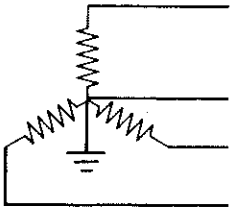
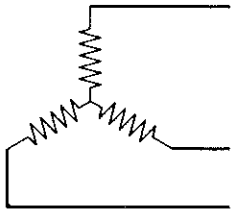
Product Data

Class 100

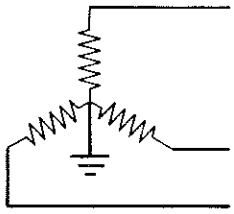
Subject: WORLD ELECTRICITY SUPPLIES
A SURVEY OF SUPPLY VOLTAGES THROUGHOUT THE WORLD



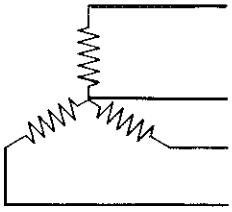
(A)
Three-Phase Star; Four-Wire; Earthed Neutral



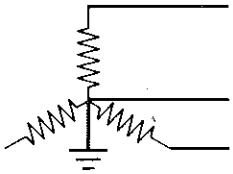
(B)
Three-Phase Star; Three-Wire



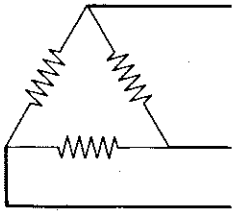
(C)
Three-Phase Star; Three-Wire; Earthed Neutral



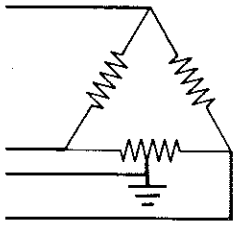
(D)
Three-Phase Star; Four-Wire; Non-Earthed Neutral



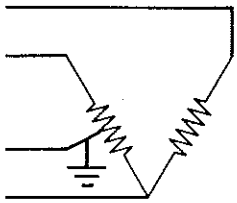
(E)
Two-Phase Star; Three-Wire; Earthed Neutral



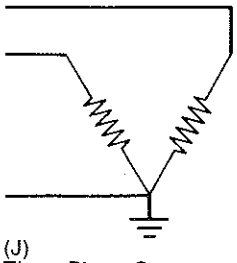
(F)
Three-Phase Delta; Three-Wire



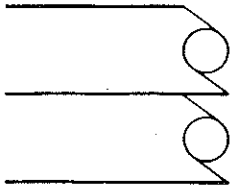
(G)
Three-Phase Delta; Four-Wire; Earthed Mid Point of Phase



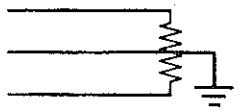
(H)
Three-Phase Open Delta; Four-Wire; Earthed Mid Point of Phase



(J)
Three-Phase Open Delta; Four-Wire; Earthed Junction of Phases



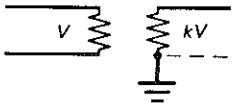
(P)
d.c.; Three-Wire



(K)
Single-Phase; Three-Wire; Earthed Mid Point

(L)
Single-Phase; Two-Wire; Earthed End of Phase

(M)
Single-Phase; Two-Wire; Non-Earthed Neutral



(N)
Single-Wire; Earthed Return (SWER)

Reference: U.S. Department of Commerce Publication "Electric Current Aboard", 1975 Edition

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FILE: Field Office Manual No. 2 - Product Data - Distribution Products
Supersedes Product Data Bulletin D-386B, Class 100, dated 8-82

Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
AFGHANISTAN, D. R. OF	50	380/220 (A) 220 (L)	380/220 (A)	380/220 (A) (3)	(9)
ALBANIA	50	220 (L) (1)	380/220 (A)	380/220 (A)	(9)
ALGERIA	50 ± 1.5	220/127 (E) 220 (L) (1)	380/220 (A) 220/127 (A)	10 kV 5.5 kV & 6.6 kV 380/220 (A)	± 5 and ± 10
ANGOLA (10)	50	220 (L) (1)	380/220 (A)	380/220 (A)	(9)
ANGUILLA	50	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
ANTIGUA	60	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
ARGENTINA	50 ± 1.0	225 (L) (1) 220 (L) (1)	390/225 (A) 380/220 (A) 220 (L)	13.2 kV 6.88 kV 390/225 (A) 380/220 (A)	± 10
AUSTRALIA (10)	50 ± 0.1	415/240 (A) (E) 240 (L)	415/240 (A) 440/250 (A) 440 (N) (6)	22 kV 11 kV 6.6 kV 415/240 (A) 440/250 (A)	± 6
Western	50	440/250 (A)	(9)	(9)	± 6
AUSTRIA	50+0.1	380/220 (A) (B) 220 (L)	380/220 (A) (B) 220 (L)	20 kV 10 kV 5 kV 380/220 (A)	± 5
AZORES (Portugal)	50	220 (L) 120 (L)	380/220 (A)	380/220 (A)	
BAHAMAS	60	240/120 (G) 120 (L)	240/120 (G) 120 (L)	415/240 (A) (3) 208/120 (A)	(9)
BAHRAIN FIR	50 & 60	400/230 (A) 230 (L) 110 (L)	400/230 (A) 380/220 (A) 230 (L) 220/110 (K)	11 kV 400/230 (A) 380/220 (A)	± 6
BANGLADESH	50 ± 4	400/230 (A) 230 (L)	11 kV 400/230 (A)	11 kV 400/230 (A)	± 5
BARBADOS	50 ± 0.4	230/115 (G) (K) 200/115 (A) (E)	230/115 (G) (K) 200/115 (A) (E)	11 kV 3.3 kV 230/115 (G) 200/115 (A)	± 6
BELGIUM	50 ± 3	380/220 (A) 220/127 (A) 220 (F)	380/220 (A) 220/127 (A) 220 (F)	15 kV 6 kV 380/220 (A) 220/127 (A) 220 (F)	± 5 (day) ± 10 (night)

NOTES:

(1) The supply to each house is normally single phase utilizing one phase line and neutral of systems (A) or (G).
(2) Frequencies below 50 Hz and dc supplies are in limited areas only. The supplies given indicate the diversity of possibilities which may exist.
(3) Information on higher voltage supplies to factories not available.
(4) More than one area of country has been given to illustrate the differences which exist. These may not be the only supplies available.
(5) Frequency is 50 Hz (eastern area) and 60 Hz (western area). Dividing line is a North/South line through Shizuoka on Honshu Island.

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
BELIZE	60 ± 0.1	220/110 (K)	220/110 (K)	440/220 (K) (3)	(9)
BENIN	50 ± 1	380/220 (A) 220 (L)	380/220 (A) 220 (L)	15 kV 380/220 (A)	± 10
BERMUDA	60 ± 0.1	240/120 (K) 208/120 (A)	240/120 (K) 208/120 (A)	4.16/2.4 kV 208/120 (A) 240/120 (K)	± 5
BOLIVIA	50 ± 1	230/115 (H)	230/115 (H)	230/115 (H) (3)	± 5
BOTSWANA	50	220 (L) (1)	380/220 (A)	380/220 (A) (3)	(9)
BRAZIL (10)	60	220 (L) (1) 127 (L) (1)	380/220 (A) 220/127 (A)	13.8 kV 11.2 kV 380/220 (A) 220/127 (A)	(9)
BRUNEI	50	240 (L)	415/240 (A)	22 kV 415/240 (A)	± 5
BULGARIA	50 ± 0.1	380/220 (A) 220 (L)	380/220 (A) 220 (L)	20 kV 15 kV 380/220 (A)	± 5
BURMA	50	230 (L) (1)	400/230 (A) 230 (L)	11kV 6.6 kV 400/230 (A)	(9)
BURUNDI	50	220 (L)	380/220 (A)	380/220 (A)	
CAMBODIA	50	208/120 (A) 120 (L)	380/220 (A) 208/120 (A)	380/220 (A) (3) 208/120 (A)	(9)
CAMEROON (FR)	50 ± 2	220 (L) (1)	380/220 (A)	15 kV 380/220 (A)	± 5
CANADA	60 ± 0.02	240/120 (K)	600/347 (A) 480 (F) 240 (F) 240/120 (K) 208/120 (A)	12.5/7.2 kV 600/347 (A) 208/120 (A) 600 (F) 480 (F) 240 (F)	+4 -8.3
CAYMAN ISLANDS	60 ± 0.1	240/120 (K)	240/120 (K) (G)	480/240 (G) 480/227 (A) 240/120 (G) 208/120 (A)	± 10
CENTRAL AFRICA	50	220 (L) (1)	220 (L) (1)	380/220 (A) (3)	(9)
CHAD	50	220 (L) (1)	220 (L) (1)	380/220 (A) (3)	(9)
CHILE	50	220 (L) (1)	380/220 (A) (1)	380/220 (A) (3)	(9)
CHINA, P. R. OF	50	220 (L) (1)	380/220 (A)	380/220 (A) (3)	± 7
COLOMBIA	60 ± 1	240/120 (K) 120 (L)	240/120 (G) 120 (L)	13.2 kV 240/120 (G)	± 10

(6) Some remote areas are supplied via a single wire earthed return (SWER) system (see Fig. N).
(7) Only a few towns have this supply.
(8) Refers to isolated mining districts.
(9) Information not available at time of printing.

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
CONGO. REP. OF	50	220 (L)	380/220 (A)	380/220 (A)	
COSTA RICA	60	120 (L) (1)	240/120 (K) 120 (L) (1)	13.8 kV 240/120 (G) (3)	(9)
CYPRUS	50 ± 2.5	240 (L) (1)	240 (L) (1)	11 kV 415/240 (A)	± 6
CZECHOSLOVAKIA	50 ± 0.1	380/220 (A) 220 (L)	380/220 (A) 220 (L)	22 kV 15 kV 6 kV 3 kV 380/220 (A)	± 10
DAHOMEY	50 ± 0.1	380/220 (A) 220 (L)	380/220 (A) 220 (L)	15 kV 380/220 (A)	± 10 ± 10
DENMARK	50 ± 0.4	380/220 (A) 220 (L)	380/220 (A) 220 (L)	30 kV 10 kV 380/220 (A)	± 10
DOMINICA	50	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
DOMINICAN REPUBLIC	60	110 (L) (1)	220/110 (K) (1) 110 (L)	220/110 (G) (3)	(9)
ECUADOR	60	127 (L) (1) 120 (L) (1) 110 (L)	240/120 (K) 208/120 (A) 220/127 (A) 220/110 (K)	240/120 (K) 208/120 (A) 220/127 (A) 220/110 (K)	± 5
EGYPT, ARAB REPUBLIC OF	50 ± 1	380/220 (A) 220 (L)	380/220 (A) 220 (L)	11 kV 6.6 kV 380/220 (A)	± 10
EL SALVADOR (10)	60 ± 1	240/120 (K)	240/120 (K) (G)	14.4 kV 2.4 kV 240/210 (G)	± 5
EQUATORIAL GUINEA	50	220 (L)	220 (L)		
ETHIOPIA	50	220 (L) (1)	380/220 (A)	380/220 (A) (3)	(9)
FALKLAND ISLANDS (UK)	50 ± 3	230 (L) (1)	415/230 (A)	415/230 (A) (3)	± 2.5
FIJI ISLANDS	50 ± 1	415/240 (A) 240 (L)	415/240 (A) 240 (L)	11 kV 415/240 (A)	(9)
FINLAND	50 ± 0.1	220 (L) (1)	380/220 (A)	660/380 (A) 500 (B) 380/220 (A) (D)	± 10
FRANCE	50 ± 1	380/220 (A) 220 (L) 220/127 (E) 127 (L)	380/220 (A) 380/220 (D) 380 (B)	20 kV 15 kV 380 (B) 380/220 (A) (D)	± 10
GABON	50	220 (L)	380/220 (A)	380/220 (A)	
GAMBIA	50	230 (A) (1)	230 (A) (1)	400/230 (A) (3)	± 5 (1)

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(4) More than one area of country has been given to illustrate the differences which exist. These may not be the only supplies available.
(5) Frequency is 50 Hz (eastern area) and 60 Hz (western area). Dividing line is a North/South line through Shizuoka on Honshu Island.

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GERMANY (FRG) (10) (West)	50 ± 0.3	380/220 (A) 220 (L)	380/220 (A) 220 (L)	20 kV 10 kV 380/220 (A)	± 10
GERMANY (GDR) (East)	50 ± 0.3	380/220 (A) 220 (L) 220/127 (A) 127 (L)	380/220 (A) 220 (L)	10 kV 6 kV 660/380 (A) 380/220 (A)	± 5
GHANA	50 ± 5	250 (L) (1)	250 (L) (1)	440/250 (A) (3)	± 10
GIBRALTAR	50 ± 1	415/240 (A)	415/240 (A)	415/240 (A) (3)	± 6
GREECE	50 ± 1	220 (L) (1)	6.6 kV 380/220 (A)	22 kV 20 kV 15 kV 6.6 kV 380/220 (A)	± 5
GREENLAND (Denmark)	50	380/220 (A) 220 (L)	380/220 (A)	380/220 (A)	(9)
GRENADA	50	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
GUADELOUPE (France)	50 & 60	220 (L) (1)	380/220 (A)	20 kV 380/220 (A)	(9)
GUAM (U.S.) (Mariana Islands)	60+1 −0.08	240/120 (K) 208/120 (A) 240 (L) 120 (L)	240/120 (K) 208/120 (A)	13.8 kV 4.0 kV 480/277 (A) 480 (F) 240/120 (H) 208/120 (A)	+8−10
GUATEMALA	60 ± 1.7	240/120 (K)	240/120 (K)	13.8 kV 240/120 (G)	± 10
GUINEA	50	380/220 (A) 220 (L)	380/220 (A)	380/220 (A)	(9)
GUINEA-BISSAU	50	380/220 (A) 220 (L)	380/220 (A)	380/220 (A)	(9)
GUIANA (France)	50 & 60	220/110 (K)	220/110 (K)	220 (F)	
HAITI	60	230 (L) (1) 220 (L) (1) 115 (L)	380/220 (A) 230/115 (K) 220 (L)	380/220 (A) 230/115 (G)	(9)
HONDURAS	60	110 (L)	220/110 (K) 110 (L)	220/110 (K) (3)	(9)
HONG KONG (and Kowloon)	50 ± 2	200 (L) (1) 346/200 (A)	11 kV 346/200 (A) 380/220 (A) 200 (L)	11 kV 346/200 (A) 380/220 (A) (3)	± 6
HUNGARY	50 ± 2	380/220 (A) 220 (L)	380/220 (A) 220 (L)	20 kV 10 kV 380/220 (A)	+5 −10

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ICELAND	50 ± 0.1	380/220 (A) 220 (L)	380/220 (A) 220 (L)	380/220 (A) (3)	(9)
INDIA (4)					
Bombay	50 ± 1	440/250 (A) 230 (L)	440/250 (A) 230 (L)	11 kV 440/250 (A)	± 4
New Delhi	50 ± 3	400/230 (A) 230 (L)	400/230 (A) 230 (L)	11 kV 400/230 (A)	± 6
Ramakrishnapuram (2)	50 ± 3 25 d.c.	400/230 (A) 230 (L) 460/230 (P)	400/230 (A) 230 (L) 460/230 (P)	22 kV & 11 kV (9) (9)	± 6
INDONESIA	50+1 −2	220/127 (A)	380/220 (A) 220/127 (A)	22 kV 380/220 (A) (3)	± 5
IRAN	50 ± 5	220 (L) (1)	380/220 (A)	20 kV 11 kV 400/231 (A) 380/220 (A)	± 15
IRAQ	50	220 (L) (1)	380/220 (A)	11 kV 6.6 kV 3 kV 380/220 (A)	± 5
IRELAND (10) NORTHERN	50 ± 0.4	230 (L) (1) 220 (L) (1)	400/230 (A) 380/220 (A)	400/230 (A) (3) 380/220 (A)	± 6
IRELAND REPUBLIC OF	50	220 (L) (1)	380/220 (A)	10 kV 380/220 (A)	(9)
ISRAEL	50 ± 0.2	400/230 (A) 230 (L)	400/230 (A) 230 (L)	22 kV 12.6 kV 6.3 kV 400/230 (A)	± 6
ITALY	50 ± 0.4	380/220 (A) 220/127 (E) 220 (L)	380/220 (A) 220/127 (E)	20 kV 15 kV 10 kV 380/220 (A) 220 (C)	± 5 (urban) ± 10 (rural)
IVORY COAST	50	220 (L) (1)	380/220 (A)	380/220 (A) (3)	(9)
JAMAICA	50 ± 1	220/110 (G) (K)	220/110 (G) (K)	4/2.3 kV 220/110 (G)	± 6
JAPAN (EAST) (4)	50 ± 0.2 (5)	200/100 (K) 100 (L)	200/100 (H) (K)	6.6 kV 200/100 (H) 200 (G) (J)	± 10
JAPAN (WEST) (4)	60 ± 0.1 (5)	210/105 (K) 200/100 (K) 100 (L)	210/105 (H) (K) 200/100 (K) 100 (L)	22 kV 6.6 kV 210/105 (H) 200/100 (H)	± 10
JORDAN	50	380/220 (A) 220 (L)	380/220 (A)	380/220 (A) (3)	(9)

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KENYA	50	240 (L) (1)	415/240 (A)	415/240 (A) (3)	(9)
KOREA, D.P.R. OF (10) (North)	60+0 −5	220 (L)	380/220 (A)	380/220 (A)	+6.8 −13.6
KOREA, REP. OF (South)	60	100 (L)	200/100 (K)	22 kV 6.6 kV	± 5
KUWAIT	50	240 (L) (1)	415/240 (A)	415/240 (A) (3)	(9)
LAOS	50 ± 8	380/220 (A)	380/220 (A)	380/220 (A) (3)	± 6
LEBANON	50	220 (L) (1) 110 (L) (1)	380/220 (A) 220 (L) 190/110 (A) 110 (L)	380/220 (A) (3) 190/110 (A)	(9)
LESOTHO	50	220 (L) (1)	380/220 (A)	380/220 (A) (3)	(9)
LIBERIA	60 ± 3.3	240/120 (K)	240/120 (K)	12.5/7.2 kV 416/240 (B) 240/120 (K) 208/120 (D)	± 1.7
LIBYA, S.P.A.J.	50	230 (L) (1) 127 (L) (1)	400/230 (A) 220/127 (A) 230 (L) 127 (L)	400/230 (A) (3) 220/127 (A)	(9)
LUXEMBOURG	50 ± 0.5	380/220 (A) 220/127 (A) 208/120 (A)	380/220 (A) 220/127 (A) 208/120 (A)	20 kV 15 kV 5 kV	± 5 and ± 10
MACAO (Portugal)	50	380/220 (A) 230/115 (K)	380/220 (A) 220/127 (A)	380/220 (A) 220/127 (A)	(9) (9)
MALAGASY REPUBLIC (Madagascar)	50 ± 2	220 (L) (1) 127 (L) (1)	380/220 (A) 220/127 (A)	5 kV 380/220 (A) 220/127 (A)	± 3
MALAWI	50	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
MALAYSIA	50 ± 1.0	240 (L) (1)	415/240 (A)	22 kV 415/240 (A) (3)	± 5
MALI	50	220 (L) (1) 127 (L) (1)	380/220 (A) 220/127 (A) 220 (L) 127 (L)	380/220 (A) (3) 220/127 (A)	(9)
MALTA	50 ± 1	240 (L) (1)	415/240 (A)	11 kV 6.6 kV 3.3 kV 415/240 (A)	(9)
MARTINIQUE (France)	50	127 (L) (1)	220/127 (A) 127 (L)	220/127 (A) (3)	(9)
MAURITANIA	50	220 (L)	220 (L)	200 (F)	(9)

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
MAURITIUS	50 ± 1.0	230 (L) (1)	400/230 (A)	400/230 (A) (3)	± 6
MEXICO	60 ± 0.2	220/127 (A) 220 (L) 120 (M)	220/127 (A) 220 (L) 120 (M)	13.8 kV 13.2 kV 480/277 (A) 220/127 (B)	± 6
MONACO	50	380/220 (A) 220 (L) 220/127 (A) 127 (L)	380/220 (A) 220 (L)	380/220 (A) (3)	(9)
MONTSERRAT	60	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
MOROCCO	50	220/127 (A) 200/115 (A)	380/220 (A)	380/220 (A) (3)	(9)
MOZAMBIQUE	50	380/220 (A) 220 (L)	380/220 (A)	380/220 (A)	(9)
NEPAL	50 ± 1	220 (L) (1)	400/220 (A) 220 (L)	11 kV 400/220 (A)	± 10
NETHERLANDS	50 ± 0.4	380/220 (A) 220 (E) (L)	380/220 (A)	10 kV 3 kV 380/220 (A)	± 6
NETHERLANDS ANTILLES	50 & 60	220 (L) (1) 127 (L) (1) 120 (L) (1) 115 (L) (1)	380/220 (A) 230/115 (K) 220/127 (A) 208/120 (A)	380/220 (A) (3) 230/115 (G) 220/127 (A) 208/120 (A)	(9)
NEW CALEDONIA (France)	50	220 (L)	380/220 (A)	380/220 (A)	
NEW ZEALAND	50 ± 1.5	400/230 (A) (E) 230 (L) 240 (L)	415/240 (A) (E) 400/230 (A) (E) 230 (L) 240 (L)	11 kV 400/230 (A) 415/240 (A) 440 (N) (6)	± 5
NICARAGUA	60	240/120 (G) (K)	240/120 (G) (K)	13.2 kV 7.6 kV 240/120 (G)	(9)
NIGER	50 ± 1	220 (L) (1)	15 kV 380/220 (A)	15 kV 380/220 (A)	± 2.5
NIGERIA	50 ± 1	230 (L) (1) 220 (L) (1)	400/230 (A) 380/220 (A)	15 kV 11 kV 400/230 (A) 380/220 (A)	± 5

NOTES:
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(3) Information on higher voltage supplies to factories not available.
(4) More than one area of country has been given to illustrate the differences which exist. These may not be the only supplies available.
(5) Frequency is 50 Hz (eastern area) and 60 Hz (western area). Dividing line is a North/South line through Shizuoka on Honshu Island.

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
NORWAY	50 ± 0.2	230 (B)	380/220 (A) 230 (B)	20 kV 10 kV 5 kV 380/220 (A) 230 (B)	± 10
OKINAWA (Japan)	60	200/100 (K) 100 (L)	200/100 (K) 100 (L)		(9)
OMAN Muscat	50	240 (L) (1)	415/240 (A) 240 (L)	415/240 (A) (3)	(9)
PAKISTAN	50	230 (L) (1)	400/230 (A) 230 (L)	400/230 (A) (3)	(9)
PANAMA	60 ± 0.17	240/120 (K)	480/277 (A) 240/120 (K)	12 kV 480/277 (A) 208/120 (A)	± 5
PAPUA New Guinea	50 ± 2	240 (L) (1)	415/240 (A) 240 (L)	22 kV 11 kV 415/240 (A)	± 5
PARAGUAY	50	220 (L) (1)	440/220 (K) 380/220 (A)	440/220 (G) (3) 380/220 (A)	(9)
PERU	60	225 (B) (M)	225 (B) (M)	10 kV 6 kV 225 (B)	(9)
PHILIPPINES	60 ± 1.6	220/110 (K)	13.8 kV 4.16 kV 2.4 kV 220/110 (H)	13.8 kV 4.16 kV 2.4 kV. 440 (V) (F) 220/110 (H)	± 5
Manila (Metropolitan area)	60 ± 0.05	240/120 (H) (K) 240/120 (H)	240/120 (H) (K) 240/120 (H)	20 kV 6.24 kV 3.6 kV 240/120 (H)	± 5
POLAND	50 ± 1	220 (L) (1)	380/220 (A)	15 kV 6 kV 380/220 (A)	± 5
PORTUGAL	50 ± 1	380/220 (A) 220 (L)	15 kV 5 kV 380/220 (A) 220 (L)	15 kV 5 kV 380/220 (A)	± 5
PUERTO RICO & VIRGIN IS. (U.S.)	60 ± 10	240/120 (L)	480 (F) 240/120 (L)	8.32 kV 4.16 kV 480 (F)	± 10
QATAR	50	240 (L) (1)	415/240 (A) 240 (L)	415/240 (A) (3)	± 6
RHODESIA	50 ± 2.5	225 (L) (1)	390/225 (A)	11 kV 390/225 (A)	± 6.6
ROMANIA	50 ± 1	220 (L) (1)	380/220 (L)	20 kV 10 kV 6 kV 380/220 (A)	± 5

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
RWANDA	50 ± 1	220 (L) (1)	380/220 (A)	15 kV 6.6 kV 380/220 (A)	± 5
SABAH (Malaysia)	50 ± 0.5	240 (L) (1)	415/240 (A)	415/240 (A) (3)	± 6
ST. KITTS & NEVIS	60	230 (L) (1)	400/230 (A)	400/230 (A) (3)	(9)
ST. LUCIA	50	240 (L) (1)	415/240 (A)	11 kV 415/240 (A)	(9)
ST. VINCENT	50	230 (L) (1)	400/230 (A)	3.3 kV 400/230 (A)	(9)
SAUDI ARABIA	50 ± 0.5 60 ± 0.5	220/127 (A) 127 (L)	380/220 (A) 220/127 (A) 127 (L)	380/220 (A) (3) 220/127 (A) 13.8 kV	± 5
SENEGAL	50	127 (L) (1)	220/127 (A) 127 (L)	220/127 (A) (3)	(9)
SEYCHELLES IS.	50	240 (L) (1)	415/240 (A)	415/240 (A) (3)	(9)
SIERRA LEONE	50	230 (L) (1)	400/230 (A) 230 (L)	11 kV 400/230 (A)	(9)
SINGAPORE	50 ± 0.5	400/230 (A) 230 (L)	6.6 kV 400/230 (A)	22 kV 6.6 kV 400/230 (A)	± 3
SOMALIA REPUBLIC	50	230 (L) 220 (L) 110 (L) (1)	440/220 (K) 220/110 (K) 230 (L)	440/220 (G) (3) 220/110 (G)	(9)
SOUTH AFRICAN REPUBLIC	50 ± 2.5 25 (8)	433/250 (A) (7) 400/230 (A) (7) 380/220 (A) 220 (L)	11 kV 6.6 kV 3.3 kV 433/250 (A) (7) 400/230 (A) (7) 380/220 (A)	11 kV 6.6 kV 3.3 kV 500 (B) 380/220 (A)	± 5
SPAIN	50 ± 3	380/220 (A) (E) 220 (L) 220/127 (A) (E) 127 (L)	380/220 (A) 220/127 (A)	15 kV 11 kV 380/220 (A)	± 7
SRI LANKA (Ceylon)	50 ± 2	230 (L) (1)	400/230 (A) 230 (L)	11 kV 400/230 (A)	± 6
SUDAN	50	240 (L) (1)	415/240 (A) 240 (L)	415/240 (A) (3)	(9)
SURINAME	50 & 60	115 (L) 127 (L) (1)	230/115 (K) 220/127 (A) 220/110 (K)	230/115 (G) (3) 220/127 (A) 220/110 (G)	(9)

NOTES:
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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
SWAZILAND	50 ± 2.5	230 (L) (1)	400/230 (A) 230 (L)	11 kV 400/230 (A)	± 6
SWEDEN	50 ± 0.2	380/220 (A) 220 (L)	380/220 (A) 220 (L)	20 kV 10 kV 6 kV 380/220 (A)	± 10
SWITZERLAND	50 ± 0.5	380/220 (A) 220 (L)	380/220 (A) 220 (L)	16 kV 11 kV 6 kV 380/220 (A)	± 10
SYRIAN ARAB. REPUBLIC	50	220 (L) (1) 115 (L) (1)	380/220 (A) 220 (L) 220/115 (A) 115 (L)	380/220 (A) (3) 200/115 (A)	(9)
TAIWAN (10) (Formosa)	60 ± 4	380/220 (A) 220 (L) 220/110 (K) 110 (L)	380/220 (A) 220/110 (H)	22.8 kV 11.4 kV 380/220 (A) 220 (H)	± 5 ± 10
TANZANIA (10)	50	400/230 (A)	400/230 (A)	11 kV 400/230 (A)	(9)
THAILAND	50 ± 1	220 (L) (1)	433/250 (A) 380/220 (A) 220 (L)	22 kV 380/220 (A) (3)	± 5
TOGO	50	220 (L) (1)	380/220 (A)	20 kV 5.5 kV 380/220 (A)	(9)
TONGA	50	415/240 (A) 240 (L) 110 (L)	415/240 (A) 240 (L) 110 (L)	11 kV 6.6 kV 415/240 (A)	(9)
TRINIDAD & TOBAGO	60 ± 0.5	230/115 (K)	400/230 (A) 230/115 (G)	12 kV 400/230 (A)	± 6
TUNISIA (10)	50 ± 2	380/220 (A) 220 (L)	380/220 (A) 220 (L)	15 kV 10 kV 380/220 (A)	± 10
TURKEY (10)	50 ± 2	220 (L) (1)	380/220 (A)	15 kV 6.3 kV 380/220 (A)	± 10
UGANDA	50 ± 0.1	240 (L) (1)	415/240 (A)	11 kV 415/240 (A)	± 4.5
UNITED ARAB EMIRATES					
Abu Dhabi	50	415/240 (A)	415/240 (A)	415/240 (A) (3)	(9)
Ajman	50	230 (L) (1)	400/230 (A)	11 kV	(9)
Dubai	50 ± 0.5	220 (L) (1)	380/220 (A) 220 (L)	6.6 kV 380/220 (A)	± 2 to 3

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
UNITED KINGDOM (excluding Northern Ireland)	50 ± 1	240 (L) (1)	415/240 (A)	22 kV 11 kV 6.6 kV 3.3 kV 415/240 (A)	± 6
UPPER VOLTA	50	220 (L)	380/220 (A)	380/220 (A)	
URUGUAY	50 ± 1	220 (B) (L)	220 (B) (L)	15 kV 6 kV 220 (B)	± 6
USA (4) Charlotte (North Carolina)	60 ± 0.06	240/120 (K) 208/120 (A)	460/265 (A) 240/120 (K) 208/120 (A)	14.4 kV 7.2 kV 2.4 kV 575 (F) 460 (F) 240 (F) 480/277 (A) 240/120 (K) 208/120 (A)	+5 -2.5
Detroit (10) (Michigan)	60 ± 0.2	240/120 (K) 208/120 (A)	480 (F) 240/120 (H) 208/120 (A)	13.2 kV 4.8 kV 4.16 kV 480 (F) 240/120 (H) 208/120 (A)	+ 4 -6.6
Los Angeles (California)	60 ± 0.2	240/120 (K)	4.8 kV 240/120 (G)	4.8 kV 240/120 (G)	± 5
Miami (Florida)	60 ± 0.3	240/120 (K) 208/120 (A)	240/120 (K) 240/120 (H) 208/120 (A)	13.2 kV 2.4 kV 480/277 (A) 240/120 (H)	± 5
New York (New York)	60	240/120 (K) 208/120 (A)	240/120 (K) 208/120 (A) 240 (F)	12.47 kV 4.16 kV 480/277 (A) 480 (F)	(9)
Pittsburgh (Pennsylvania)	60 ± 0.03	240/120 (K)	460/265 (A) 240/120 (K) 208/120 (A) 460 (F) 230 (F)	13.2 kV 11.5 kV 2.4 kV 460/265 (A) 208/120 (A) 460 (F) 230 (F)	±5 (lighting) ±10 (power)

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Country	Frequency and Tolerance Hz & %	Household Voltage V	Commercial Voltage V	Industrial Voltage V	Voltage Tolerance %
Portland (Oregon)	60	240/120 (K)	480/277 (A) 240/120 (K) 208/120 (A) 480 (F) 240 (F)	19.9 kV 12 kV 7.2 kV 2.4 kV 480/277 (A) 208/120 (A) 480 (F) 240 (F)	(9)
San Francisco (California)	60 ± 0.08	240/120 (K)	480/277 (A) 240/120 (K)	20.8 kV 12 kV 4.16 kV 480/277 (A) 240/120 (G)	± 5
Toledo (Ohio)	60 ± 0.08	240/120 (K) 208/120 (A)	480/277 (C) 240/120 (H) 208/120 (K)	12.47 kV 7.2 kV 4.8 kV 4.16 kV 480 (F) 480/277 (A) 208/120 (A)	± 5
USSR	50	380/220 (A) 220 (L) 220/127 (A) 127 (L)	380/220 (A) 220 (L)	380/220 (A) (3)	(9)
VENEZUELA	60	240/120 (G) 208/120 (A)	240/120 (G) 208/120 (A)	13.8 kV 12.47 kV 4.8 kV 4.16 kV 2.4 kV 240/120 (G) 208/120 (A)	(9)
VIETNAM	50 ± 0.1	220 (L) (1) 120 (L) (1)	380/220 (A) 208/120 (A)	15 kV 380/220 (A)	± 10
WESTERN SAMOA	50	400/230	(9)	(9)	(9)
YEMEN ARAB REPUBLIC	50	220	(9)	(9)	(9)
YEMEN (PDR)	50 ± 1	250 (L) (1)	440/250 (A)	440/250 (A) (3)	± 4
YUGOSLAVIA	50	380/220 (A) 220 (L)	380/220 (A) 220 (L)	10 kV 6.6 kV 380/220 (A)	(9)
ZAIRE	50	220 (L) (1)	380/220 (A)	380/220 (A) (3)	(9)
ZAMBIA	50 ± 2.5	230 (L) (1)	400/230 (A)	400/230 (A) (3)	± 3.75

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CABLE RATINGS (TO I.E.E. REGULATIONS)

P.V.C. Armored Multi-Core

Close excess current protection
Ambient temperature: 30°C

At other ambients the following rating factors apply:

Ambient temperature	25°C	35°C	40°C	45°C	50°C
Rating factor	1.06	0.94	0.87	0.79	0.71

For groups of cables the following rating factors apply:

Number of cables	2	3	4	5	6	8	10
Rating factor	0.80	0.70	0.65	0.60	0.57	0.52	0.48

3 or 4 Cores, 3 Phase

Cross Section mm²	Clipped Direct to a Surface or on a Cable Tray, and Unenclosed		Defined Conditions (See I.E.E. Regulations)	
	Cu Amps	Al Amps	Cu Amps	Al Amps
1.5	18	—	—	—
2.5	24	—	—	—
4	31	—	—	—
6	41	—	42	—
10	56	—	58	—
16	73	55	77	58
25	97	67	102	71
35	119	88	125	93
50	147	105	155	110
70	180	138	190	145
95	219	166	230	175
120	257	195	270	205
150	295	219	310	230
185	333	257	350	270
240	399	304	420	320
300	451	347	475	365
400	523	—	550	—

CABLE RATING (TO I.E.E. REGULATIONS)

Paper, Single-Core, Lead Sheathed

Close or coarse excess current protection
Ambient temperature: 30°C

At other ambients the following rating factors apply:

Ambient temperature	25°C	35°C	40°C	45°C	50°C
Rating factor	1.05	0.95	0.89	0.82	0.75

For groups of cables the following rating factors apply:

Number of 3-Phase Circuits	2	3	4	5	6	8	10
Rating factor	0.80	0.69	0.62	0.59	0.55	0.51	0.48

3 or 4 Cables, 3 Phase

Cross Section mm²	Clipped Direct to a Surface or on a Cable Tray, Bunched and Unenclosed		Defined Conditions (See I.E.E. Regulations)	
	Cu Amps	Al Amps	Cu Amps	Al Amps
50	180	144	220	170
70	230	175	280	215
95	285	215	345	270
120	340	260	405	315
150	390	295	460	360
185	450	345	535	420
240	575	430	670	530
300	660	500	760	605
400	765	590	870	700
500	870	675	975	790
630	990	790	1100	910
800	1100	890	1220	1030
1000	1190	990	1330	1140

CABLE RATINGS (TO I.E.E. REGULATIONS)

P.V.C. Non-Armored Multi-Core

Close excess current protection
Ambient temperature: 30°C

At other ambients the following rating factors apply:

Ambient temperature	25°C	35°C	40°C	45°C	50°C
Rating factor	1.06	0.94	0.87	0.79	0.71

For groups of cables the following rating factors apply:

Number of cables	2	3	4	5	6	8	10
Rating factor	0.80	0.70	0.65	0.60	0.57	0.52	0.48

3 or 4 Cores, 3 Phase

Cross Section mm²	Enclosed in Conduit or Trunking		Clipped Direct to a Surface or on a Cable Tray, and Unenclosed		Defined Conditions (See I.E.E. Regulations)	
	Cu Amps	Al Amps	Cu Amps	Al Amps	Cu Amps	Al Amps
1.0	12	—	13	—	—	—
1.5	16	—	17	—	—	—
2.5	21	—	24	—	—	—
4	29	—	32	—	—	—
6	36	—	40	—	—	—
10	49	—	54	—	—	—
16	62	43	71	53	—	55
25	70	57	90	70	95	74
35	86	70	115	86	122	91
50	—	87	140	106	148	110
70	—	—	176	133	186	139
95	—	—	215	163	227	172
120	—	—	251	190	265	200
150	—	—	287	217	302	227
185	—	—	330	247	348	260
240	—	—	392	296	413	311
300	—	—	450	340	474	358

EXTERNAL DIAMETER OF CABLES (Typical)

Non-Armored, P.V.C. Insulated and Oversheathed, 600/1000 V.

Nominal Area mm²	Solid Aluminum		Standard Copper	
	Single Core mm Diameter	Four Core mm Diameter	Single Core mm Diameter	Four Core mm Diameter
16	—	18.1	—	19.3
25	—	21.5	—	22.9
35	—	23.6	—	25.4
50	13.8	27.1	15.1	29.2
70	15.4	30.6	16.9	33.0
95	17.6	35.5	19.4	38.3
120	19.0	38.6	21.0	41.8
150	21.0	42.8	23.2	46.3
185	23.3	47.4	25.8	51.3
240	26.1	53.5	29.0	58.0
300	28.9	59.6	32.1	64.6
400	—	—	35.8	72.0
500	—	—	39.6	—
630	—	—	43.8	—

Armored, P.V.C. Insulated and Oversheathed 600/1000 V.

16	—	22.8	—	23.9
25	—	26.3	—	27.8
35	—	28.6	—	30.5
50	17.8	33.3	19.1	35.4
70	19.6	36.8	21.1	39.2
95	21.6	41.4	23.4	44.3
120	24.3	46.1	26.3	49.3
150	26.1	50.1	28.3	53.6
185	28.3	55.1	30.8	59.0
240	31.2	61.2	34.1	65.7
300	33.7	67.0	37.0	72.0
400	—	—	42.0	81.3
500	—	—	45.6	—
630	—	—	49.7	—

MINIMUM FUSE SIZES FOR SHORT-CIRCUIT PROTECTION OF 3-PHASE MOTORS

The maximum size is determined by the requirements of the switchgear or motor overload relay. Unless otherwise stated fuses are to DIN (slow-fast). BS88 fuses shown are Class Q1.

The motor rated currents are for standard 1500 r.p.m. motors with normal cooling.
The fuse sizes are valid for the stated motor rated currents and:

FLV: Full Line Voltage Starting: Maximum starting current 6x rated current
Maximum starting time 5 seconds

Y△: Wye-Delta Starting: Maximum starting current 2x rated current
Maximum starting time 15 seconds

For higher rated currents, starting currents and/or longer starting times larger fuses will be required.

RATED CURRENTS OF 3-PHASE MOTORS (Approximate figures for squirrel cage motors)

Motor Rating			220V. Motor Rated Current	Fuse FLV	Y△	380V. Motor Rated Current	Fuse FLV	Y△	415V. Motor Rated Current	FLV BS88	Fuses DIN	Y△ BS88	Fuses DIN
kW	cos θ	η %	Amps	A	A	Amps	A	A	Amps	A	A	A	A
0.25	0.7	62	1.4	4	2	0.8	2	2	0.7	2	2	2	2
0.37	0.72	64	2.1	4	2	1.2	4	2	1.2	4	4	2	2
0.55	0.75	69	2.7	4	4	1.6	4	2	1.6	4	4	2	2
0.75	0.8	74	3.4	6	4	2	4	4	1.8	6	4	4	4
1.1	0.83	77	4.4	6	6	2.6	4	4	2.6	6	6	4	4
1.5	0.83	78	6	10	10	3.5	6	4	3.5	10	6	4	4
2.2	0.83	81	8.7	20	16	5	10	6	5.0	15	10	6	6
3	0.84	81	11.5	20	16	6.6	16	10	6.2	15	16	10	10
4	0.84	82	14.7	25	20	8.5	20	16	7.5	15	16	16	16
5.5	0.85	83	19.8	35	25	11.5	25	20	11	25	25	20	20
7.5	0.86	85	26.5	50	35	15.5	35	25	14	30	25	20	20
11	0.86	87	39	63	50	22.5	35	35	21	40	35	25	25
15	0.86	87	52	80	63	30	50	35	28	60	50	35	35
18.5	0.86	88	62	100	80	36	63	50	35	60	63	50	50
22	0.87	89	74	100	80	43	63	50	40	80	63	50	50
30	0.87	90	98	125	100	57	80	63	55	100	80	60	63
37	0.87	90	124	200	160	72	100	80	66	125	100	80	80
45	0.88	91	147	225	200	85	125	100	80	160	125	100	100
55	0.88	91	180	250	225	104	160	125	100	200	160	100	100
75	0.88	91	246	350	250	142	200	160	135	200	200	160	160
90	0.88	92	287	355	300	169	225	200	165	250	225	200	200
110	0.88	92	350	425	355	204	250	225	200	250	250	200	200
132	0.88	92	416	600	425	243	300	250	230	350	300	250	250
160	0.88	93	500	600	600	292	355	300	275	400	400	300	300
200	0.88	93	620	800	800	368	425	425	324	450	450	350	355
250	0.88	93	—	—	—	465	500	500	425	500	500	500	500
315	0.88	93	—	—	—	580	630	630	530	600	630	600	630
400	0.89	96	—	—	—	—	—	—	—	—	—	—	—
500	0.89	96	—	—	—	—	—	—	—	—	—	—	—
600	0.90	97	—	—	—	—	—	—	—	—	—	—	—

General Comparison of International Unit System (SI) to American Wire Gauge (B&S) for Rigid Cable Conductors (not extra flexible) common to the European Economic Community (EEC) and North America:

mm^2	AWG/MCM	Area Circular Mils	Number Strands
—	18	1620	Solid
1	—	1974	Solid
—	16	2580	Solid
1.5	—	2960	Solid
—	14	4110	Solid
2.5	—	4934	Solid
—	12	6530	Solid
4	—	7894	7
—	10	10380	Solid
6	—	11841	7
—	8	16510	7
10	—	19735	7
—	6	26240	7
16	—	31576	7
—	4	41740	7
25	—	49338	7
—	3	52620	7
—	2	66360	7
35	—	69073	19
—	1	83690	19
50	—	98676	19
—	0	105600	19
—	00	133100	19
70	—	138147	19
—	000	167800	19
95	—	187485	19
—	0000	211600	19
120	—	236823	37
—	250	250000	37
150	—	296029	37
—	300	300000	37
—	350	350000	37
185	—	365102	37
—	400	400000	37
240	—	473646	61
—	500	500000	37
300	—	592058	61
—	600	600000	61
—	700	700000	61
—	750	750000	61
400	—	789410	61
—	800	800000	61
—	900	900000	61
500	—	986762	61
—	1000	1000000	61
630	—	1243321	127

Metric cable per BS6004: 1969 Table 5 600/1000V.
AWG cable per 1981 National Electrical Code Chapter 9 Table 8

DISTRIBUTION EQUIPMENT MARKETING
Ken Hightower — Lexington

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