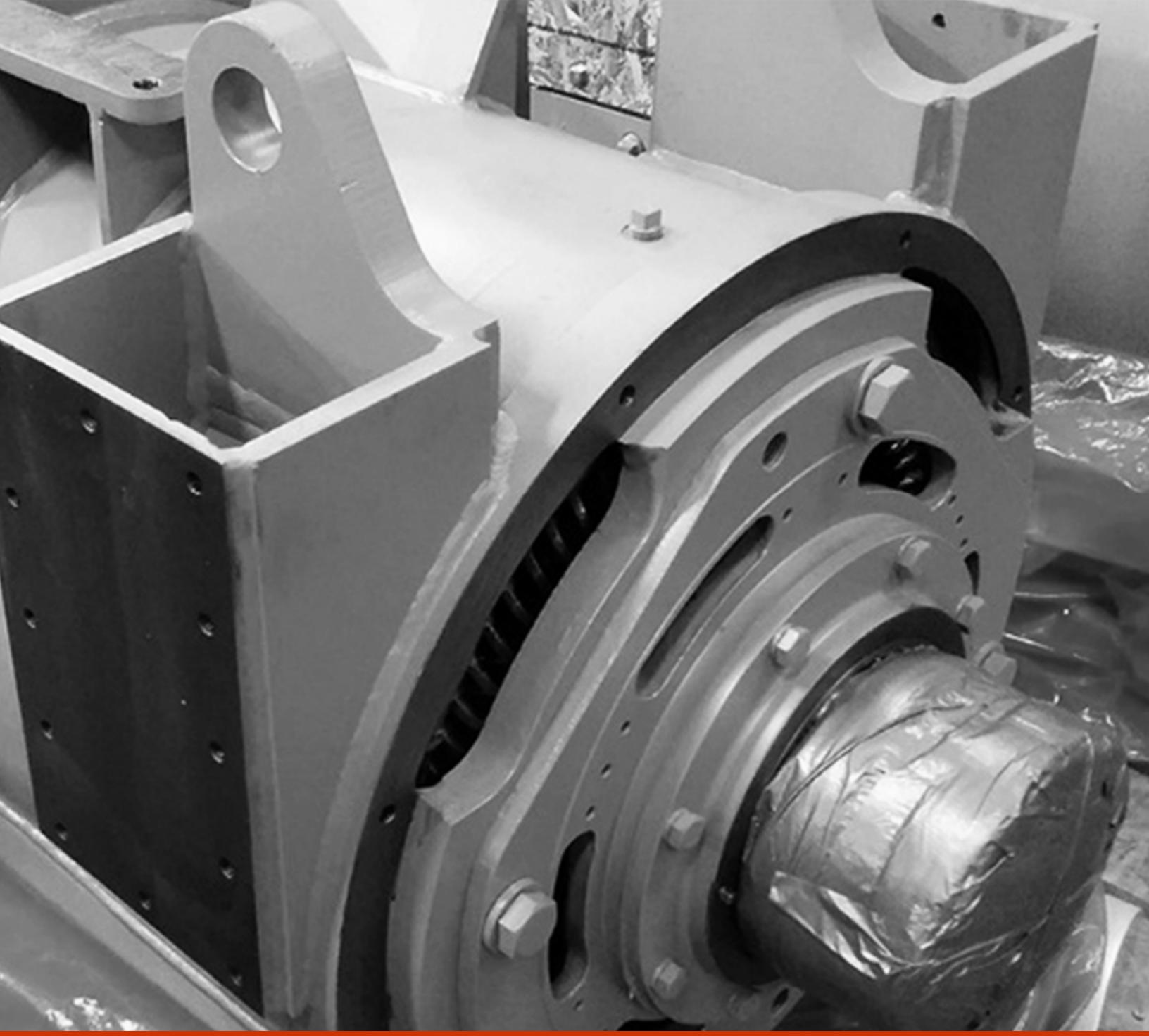

USEFUL CONVERSIONS & FORMULAS **GUIDE**

TECHNICAL INFORMATION EDUCATION SERIES

GULF ELECTROQUIP
ELECTRIC MOTORS AND GENERATORS

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COMMON FRACTIONS OF AN INCH

DECIMAL AND METRIC EQUIVALENTS

FRACTION	DECIMAL	mm	FRACTION	DECIMAL	mm
1/64	0.01562	0.397	33/64	0.51562	13.097
1/32	0.03125	0.794	17/32	0.53125	13.494
3/64	0.04688	1.191	35/64	0.54688	13.891
1/16	0.06250	1.588	9/16	0.56250	14.288
5/64	0.07812	1.984	37/64	0.57812	14.684
3/32	0.09375	2.381	19/32	0.59375	15.081
7/64	0.10938	2.778	39/64	0.60938	15.478
1/8	0.12500	3.175	5/8	0.62500	15.875
9/64	0.14062	3.572	41/64	0.64062	16.272
5/32	0.15625	3.969	21/32	0.65625	16.669
11/64	0.17188	4.366	43/64	0.67188	17.066
3/16	0.18750	4.763	11/16	0.68750	17.463
13/64	0.20312	5.159	45/64	0.70312	17.859
7/32	0.21875	5.556	23/32	0.71875	18.256
15/64	0.23438	5.953	47/64	0.73438	18.653
1/4	0.25000	6.350	3/4	0.75000	19.05
17/64	0.26562	6.747	49/64	0.76562	19.447
9/32	0.28125	7.144	25/32	0.78125	19.844
19/64	0.29688	7.541	51/64	0.79688	20.241
5/16	0.31250	7.938	13/16	0.81250	20.638
21/64	0.32812	8.334	53/64	0.82812	21.034
11/32	0.34375	8.731	27/32	0.84375	21.431
23/64	0.35938	9.128	55/64	0.85938	21.828
3/8	0.37500	9.525	7/8	0.87500	22.225
25/64	0.39062	9.922	57/64	0.89062	22.622
13/32	0.40625	10.319	29/32	0.90625	23.019
27/64	0.42188	10.716	59/64	0.92188	23.416
7/16	0.43750	11.113	15/16	0.93750	23.813
29/64	0.45312	11.509	61/64	0.95312	24.209
15/32	0.46875	11.906	31/32	0.96875	24.606
31/64	0.48438	12.303	63/64	0.98438	25.003
1/2	0.50000	12.700	1/1	1.00000	25.400

USEFUL FORMULAS

FORMULAS FOR ELECTRIC MOTORS

TO FIND	DIRECT CURRENT	SINGLE PHASE	THREE PHASE
Horsepower	$\frac{E \times I \times EFF}{746}$	$\frac{E \times I \times EFF \times PF}{746}$	$\frac{1.732 \times E \times I \times EFF \times PF}{746}$
Current	$\frac{746 \times hp}{E \times EFF}$	$\frac{746 \times hp}{E \times EFF \times PF}$	$\frac{746 \times hp}{1.732 \times E \times EFF \times PF}$
Efficiency	$\frac{746 \times hp}{E \times I}$	$\frac{746 \times hp}{E \times I \times PF}$	$\frac{746 \times hp}{1.732 \times E \times I \times PF}$
Power Factor	——	$\frac{\text{Input watts}}{E \times I}$	$\frac{\text{Input watts}}{1.732 \times E \times I}$

E = Volts
EFF = Efficiency (decimal)
hp = Horsepower
I = Amperes
PF = Power factor (decimal)

FORMULAS FOR ELECTRICAL CIRCUITS

TO FIND	DIRECT CURRENT	SINGLE PHASE	THREE PHASE
Amperes	$\frac{\text{Watts}}{\text{Volts}}$	$\frac{\text{Watts}}{\text{Volts} \times \text{Power factor}}$	$\frac{\text{Watts}}{1.732 \times \text{Volts} \times \text{Power factor}}$
Volt-Amperes	——	Volts x Amperes	1.732 x Volts x Amperes
Watts	Volts x Amperes	Volts x Amperes x Power factor	1.732 x Volts x Amperes x Power factor

OHMS LAW	CAPACITANCE IN MICROFARADS AT 60 HZ
Ohms = Volts/Amperes (R = E/I) Amperes = Volts/Ohms (I = E/R) Volts = Amperes x Ohms (E = IR)	Capacitance = $\frac{2650 \times \text{Amperes}}{\text{Volts}}$ Capacitance = $\frac{2.65 \times \text{kVAR}}{(\text{Volts})^2}$

USEFUL FORMULAS

TEMPERATURE CORRECTION OF WINDING RESISTANCE

$$R_C = R_H \times \frac{(K + T_C)}{(K + T_H)}$$

$$R_H = R_C \times \frac{(K + T_H)}{(K + T_C)}$$

VALUE OF K	
Material	**K**
Aluminum	225
Copper	234.5

R_C = Resistance at temperature T_C (Ohms)

R_H = Resistance at temperature T_H (Ohms)

T_C = Temperature of cold winding (° C)

T_H = Temperature of hot winding (° C)

MOTOR APPLICATION FORMULAS

OUTPUT

$$\text{Horsepower} = \frac{\text{Torque (lb·ft)} \times \text{rpm}}{5252} \qquad \text{Kilowatts} = \frac{\text{Torque (N·m)} \times \text{rpm}}{9550}$$

$$\text{Torque (lb·ft)} = \frac{\text{Horsepower} \times 5252}{\text{rpm}} \qquad \text{Torque (N·m)} = \frac{\text{Kilowatts} \times 9550}{\text{rpm}}$$

For approximation, use:

Full-load torque = 1.5 ft•lb per hp per pole pair at 60 Hz

Full-load torque = 3.2 N•m per kilowatt per pole pair at 50 hZ

TIME FOR MOTOR TO REACH OPERATING SPEED

$$\text{Seconds} = \frac{Wk^2(\text{lb} \cdot \text{ft}^2) \times \text{Speed change (rpm)}}{308 \times \text{Avg. accelerating torque (lb} \cdot \text{ft)}}$$

$1\ \text{lb} \cdot \text{ft}^2 = .04214\ \text{kg} \cdot \text{m}^2$

$$\text{Seconds} = \frac{J(\text{kg} \cdot \text{m}^2) \times \text{Speed change (rpm)}}{9.55 \times \text{Avg. accelerating torque (N} \cdot \text{m)}}$$

$1\ \text{kg} \cdot \text{m}^2 = 23.73\ \text{lb} \cdot \text{ft}^2$

$$\left.\begin{matrix} Wk^2 \\ J \end{matrix}\right\} = \text{Inertia of rotor} + \frac{\text{Inertia of load} \times \text{Load rpm}^2}{\text{Motor rpm}^2}$$

$$\text{Average accelerating torque} = \frac{[(FLT + BDT)/2] + BDT + LRT}{3}$$

Where: BDT = Breakdown torque
FLT = Full-load torque
LRT = Locked-rotor torque

CONVERSION FACTORS

	MULTIPLY		BY		TO OBTAIN
Length	Centimeters	x	.3937	=	Inches
	Feet	x	12.0	=	Inches
	Feet	x	.3048	=	Meters
	Inches	x	2.54	=	Centimeters
	Inches	x	25.4	=	Millimeters
	Kilometers	x	.6214	=	Miles
	Meters	x	3.281	=	Feet
	Meters	x	39.37	=	Inches
	Meters	x	1.094	=	Yards
	Miles	x	5280.0	=	Feet
	Miles	x	1.609	=	Kilometers
	Millimeters	x	.03937	=	Inches
	Yards	x	.9144	=	Meters
Area	Circular mils	x	7.854×10^{-7}	=	Square inches
	Circular mils	x	.7854	=	Square mils
	Square centimeters	x	.155	=	Square inches
	Square feet	x	144.0	=	Square inches
	Square feet	x	.0929	=	Square meters
	Square inches	x	6.452	=	Square centimeters
	Square meters	x	10.764	=	Square feet
	Square meters	x	1.196	=	Square yards
	Square millimeters	x	.00155	=	Square inches
	Square mils	x	1.273	=	Circular mils
	Square yards	x	.8361	=	Square meters
Volume	Cubic centimeters	x	.061	=	Cubic inches
	Cubic feet	x	.0283	=	Cubic meters
	Cubic feet	x	7.481	=	Gallons
	Cubic inches	x	.5541	=	Ounces (fluid)
	Cubic meters	x	35.31	=	Cubic feet
	Cubic meters	x	1.308	=	Cubic yards
	Cubic meters	x	264.2	=	Gallons
	Cubic yards	x	.7646	=	Cubic meters
	Gallons	x	.1337	=	Cubic feet
	Gallons	x	3.785	=	Liters
	Liters	x	.2642	=	Gallons
	Liters	x	1.057	=	Quarts (liquid)
	Ounces (fluid)	x	1.805	=	Cubic inches
	Quarts (liquid)	x	.9463	=	Liters

EASA
The Electro•Mechanical Authority

Source The Electrical Engineering Pocket Handbook
Electrical Apparatus Service Association

ISO CERTIFICATION 9001:2015

OVER 60 YEARS

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