71

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