

## X/R Ratios

Typical values for generators, synchronous motors, power transformers, induction motors, utility sources, and reactors. (From ANSI Standard C37.010)

### A. Large generators and hydrogen-cooled synchronous condensers

Range	Typical
40-120	80

### B. Generators and synchronous motors (See TABLE 8A)

### C. Power transformer (See TABLE 8B)

### D. Induction motors (See TABLE 8C)

### E. Utility source

- Near generating plant  
Range: 15-30
- Long open-wire line  
Range: 2-16
- Typical  
Range: 5-12

### F. Reactors

Range	Typical
40-120	80

**TABLE 9—Primary Substation Transformers (501-5000 kVA 1 $\phi$ , 501—10,000 kVA 3 $\phi$ ) 65C rise ANSI C57.12.00**

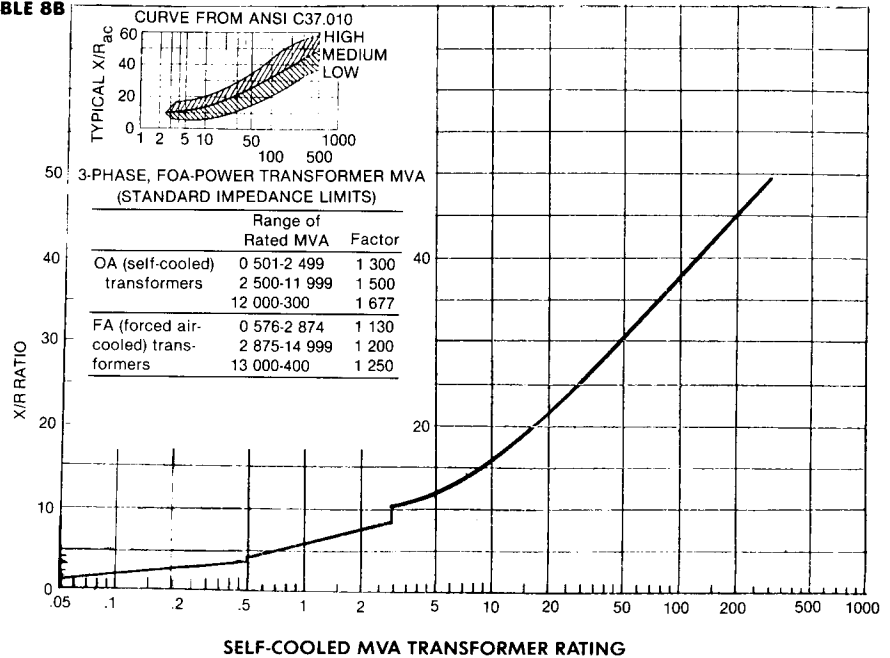
STANDARD IMPEDANCES		
High-voltage Winding BIL kV	Low-voltage Winding BIL kV	Percent Impedance*
110	45	5.75
	60-110	5.5
150	45	5.75
	60-110	5.
200	45	7.25
	60-150	7.0
250	45	7.75
	60-200	7.5
350	60-250	8.0
450	60-350	8.5
550	60-450	9.0
650	60-550	9.5

\* For load tap changing (LTC) transformers, add 0.5 to values listed.

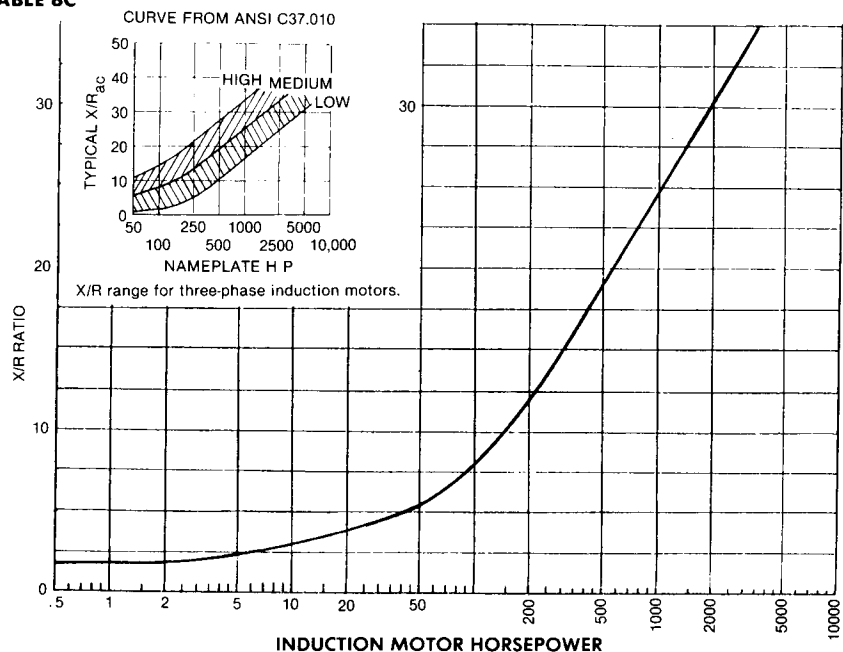
**TABLE 10—Network Transformers Three-phase (Low Voltages 216Y/125 or 480Y/277 volts)**

STANDARD IMPEDANCES	
kVA	Percent Impedance
1000 kVA and Below	5.0
Above 1000 kVA	7.0

**TABLE 8B**



**TABLE 8C**



# Appendix

**TABLE 11—Distribution Transformers—Single-phase**

kVA	Low Voltage	%IR	%IX	%IZ
<b>HIGH VOLTAGE 2400/4160Y</b>				
10	<b>120/240</b>	2.4	0.9	2.6
15		2.2	1.4	2.6
25		1.6	1.9	2.5
37½		1.6	2.3	2.8
50		1.6	1.9	2.2
75		1.0	2.1	2.3
100		0.8	2.1	2.3
167		1.0	1.9	2.1
10	<b>240/480</b>	2.4	0.8	2.5
15		2.2	1.3	2.5
25		1.6	1.8	2.4
37½		0.9	1.5	1.8
50		1.2	1.6	2.0
75		0.9	1.9	2.1
100		0.7	1.9	2.0
167		0.9	1.6	1.8
<b>HIGH VOLTAGE 4160/7200Y</b>				
10	<b>120/240</b>	2.4	0.8	2.5
15		2.1	1.4	2.5
25		1.6	1.9	2.4
37½		1.6	2.3	2.8
50		1.1	1.8	2.1
100		0.8	2.1	2.2
10	<b>240/480</b>	2.4	0.8	2.5
15		2.1	1.2	2.5
25		1.4	2.0	2.4
37½		0.9	1.5	1.8
50		1.1	1.6	1.9
100		0.7	1.7	1.8
<b>HIGH VOLTAGE 4800/8320Y</b>				
10	<b>120/240</b>	2.4	0.8	2.5
15		2.0	1.5	2.5
25		1.6	1.8	2.4
37½		1.6	2.2	2.7
50		1.1	1.9	2.2
75		1.0	1.9	2.2
100		0.8	2.2	2.3
167		1.0	1.9	2.1
10	<b>240/480</b>	2.4	0.8	2.5
15		2.1	1.3	2.4
25		1.4	2.0	2.5
37½		1.0	1.3	1.7
50		1.2	1.6	2.0
75		0.9	1.7	1.9
100		0.7	1.8	1.9
167		0.9	1.6	1.8
<b>HIGH VOLTAGE 7200/12470 or 12470GRDY/7200</b>				
10	<b>120/240</b>	2.5	0.9	2.6
15		2.1	1.6	2.6
25		1.6	2.0	2.6
37½		1.6	2.5	3.0
50		1.2	2.0	2.3
75		1.0	2.0	2.3
100		0.8	2.2	2.3
167		1.0	2.0	2.2
10	<b>240/480</b>	2.5	0.8	2.6
15		2.1	1.5	2.6
25		1.6	1.9	2.5
37½		1.0	1.5	1.8
50		1.1	1.8	2.1
75		0.9	1.8	2.0
100		0.7	1.8	2.0
167		0.9	1.7	1.9
<b>HIGH VOLTAGE 7620/13200Y OR 13200GRDY/7620</b>				
10	<b>120/240</b>	2.5	0.9	2.6
15		2.1	1.6	2.6
25		1.6	2.0	2.6
37½		1.6	2.5	3.0
50		1.2	2.0	2.3
75		1.0	2.0	2.3
100		0.8	2.2	2.3
167		1.0	2.0	2.2
10	<b>240/480</b>	2.5	0.8	2.6
15		2.1	1.5	2.6
25		1.6	1.9	2.5
37½		1.0	1.5	1.8
50		1.1	1.6	2.1
75		0.9	1.8	2.0
100		0.7	1.8	2.0
167		0.9	1.7	1.9
<b>HIGH VOLTAGE 14400/24940GRDY OR 24940GRDY/14400</b>				
10	<b>120/240</b>	1.9	1.3	2.3
15		2.2	1.6	2.7
25		1.6	2.1	2.6
37½		1.7	2.3	2.9
50		1.2	1.9	2.2
75		1.0	2.1	2.3
100		0.8	2.1	2.3
10		<b>240/480</b>	2.0	1.1
15	1.2		1.5	2.7
25	1.6		2.0	2.5
37½	1.0		1.7	1.9
50	1.1		1.8	2.1
75	0.9		1.8	2.0
100	0.7		1.8	2.0

**TABLE 12—Distribution Transformers—Three-phase Padmount—Single-voltage Primary Maximum Line-to-Line Primary Voltage—25 kV Wye—18 kV Delta**

kVA	Low Voltage						kVA	Low Voltage					
	208Y/120			480Y/277				208Y/120			480Y/277		
	%IZ	%IR	%IX	%IZ	%IR	%IX		%IZ	%IR	%IX	%IZ	%IR	%IX
75	2.9	1.8	2.2	2.6	1.7	2.0	500	4.90	1.20	4.70	4.40	1.20	4.20
112.5	3.9	1.8	3.5	3.9	1.8	3.5	750	5.75	1.40	5.50	5.75	1.30	5.70
150	4.4	1.6	4.0	4.2	1.7	3.8	1000	5.75	1.30	5.70	5.75	1.20	5.70
225	4.1	1.5	3.8	4.0	1.4	3.7	1500	.....	.....	.....	5.75	0.72	5.70
300	4.6	1.4	4.4	4.7	1.4	4.5	2000	.....	.....	.....	5.75	0.68	5.71
							2500	.....	.....	.....	5.75	0.61	5.72

