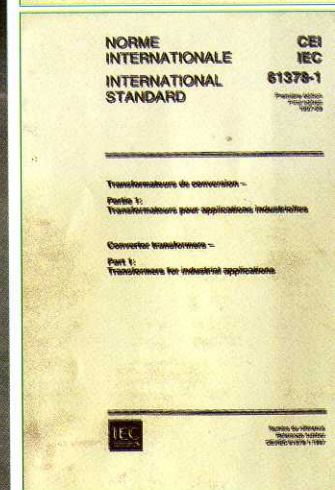
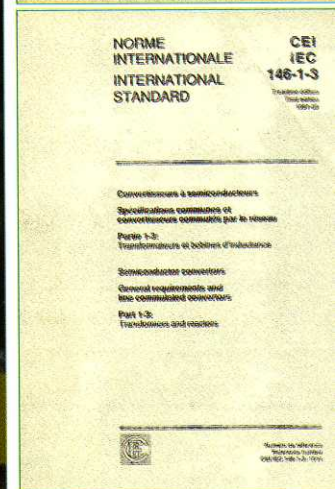
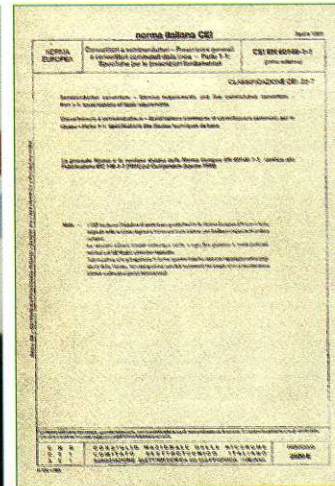




CONVERTER TRANSFORMERS

PRESENTATION

The company MF Trasformatori boasts twenty years of experience in the branch of the planning and the construction of transformers able to the interaction with semiconductor conversion groups for electrochemical appliances, industrial applications and for traction. The range of products includes oil, cast resin and class H transformers. It answers to all the exemplified duty classes from CEI norms.






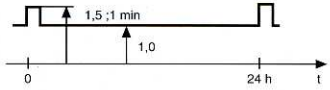
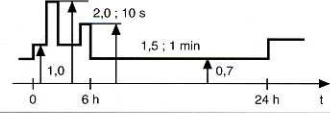
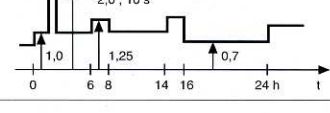
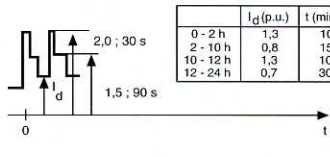
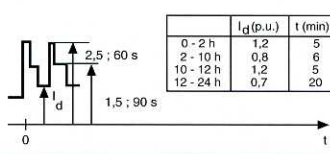
A PRACTICAL GUIDE FOR ORDERS

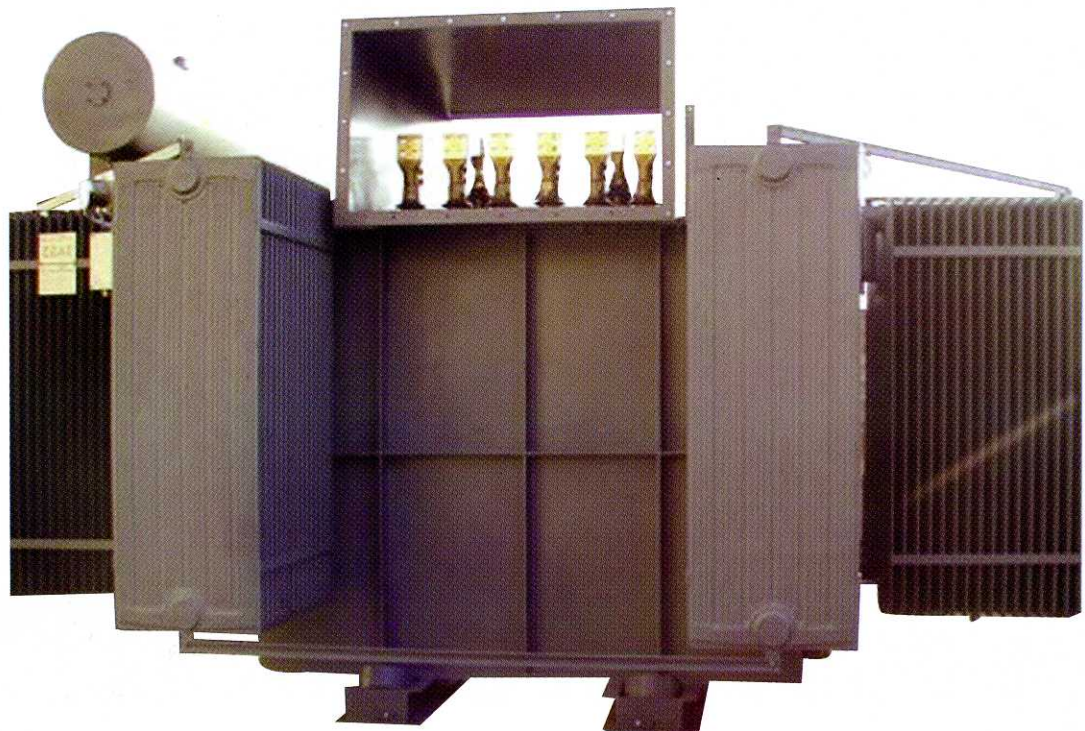
In order to carry out correctly the planning of a converter transformer they are necessary - beyond to the typical characteristics of a normal transformer - the following information:

- type of converter
- cycle of working
- harmonic of developed tension and current.

Here below are listed the tables of the duty classes, examples of cargo diagrams as guide for the choice of the aforesaid ones and the limits of overtemperature of the relative windings to the several classes and the structural modalities. The last table is devoid concerning the cast-resin transformers for which it is possible to obtain reliable results turning out on the base of the existing values.

Duty class	Rated current for converters and test conditions for assembles (value at/dn)
I	1,0 p.u. permanent
II	1,0 p.u. permanent 1,5 p.u. 1 min
III	1,0 p.u. permanent 1,5 p.u. 2 min 2,0 p.u. 10 s
IV	1,0 p.u. permanent 1,25 p.u. 2 h 2,0 p.u. 10 s
V	1,0 p.u. permanent 1,5 p.u. 2 h 2,0 p.u. 1 min
VI	1,0 p.u. permanent 1,5 p.u. 2 h 3,0 p.u. 1 min

Duty class	Specific application	Rated current for converters and test conditions for assembles (value at/dn)															
I	Electrochemical appliances																
II	Electrochemical appliances																
III	Industrial applications and traction substation: light duty																
IV	Industrial applications: heavy duty																
V	Traction substation and mines: mean duty	 <table border="1" data-bbox="1300 985 1476 1064"> <thead> <tr> <th></th> <th>I_d (p.u.)</th> <th>t (min)</th> </tr> </thead> <tbody> <tr> <td>0 - 2 h</td> <td>1,3</td> <td>10</td> </tr> <tr> <td>2 - 10 h</td> <td>0,8</td> <td>15</td> </tr> <tr> <td>10 - 12 h</td> <td>1,3</td> <td>10</td> </tr> <tr> <td>12 - 24 h</td> <td>0,7</td> <td>30</td> </tr> </tbody> </table>		I_d (p.u.)	t (min)	0 - 2 h	1,3	10	2 - 10 h	0,8	15	10 - 12 h	1,3	10	12 - 24 h	0,7	30
	I_d (p.u.)	t (min)															
0 - 2 h	1,3	10															
2 - 10 h	0,8	15															
10 - 12 h	1,3	10															
12 - 24 h	0,7	30															
VI	Traction substation: heavy duty	 <table border="1" data-bbox="1300 1164 1476 1243"> <thead> <tr> <th></th> <th>I_d (p.u.)</th> <th>t (min)</th> </tr> </thead> <tbody> <tr> <td>0 - 2 h</td> <td>1,2</td> <td>5</td> </tr> <tr> <td>2 - 10 h</td> <td>0,8</td> <td>6</td> </tr> <tr> <td>10 - 12 h</td> <td>1,2</td> <td>5</td> </tr> <tr> <td>12 - 24 h</td> <td>0,7</td> <td>20</td> </tr> </tbody> </table>		I_d (p.u.)	t (min)	0 - 2 h	1,2	5	2 - 10 h	0,8	6	10 - 12 h	1,2	5	12 - 24 h	0,7	20
	I_d (p.u.)	t (min)															
0 - 2 h	1,2	5															
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12 - 24 h	0,7	20															



PROBLEMS AND CONSTRUCTIVE METHODOLOGIES

MF

The presence of a distorted condition of tension provokes as main consequence, the increase of the additional losses relating to the windings, to the connections and to the structural parts. To obviate this kind of problems, that means in order to reduce the aforesaid losses as far as possible, there are taken following precautions:

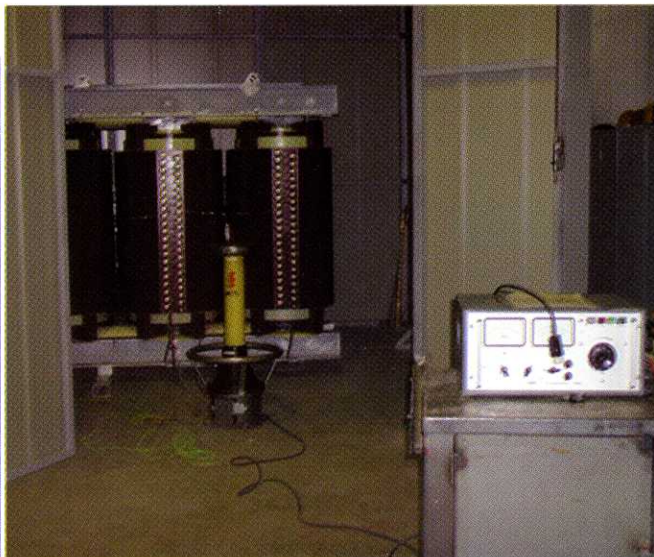
- suitable choice of the value (volt/turn) and the magnetic induction
- realization of the BT windings in slab and MT windings in hinge in order to reduce to the lowest
- the radial thickness
- parallel subdivision of the too elevated currents values

Converter duty class 1)	Transformer cooling medium	Transformer temperature class	Limit of winding temperature rise in K (measured by resistance)	
			1	2
	Air	A	60	55
		B	80	80
H		125	150	
	Oil	A	65	55
		A +	-	65
	Air	A	55	55
		B	70	80
H		110	150	
	Oil	A	65	55
		A +	-	65
	Air	A	50	50
		B	65	80
H		100	150	
	Oil	A	60	55
		A +	-	65
	Air	A	45	45
		B	60	75
H		90	140	
	Oil	A	50	50
		A +	-	60
	Air	A	40	40
		B	55	70
H		85	130	
	Oil	A	50	50
		A +	-	60

1) Refer to IEC 146-1-1, table 2.

NOTES

- 1 Temperature rise limits given in columns 1 and 2 reflect two different practices and climatic conditions in different areas of the world. Technical Committees dealing with transformers will be asked to study the problem with a view to reconciling the differences if this is technically feasible.
- 2 The temperature rise figures are based on a maximum ambient temperature of +40°C, with an average annual temperature not exceeding +20°C and an average daily ambient temperature of +30°C.
- 3 Other transformer temperature classes may be used. In such cases and when temperature rise figures are not shown in the table, these are to be agreed upon by user and supplier.
- 4 Temperature class A+ designates thermally upgraded paper with a permissible hot spot temperature of +120°C.





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