PumpTech Customer Education

http://www.Pumptechnw.com

Bellevue Moses Lake Canby

PumpTech Product Lines

PumpTech inc.

Two full time Mechanical Engineers
Licensed in OR, WA & ID

SolidWorks & E-Drawings Viewer

AutoCad Compatible Drawings

All Systems UL QCZJ Listed

Designed to HI Standards

HYDRONIX

iRover
Mobile HMI

METERMAN
Pump Systems
"For The Best In Flow Technology"

PumpTech inc.

Manufacturing Facility Canby, OR

HYDRONIX

iRover Mobile HMI

METERMAN Pump Systems "For The Best In Flow Technology"

PumpTech inc.

Installation, Maintenance & Repair

- 9 Full Time Service Technicians
- 3 Full Service Shops
- 6 Service Trucks
- 23 Ton Crane Truck
- 8 Ton Crane Truck
- 3 Ton Crane Truck
- 2 Ton Flatbed & Trailer
- 1 Ton Flatbed & Trailer

HYDRONIX

iRover
Mobile HMI

METERMAN
Pump Systems
"For The Best In Flow Technology"

PumpTech Pipeline

Summer 2010 — www.PumpTechnw.com — Volume I, Issue 2

PumpTech Inc. — Serving the Pacific Northwest

PumpTech Pipeline

Providing Knowledgeable Solutions

Cornell Names PumpTech Its Top Industrial Distributor

Cornell Pump Company (Clackamas, Oregon) has named PumpTech its number one industrial pump distributor in the US. Cornell manufacturers a wide line of clear water, solids handling, hot oil and food processing pumps for numerous industrial applications.

Mike Shoemaker, PumpTech's Industrial Products Manager, accepted the award at the annual distributor's meeting in Chicago. Our industrial sales team covers Idaho, Oregon and Washington and focuses on the food processing, petrochemical, oil & gas, lumber, pulp & paper, power generation, and aluminum industries.

In addition to Cornell, PumpTech represents a number of other manufacturers of specialty industrial products. Congratulations to our industrial sales team !

PumpTech Named NW Master Distributor for Grundfos

Grundfos Pumps (Olathe, Kansas) has selected PumpTech as the Pacific Northwest master distributor for its Grundfos Dosing line of chemical metering pumps.

The product line includes a wide range of diaphragm metering pumps with flows to 1050 GPH and pressures up to 3000 PSI. Grundfos Dosing pumps offer a variety of metering technologies including digital dosing. Digital dosing pumps utilize stepper-motors that allow a 1000:1 turn down. In addition to dosing pumps, Grundfos offers a complete line of measurement & disinfection equipment including one of the best chlorine generators on the market.

Per this agreement PumpTech will stock $100,000 of Grundfos Dosing pumps to support sales in the Pacific Northwest. This inventory will be centrally located in our Canby, OR branch and will allow quick delivery to OEM's. Additionally, this inventory will support our MeterMan division which manufacturers chemical metering systems in our Canby facility and also functions as the Grundfos Key Systems provider for the entire western United States.

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Canby, OR
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Canby, OR 97013
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Moses Lake, WA
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Moses Lake WA 98837
509-766-6330

Inside this issue:

Fall 2010 — www.PumpTechnw.com — Volume I, Issue 3

PumpTech Inc. — Serving the Pacific Northwest

PumpTech Pipeline

Providing Knowledgeable Solutions

PumpTech's Feature Rich Multi-Pump Controller

PumpTech's intelligent, multi-pump controller features an integrated PLC and Color Touch-Screen Human Machine Interface (HMI) that makes setup simple and extremely flexible. Up to four pumps can be set up for VFD control, across the line starting or a combination of the two.

The controller is preprogrammed for pump down, level control and booster applications. At start up all you have to do is select the application and follow the setup instructions on the screen.

The PLC provides for 22 digital inputs and 12 digital outputs. Also two 4-20mA or 0-10VDC transducer inputs are provided.

When motors are started across the line or via RVSS, "smart" motor

Continued on Page 4

QCEC Introduces New Refrigerated Sampler

Quality Control Equipment Company (QCEC) has introduced a new sampler with a modular refrigeration system. The refrigerator unit slides out for easy service or replacement. All units are made right here in the US and come with a 2 year warranty.

It features the same, time proven sampling technology that has set QCEC apart from its competition for over 40 years. All samplers use vacuum pumps rather than peristaltic pumps for higher reliability and accuracy. Vacuum pumps never need hose replacement and increase the sampling range by providing lifts to 28 feet and horizontal runs up to 150 feet. This provides lots of flexibility when locating the sampling unit.

The QLS model is the only sampler in the world that provides repeatable, self calibration and consistent sample size. It also provides flow - paced samples from a 4 - 20 input.

For more information on the features and benefits of QCEC samplers, contact your local PumpTech branch.

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Inside this issue:

newsletter@PumpTechnw.com

Pump Ed 101

Joe Evans, Ph.D

http://www.PumpEd101.com

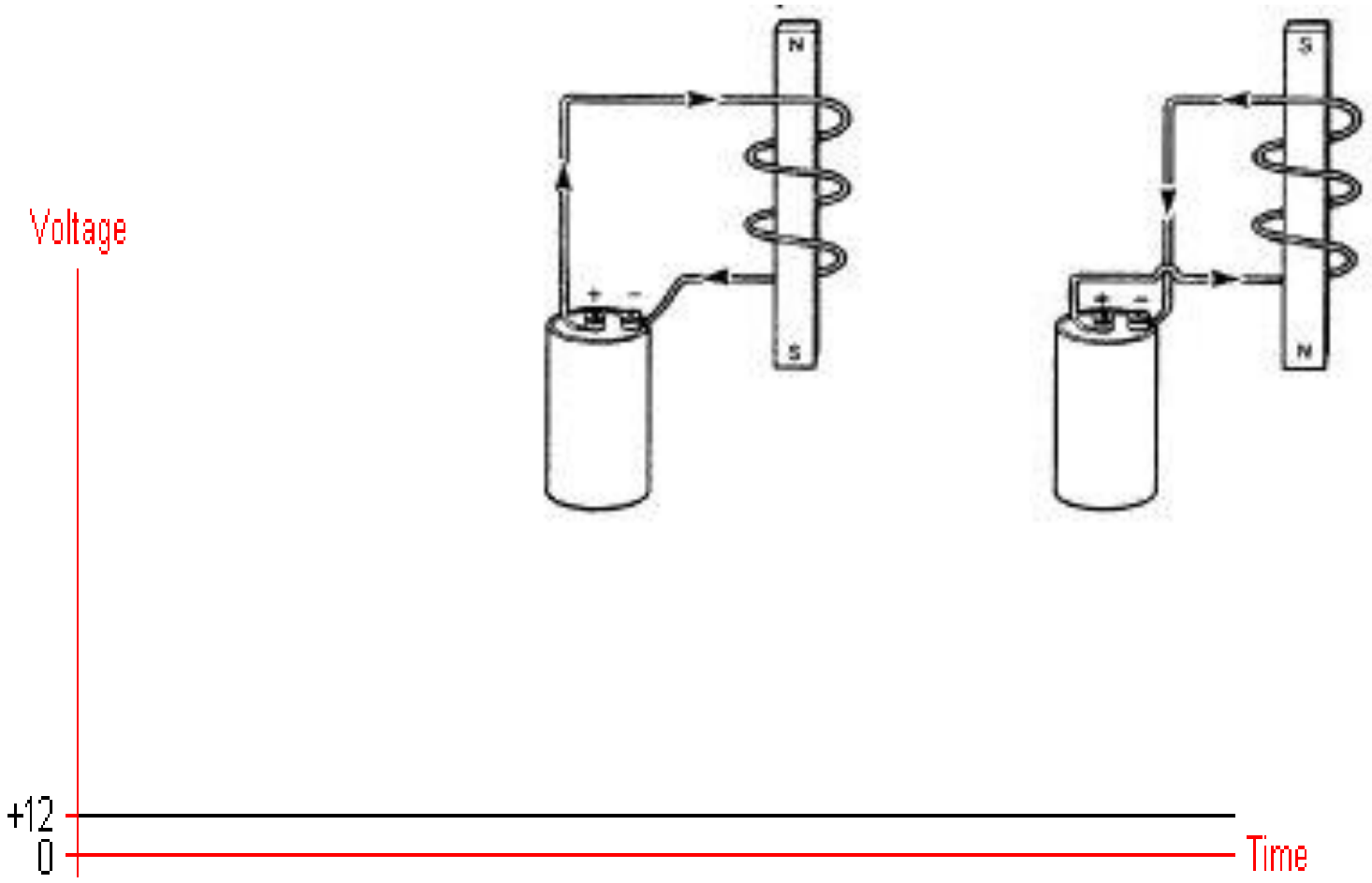
http://www.Pump-Zone.com

AC Motors

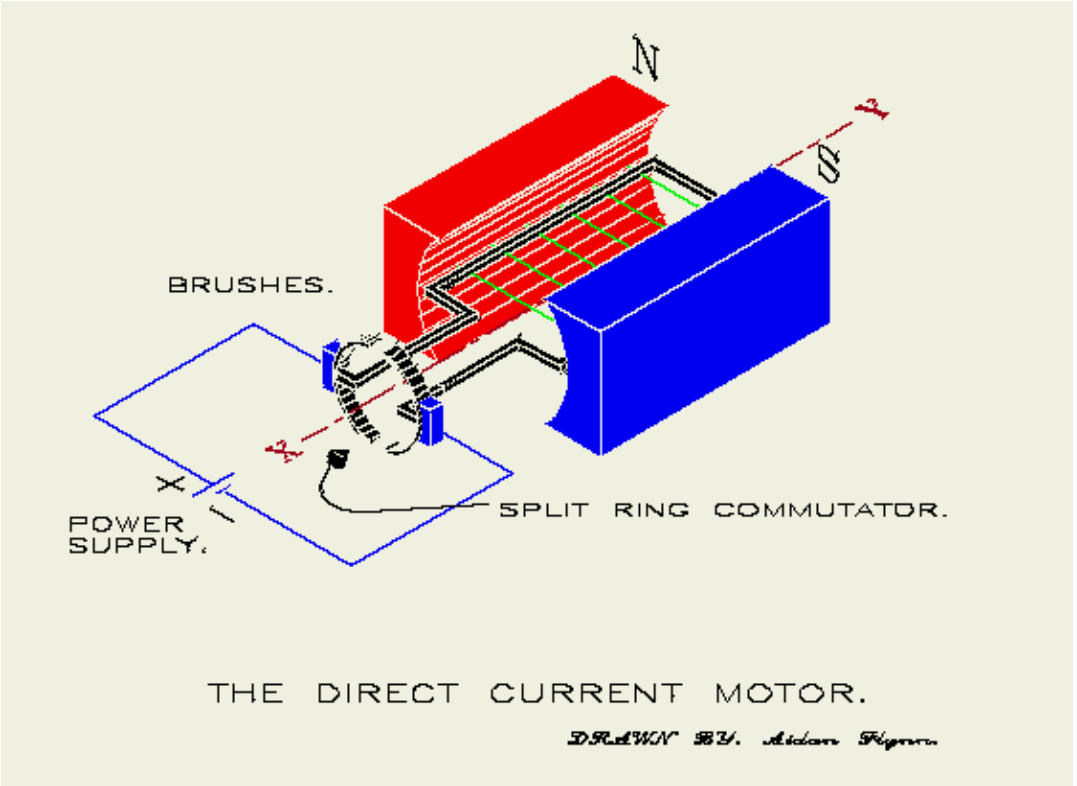
AC Motor Topics

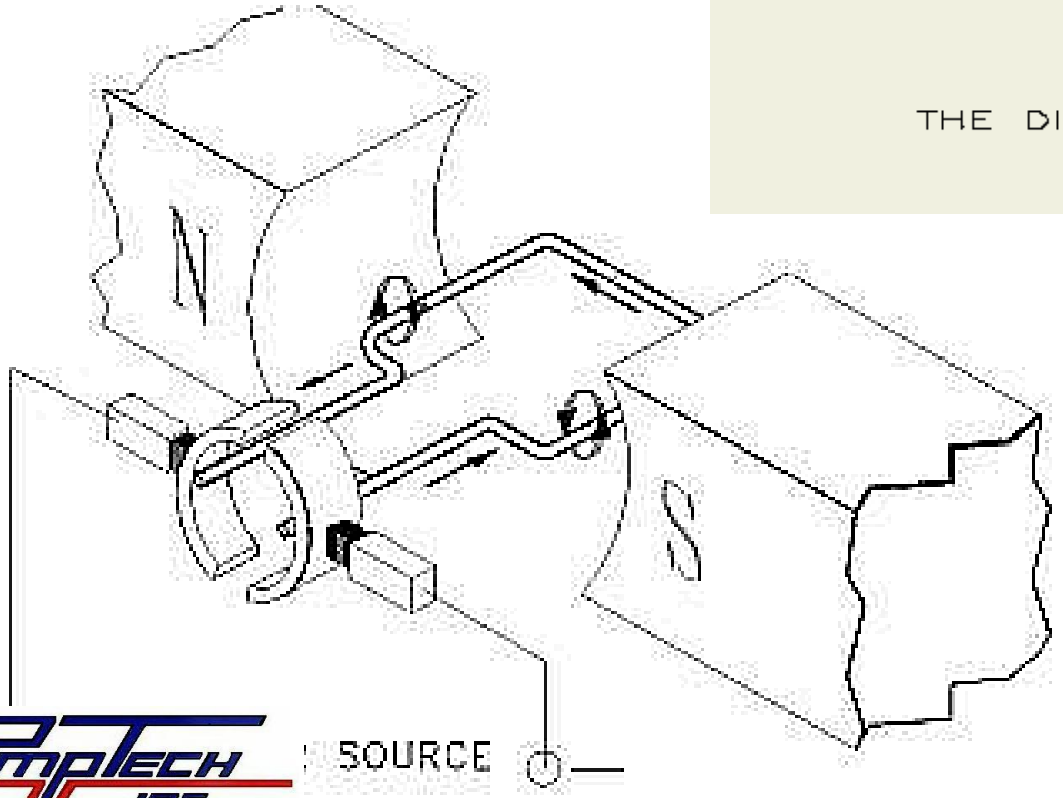
Simple DC Motor
Induction
AC Motor Components
Single Phase Curve
Single Phase Field
Three Phase Curve
Three Phase Field
Motor Speed
Single Phase Starting
Service Factor
Power & Torque
Load Types

DC Power

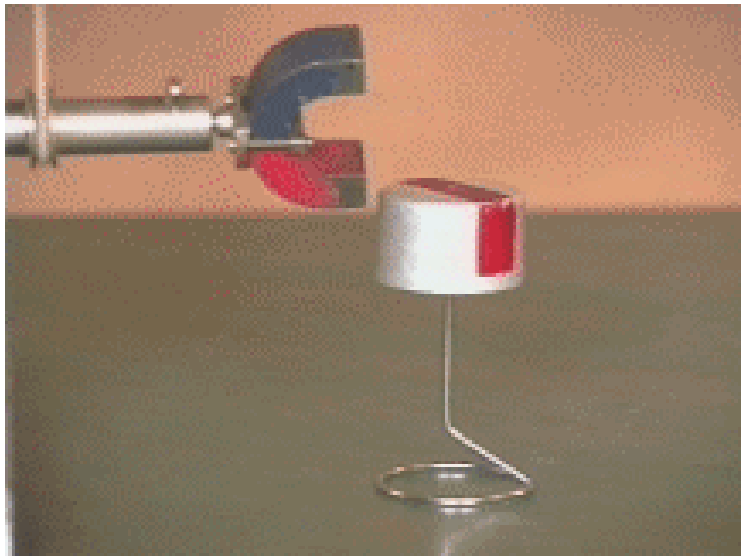


Simple DC Motor





PumpTech Inc.



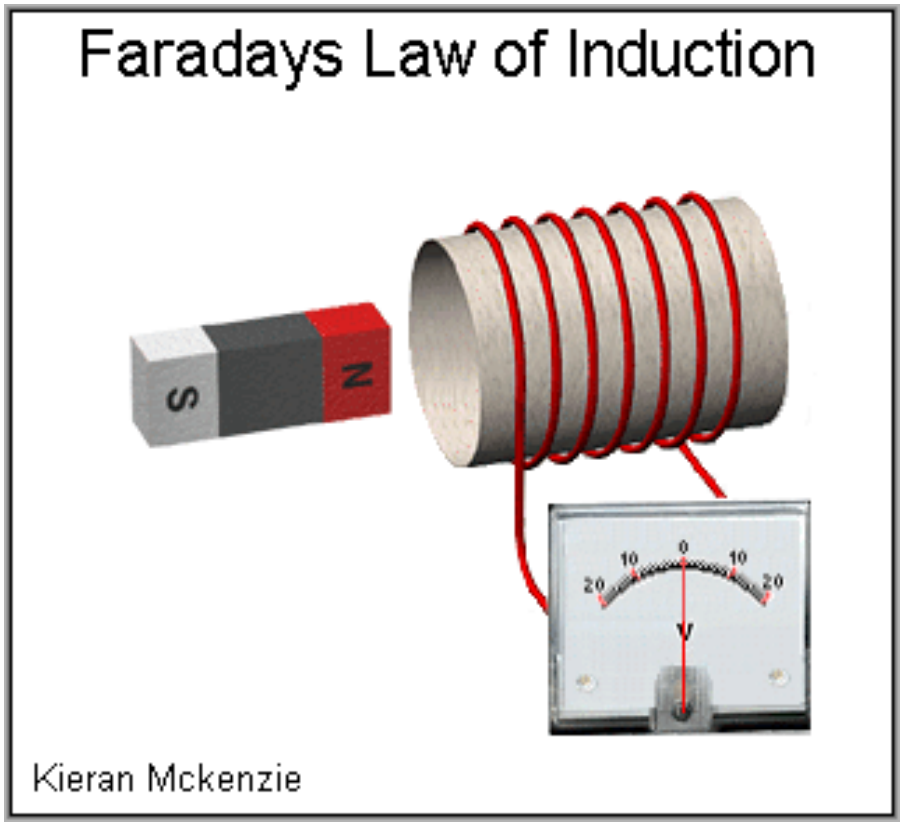
Induction

A decaying magnetic field can induce a charge in a nearby metallic object.

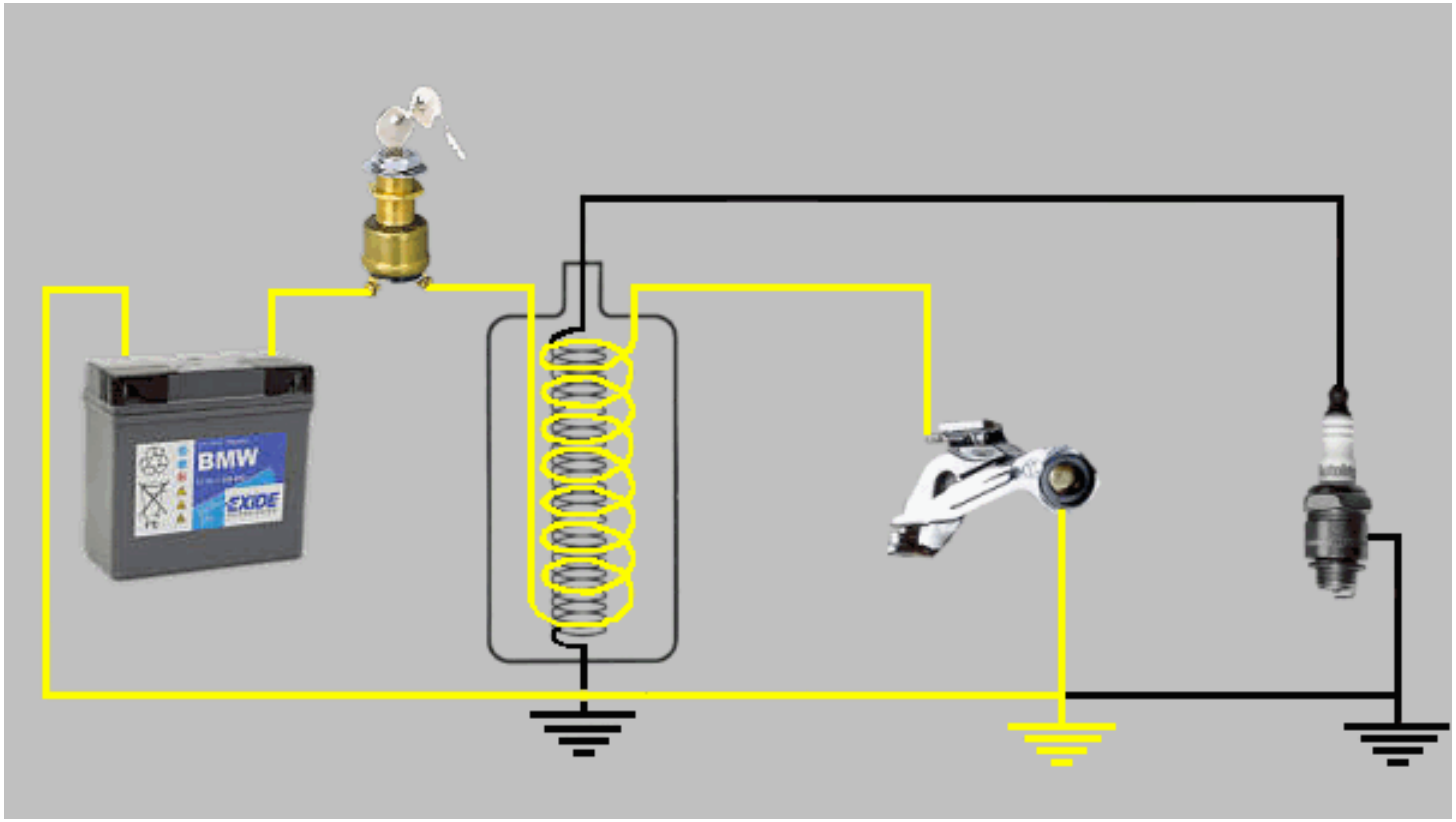
That charge can give rise to a separate magnetic field.

The new magnetic field will oppose the magnetic field that created it.

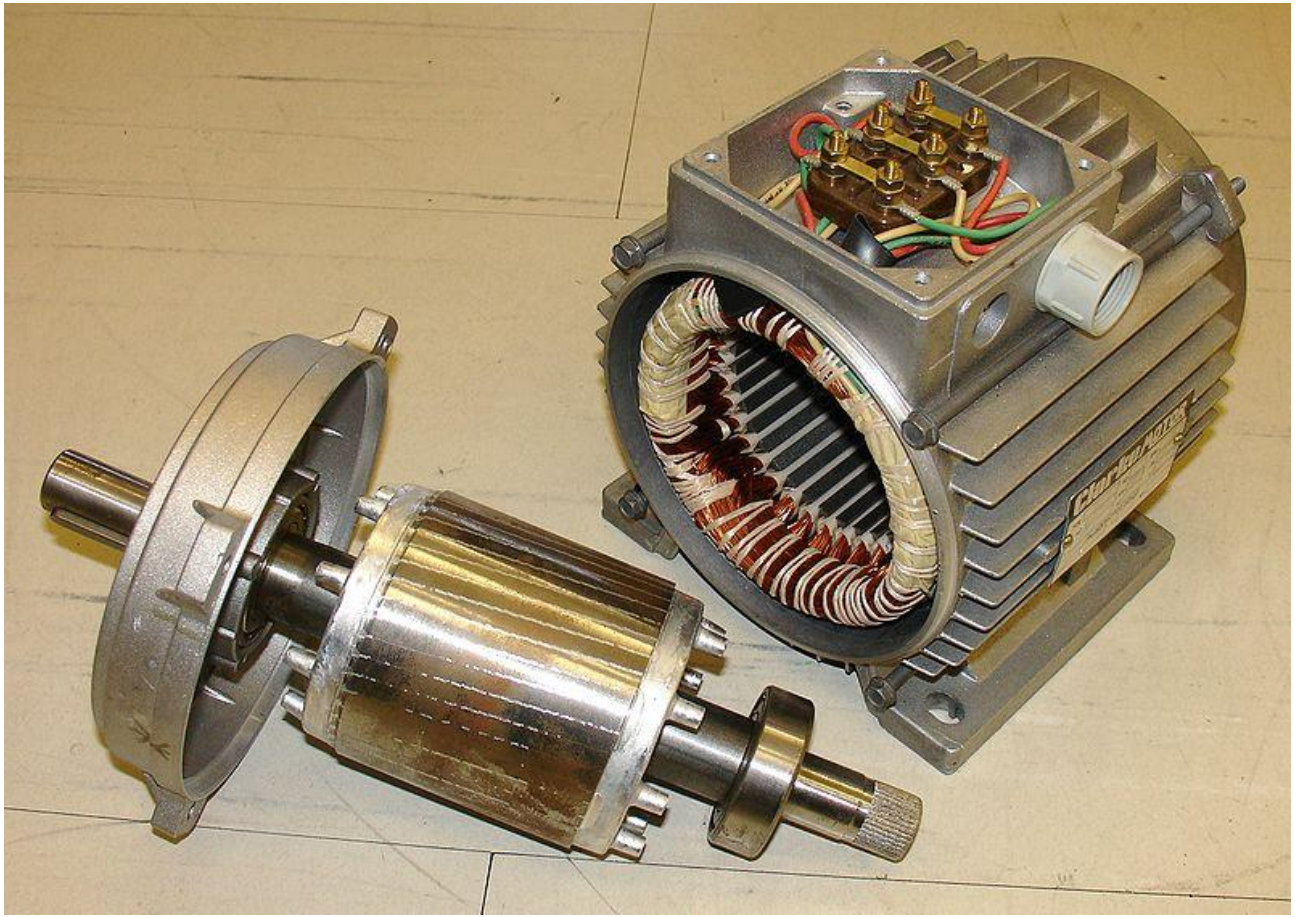
Magnetic Induction



Induction



Induction Motor Components



Rotor

Stator & Housing

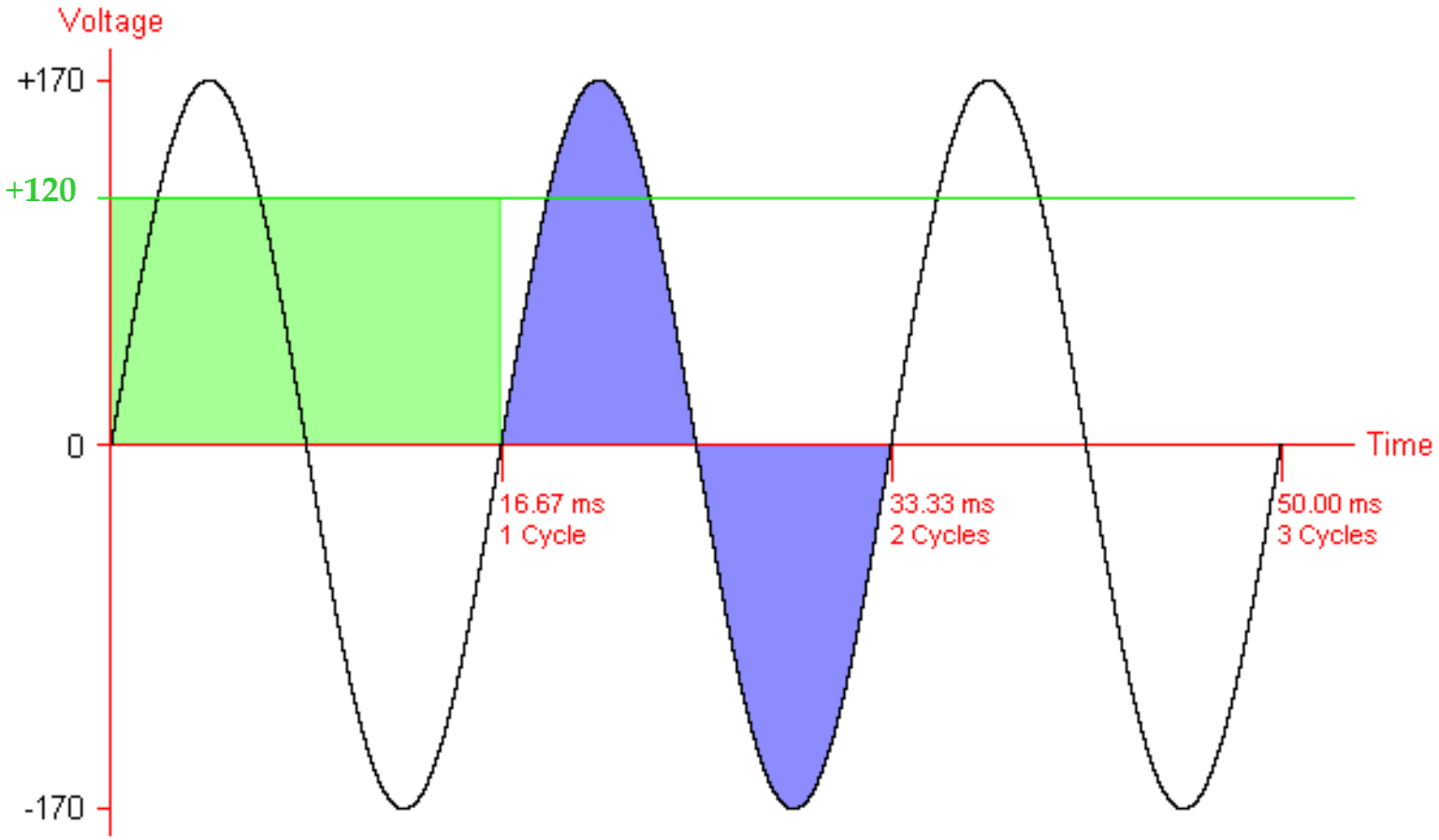
PumpTech Inc.

Induction Motor Types

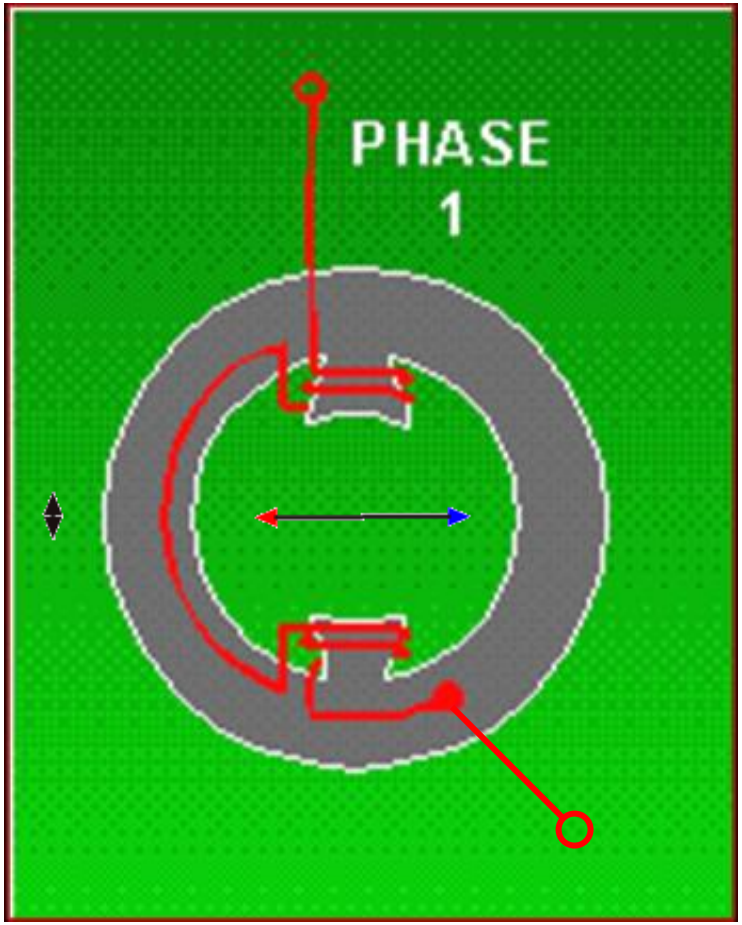
Single Phase

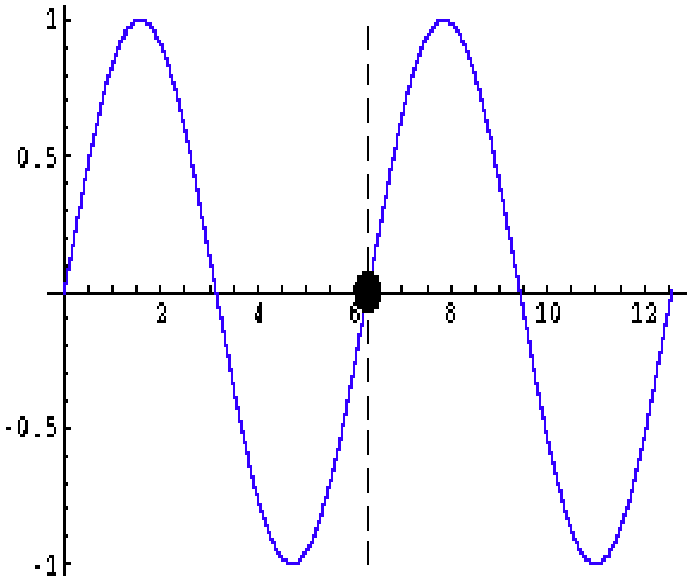
Three Phase

The Single Phase AC Curve

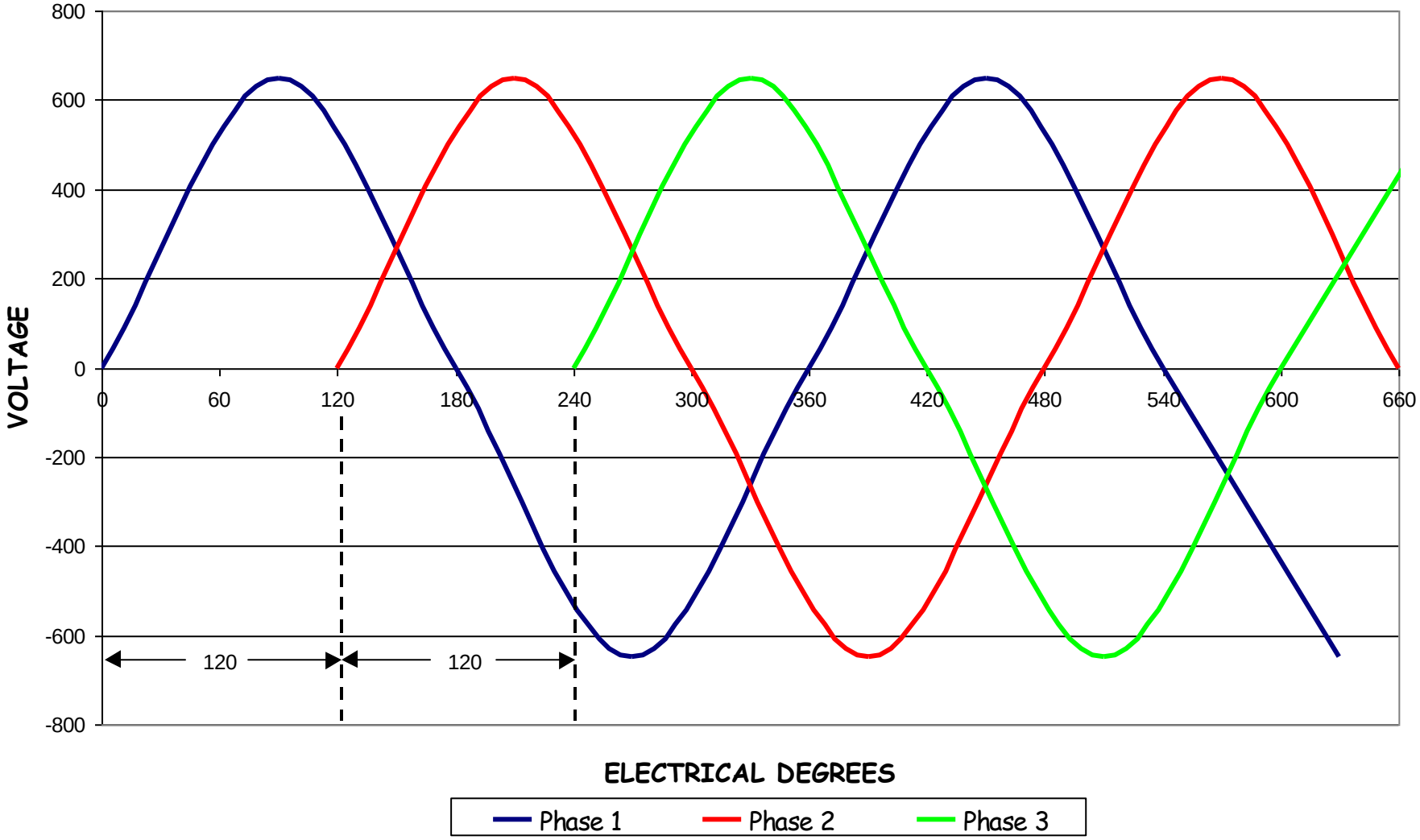


Single Phase Two Pole Motor

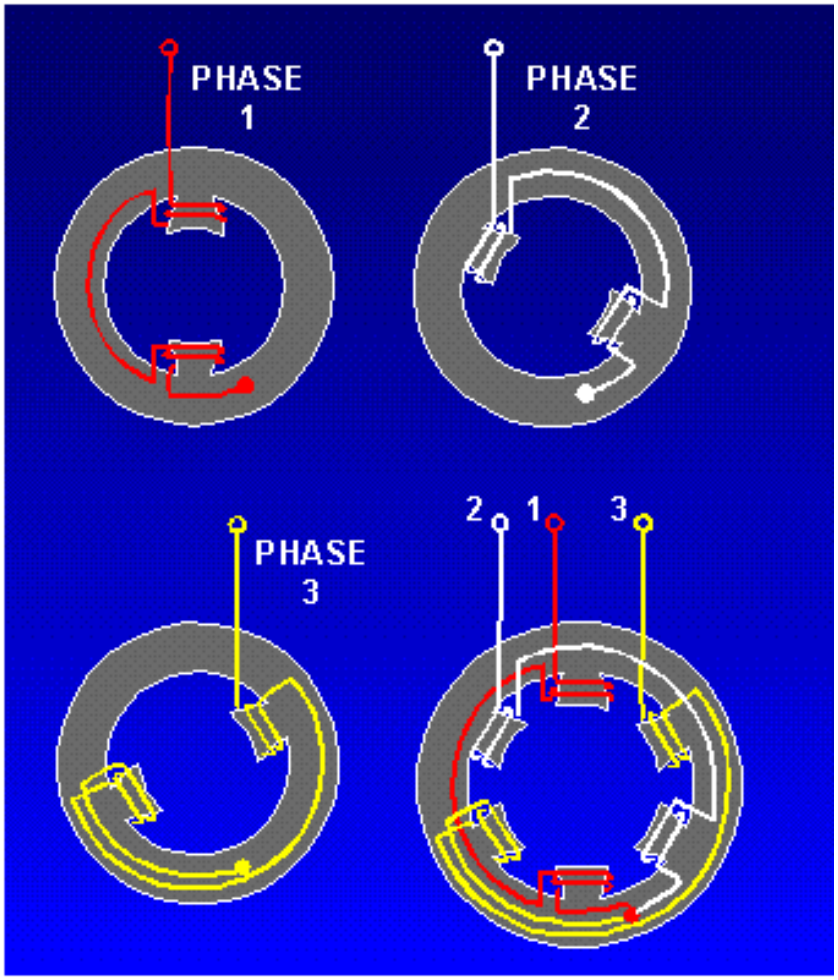




THREE PHASE CURVE

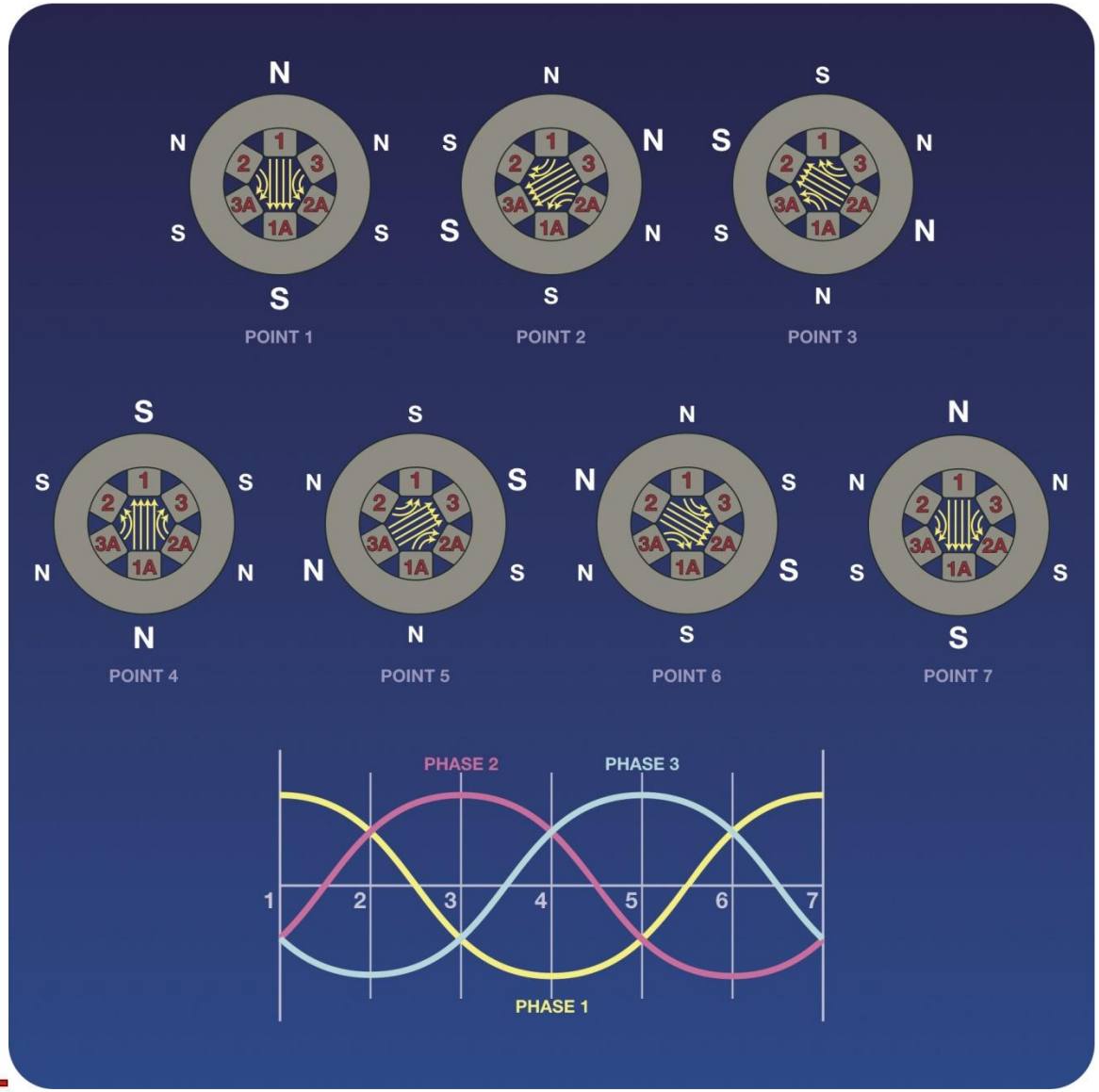


Three Phase, Two Pole Motor



Synchronous Speed
3600 RPM

Three Phase Rotating Field



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Pump ED 101

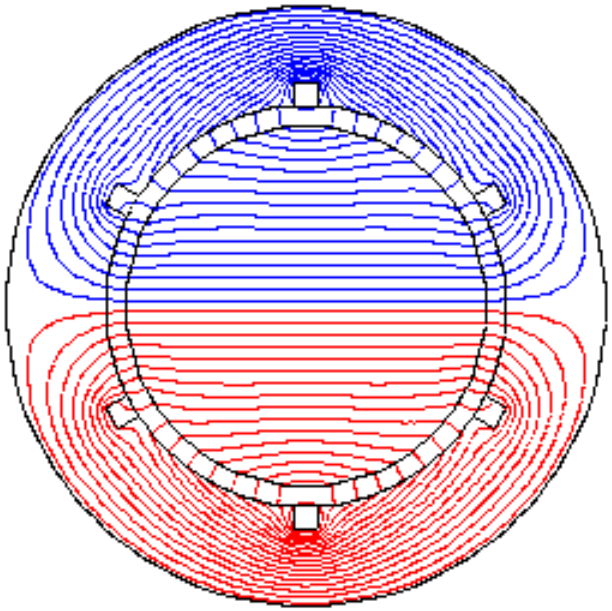
Motor Speed

Depends upon frequency & number of poles

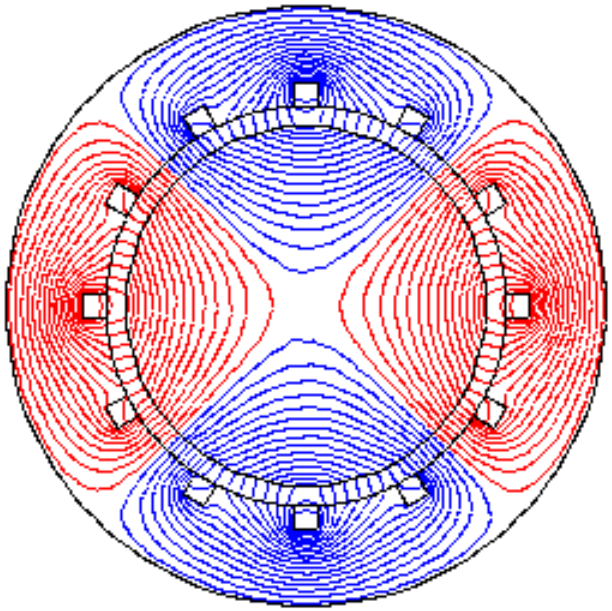
RPM = 120 x frequency / # of poles

Synchronous Speed VS Slip Speed

Three Phase Rotating Field



Two Pole



Four Pole

Motor Windings

Motor windings may be connected as Wye or Delta.

The primary reason for a particular connection is the manufacturing process.

Smaller motors are usually Wye connected.

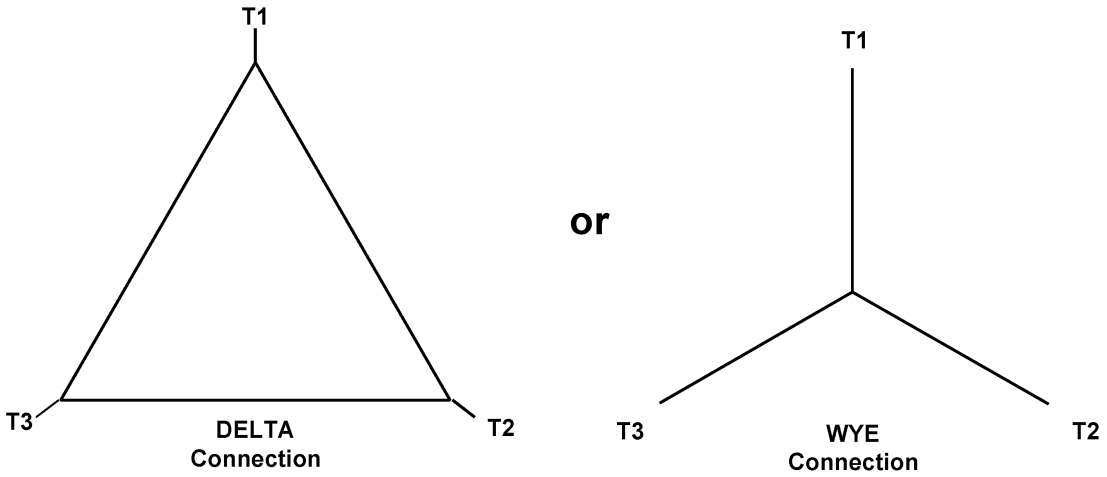
Larger motors are usually Delta connected (smaller leads on dual voltage).

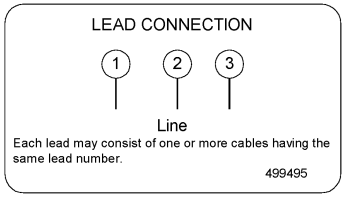
Nine lead motors are most common.

Low voltage connections are in parallel.

High voltage connections are in series.

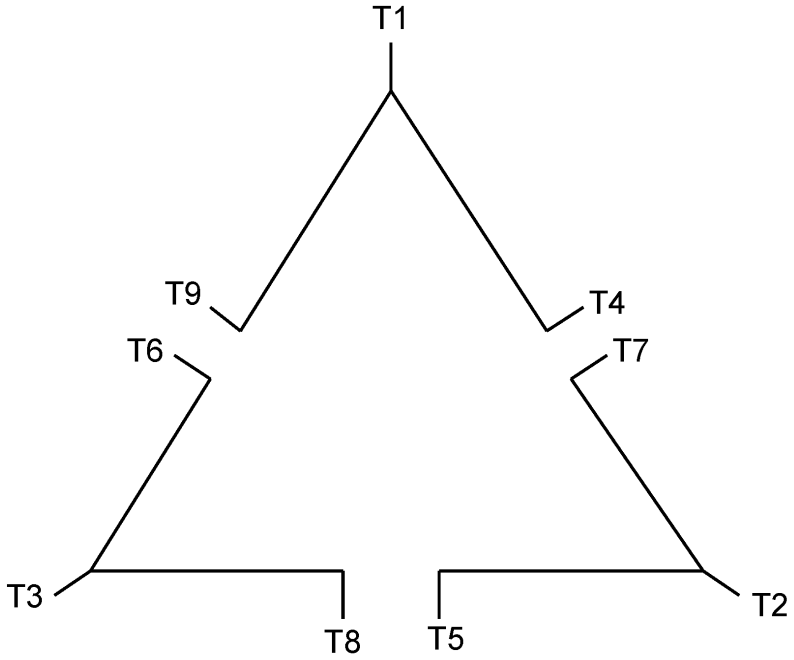
Single Voltage Windings

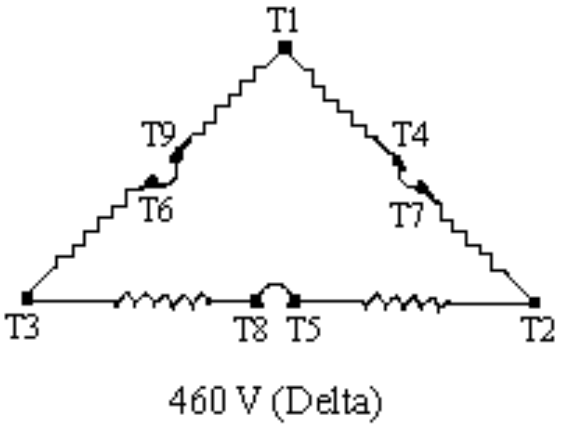


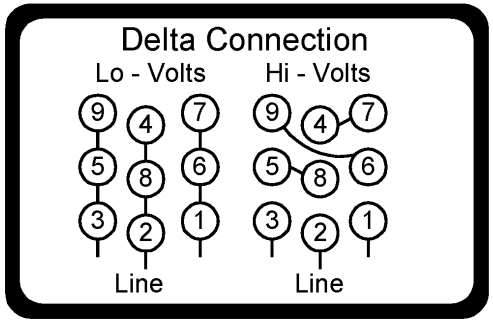


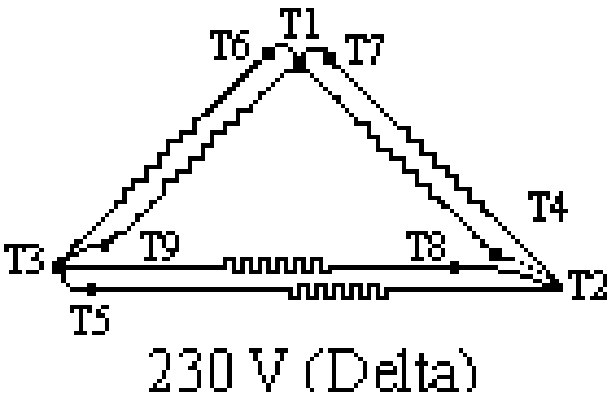
Dual Voltage Windings

US Voltage Ratio 2:1



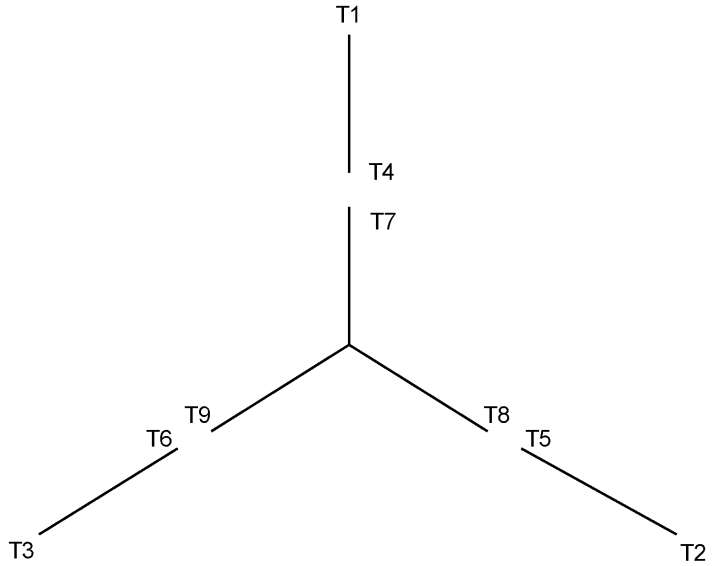


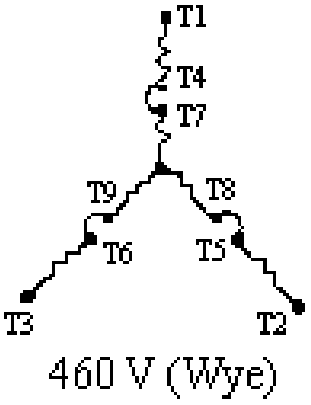


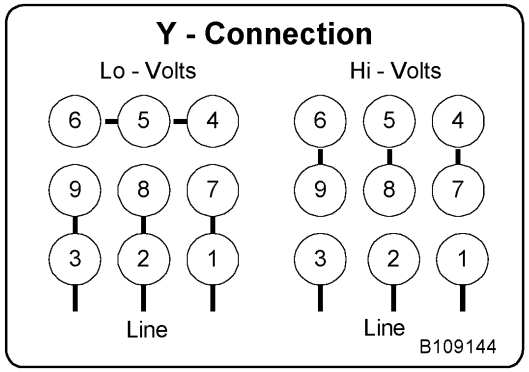


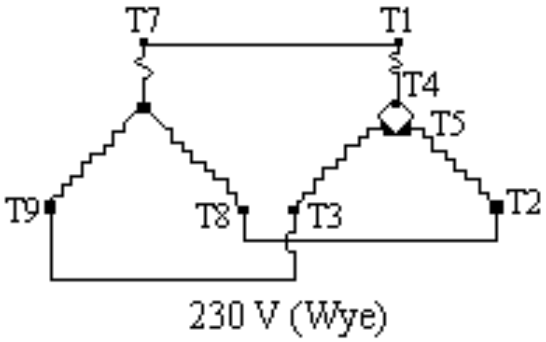
Dual Voltage Windings

US Voltage Ratio 2:1

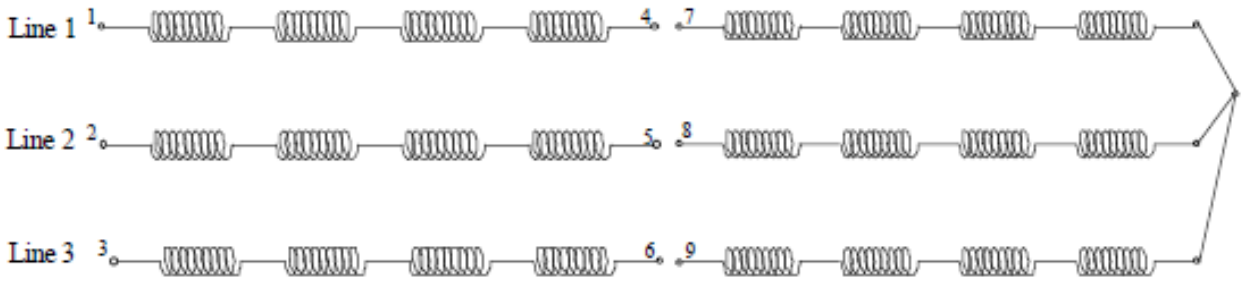




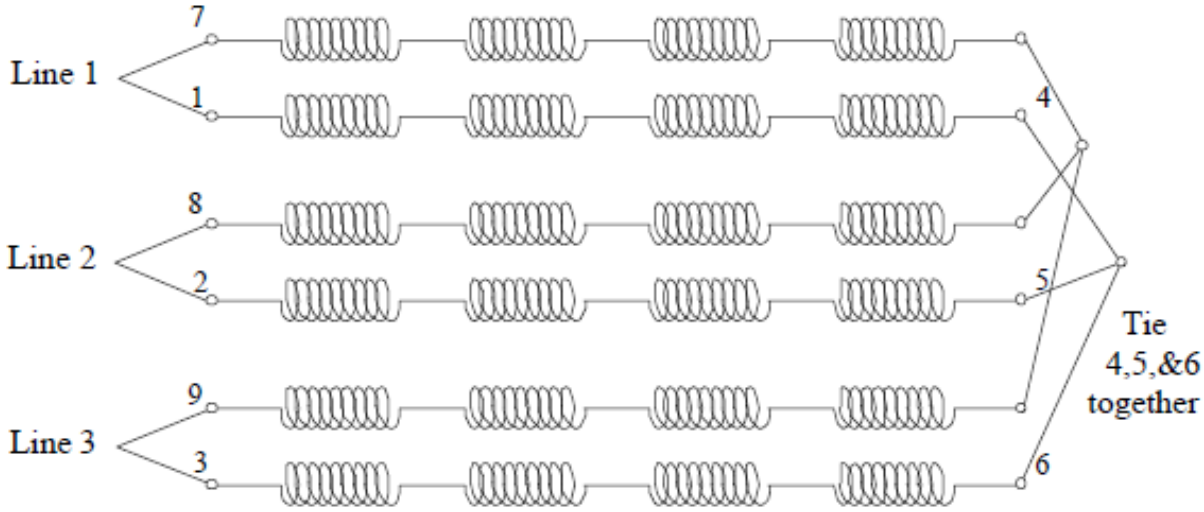




Winding Resistance



High Voltage



Low Voltage

PumpTech Inc.

Winding Resistance

Series (460V)

R = R1 + R2

R = 10 + 10

R = 20

I = V/R

I = 460/20

I = 23

Parallel (230V)

R = 1/(1/R1 + 1/R2)

R = 1/(1/10 + 1/10)

R= 1/(0.2)

R = 5

I = V/R

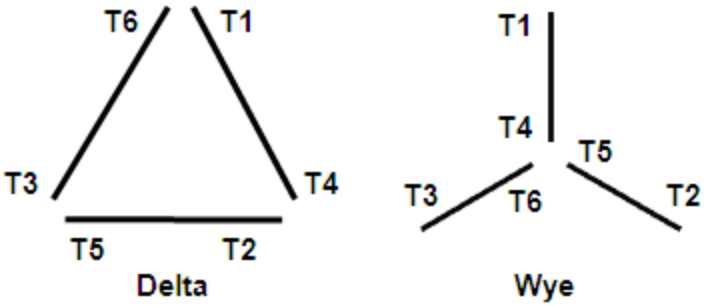
I = 230/5

I= 46

PumpTech Inc.

Wye/Delta Dual Voltage

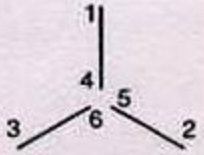
IEC Voltage Ratio √3:1



NEMA NOMENCLATURE—6 LEADS

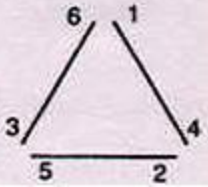
SINGLE VOLTAGE
EXTERNAL WYE CONNECTION

L1	L2	L3	JOIN
1	2	3	4&5&6



SINGLE VOLTAGE
EXTERNAL DELTA CONNECTION

L1	L2	L3
1,6	2,4	3,5



Six Lead Wye or Delta

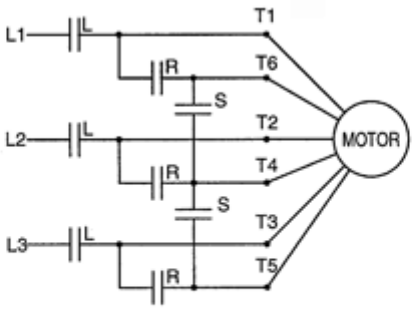
Wye Impedance = 3X Delta

IEC Voltage Ratio - √3:1

High Voltage on Wye – 380 V

Low Voltage on Delta – 220 V

Wye Start / Delta Run



Six Lead Wye Start / Delta Run

Single Voltage

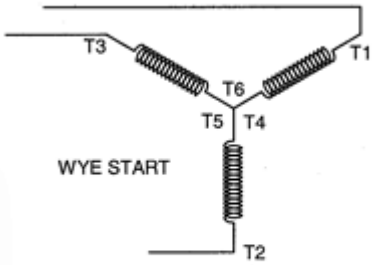
Full Voltage Start on Delta Only

Wye Impedance = 3X Delta

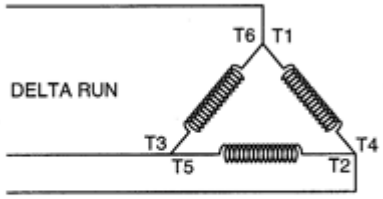
Line Current & Torque About 33%

Transition Speed Related to Inertia

Voltage ≈ 58%



Voltage = 100%

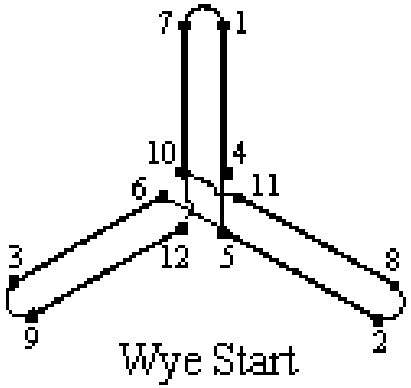


START: R OPEN, L & S CLOSED
RUN: R & L CLOSED, S OPEN

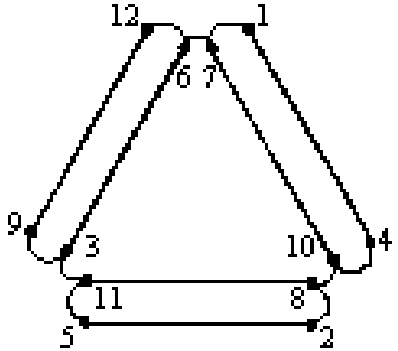
PumpTech Inc.

Wye Start / Delta Run

12 Lead, Dual Voltage

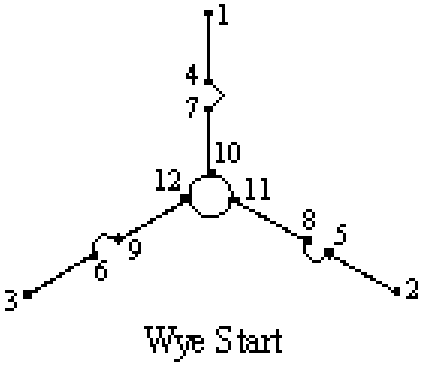


Wye Start

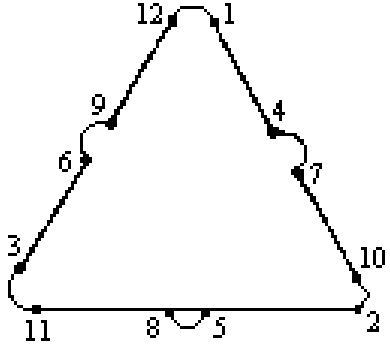


Delta Run

Low Voltage - Parallel



Wye Start



Delta Run

High Voltage - Series

Single Phase Starting Methods

Shaded Pole

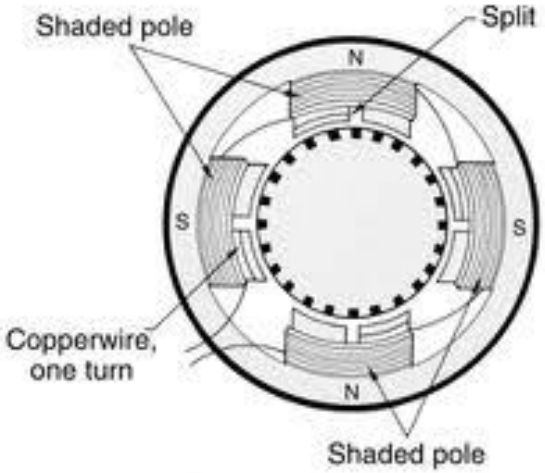
Split Phase

Capacitor Start

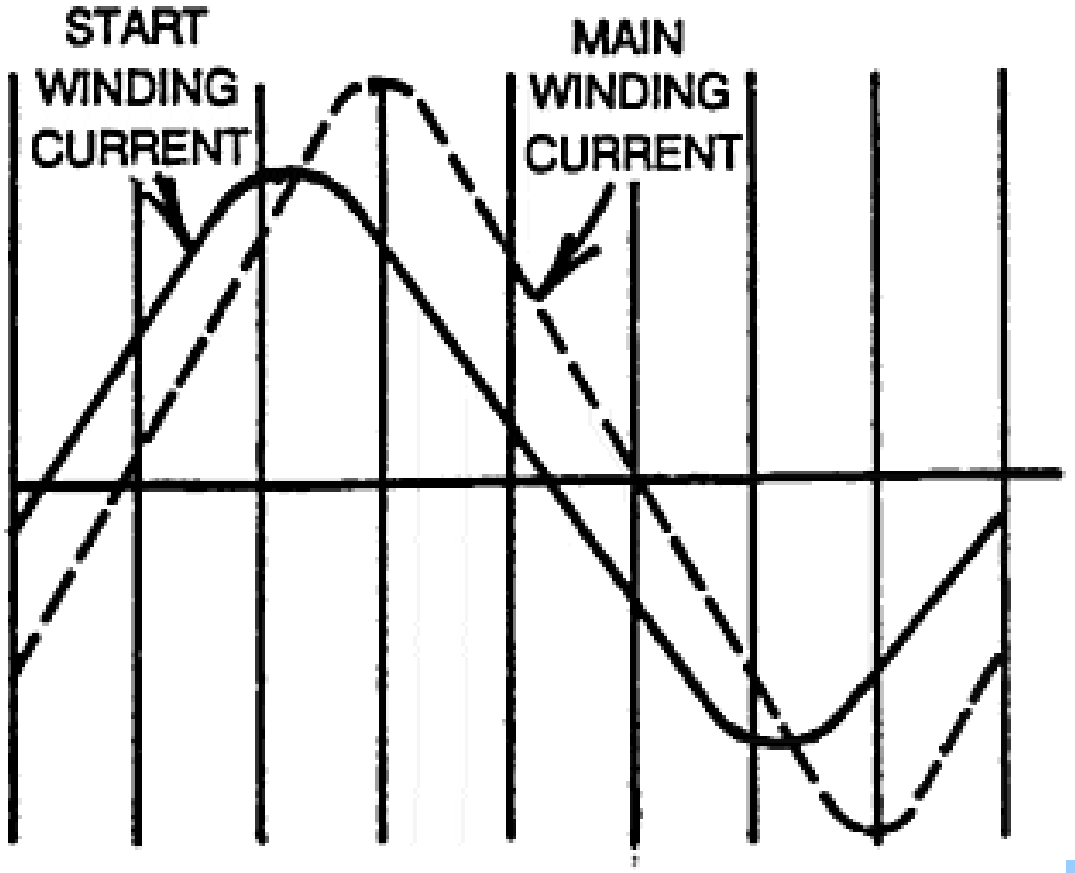
Permanent Split Capacitor

Capacitor Start / Run

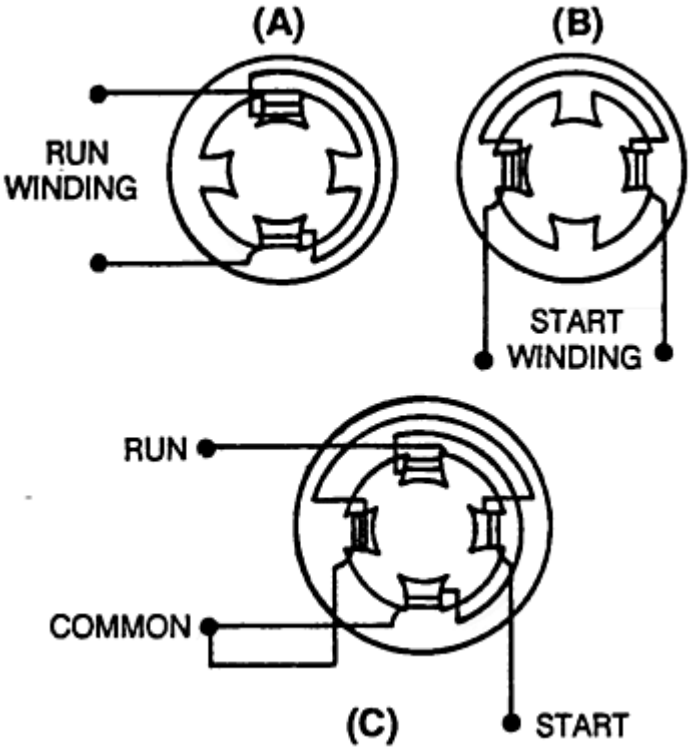
Shaded Pole

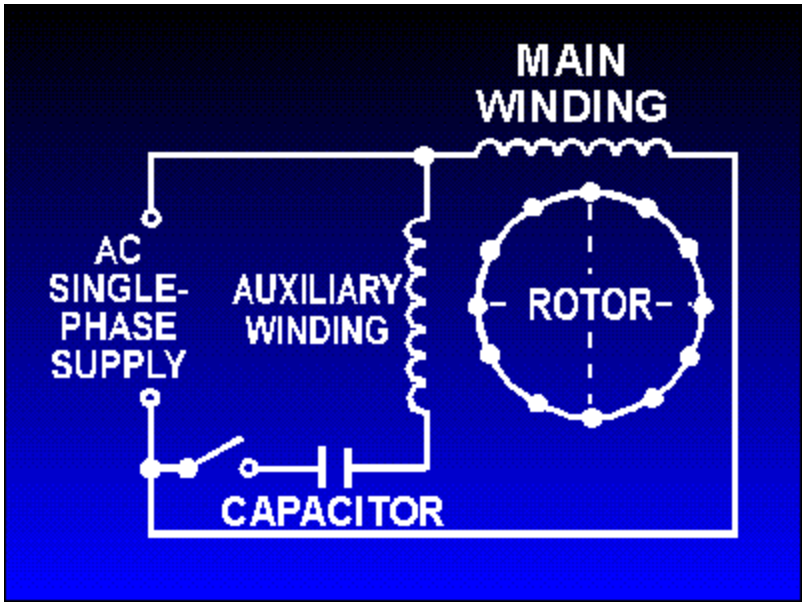


Split Phase Current

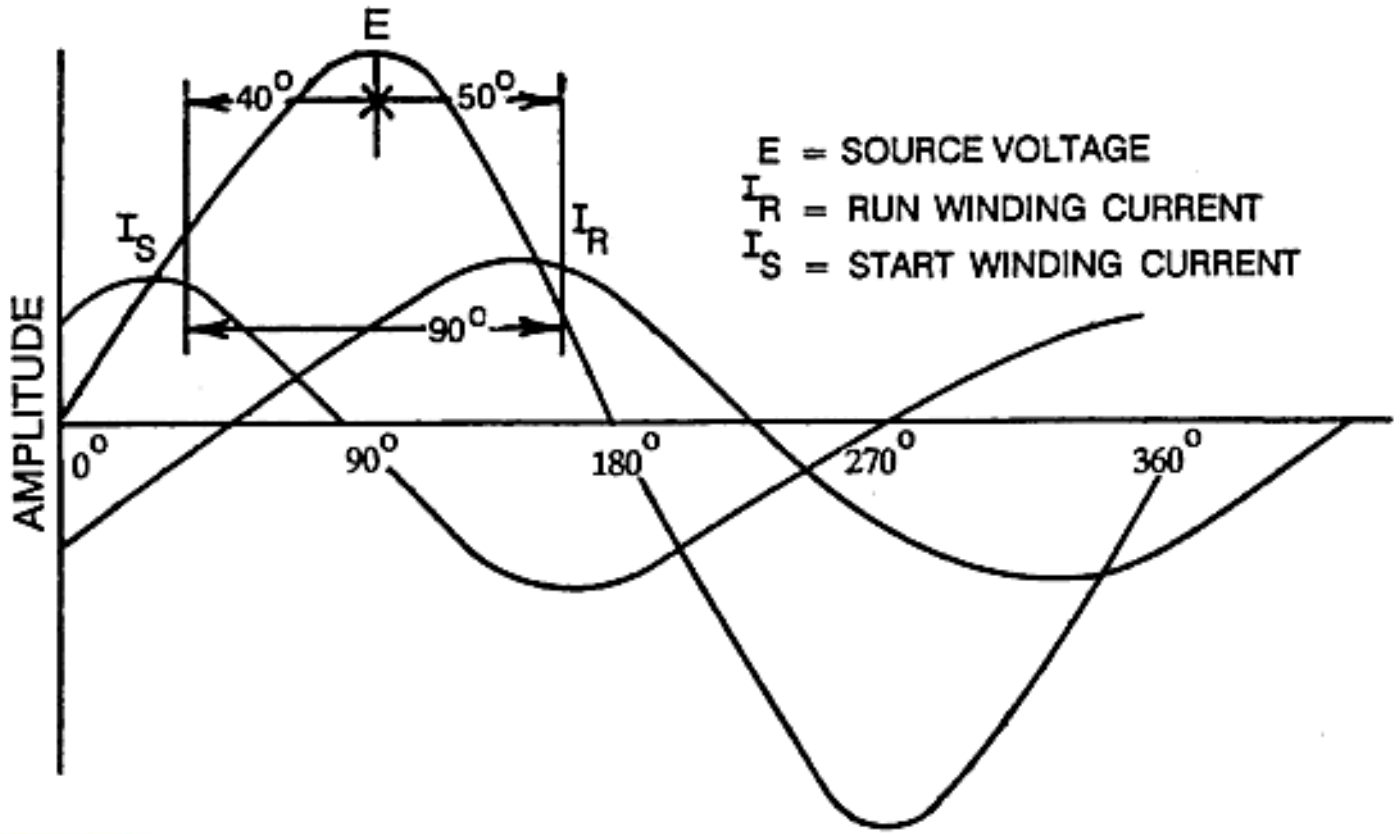


Capacitor Start

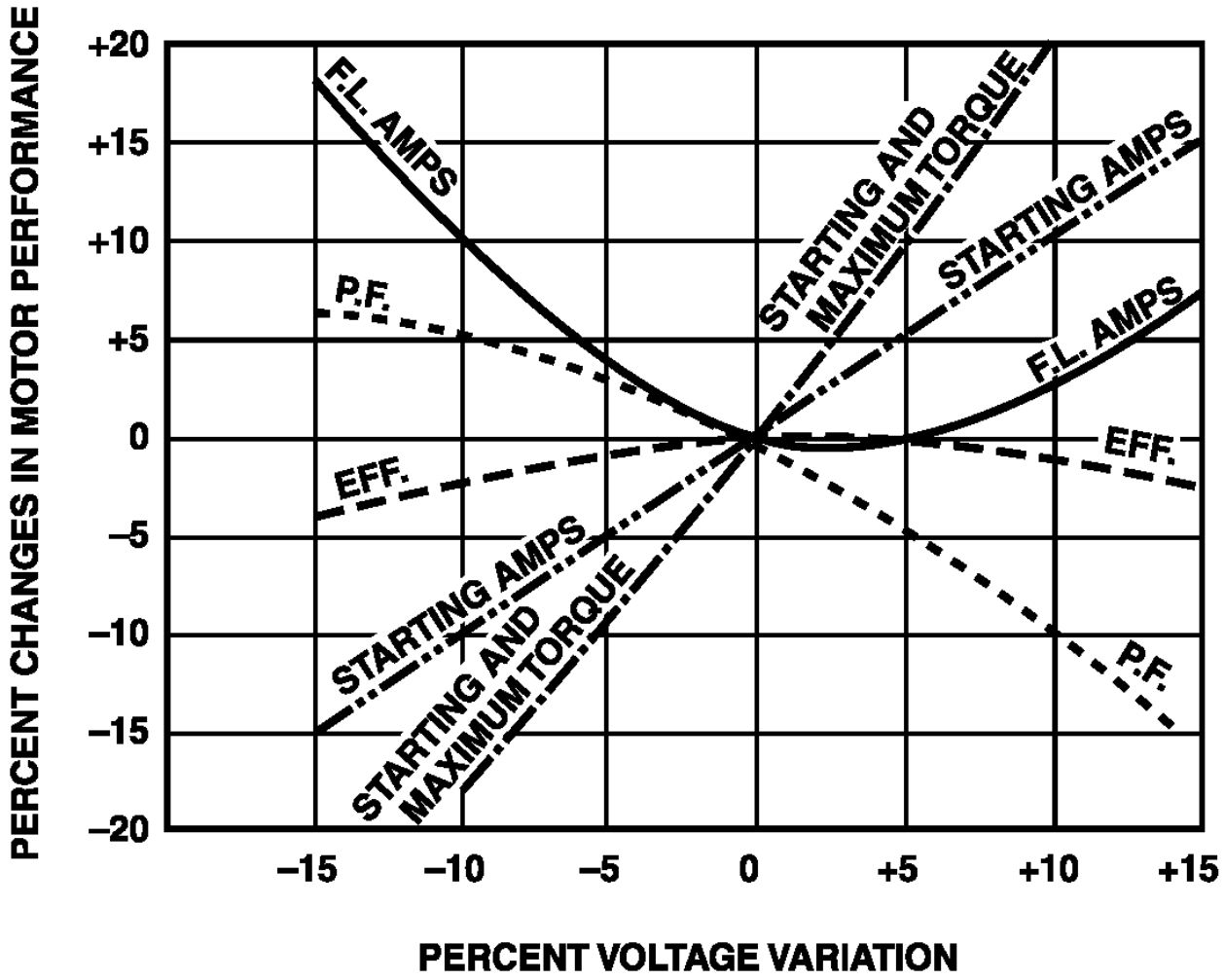




Capacitor Start Current

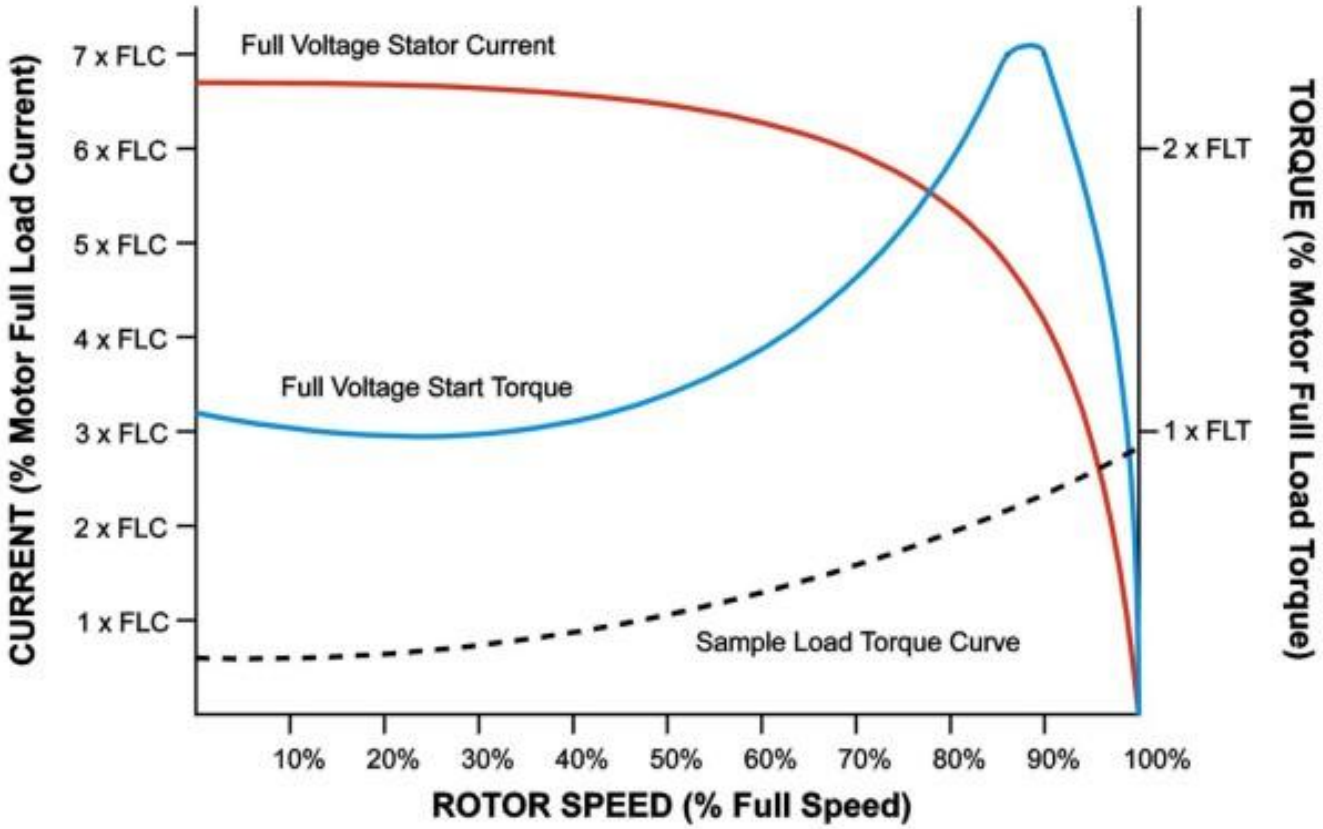


Three Phase Voltage

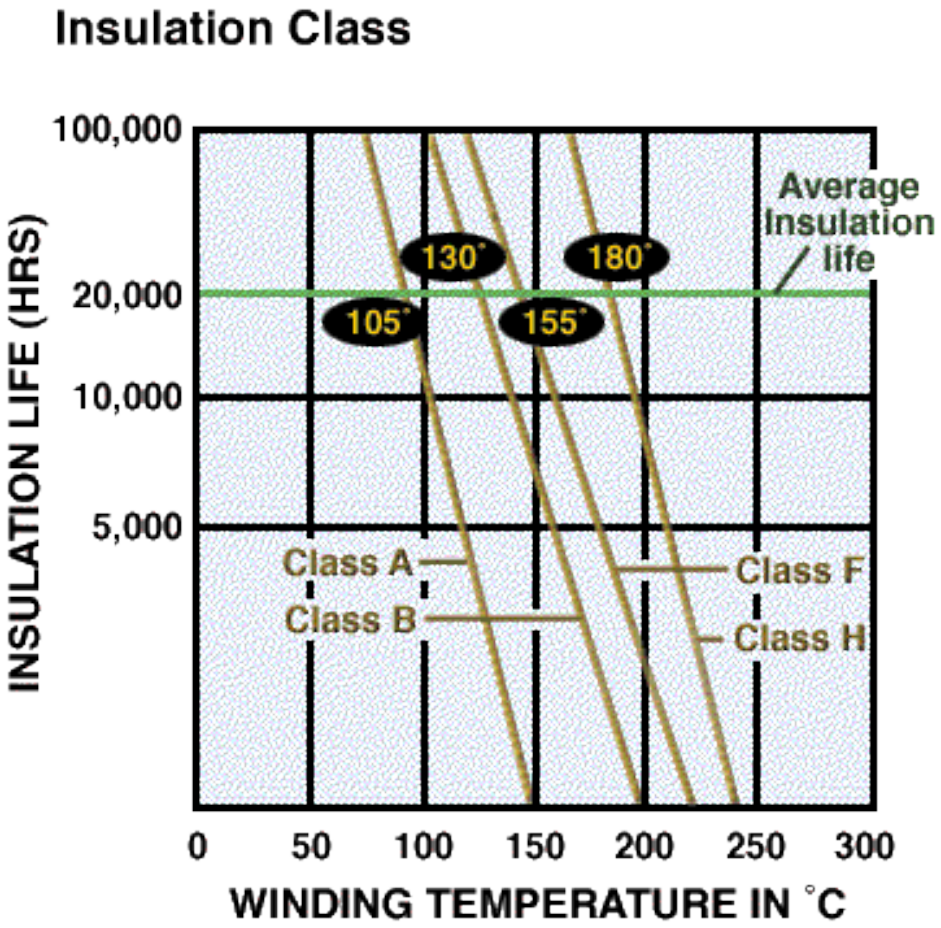


460 = 414 to 506

Three Phase Starting



Insulation Life



Service Factor

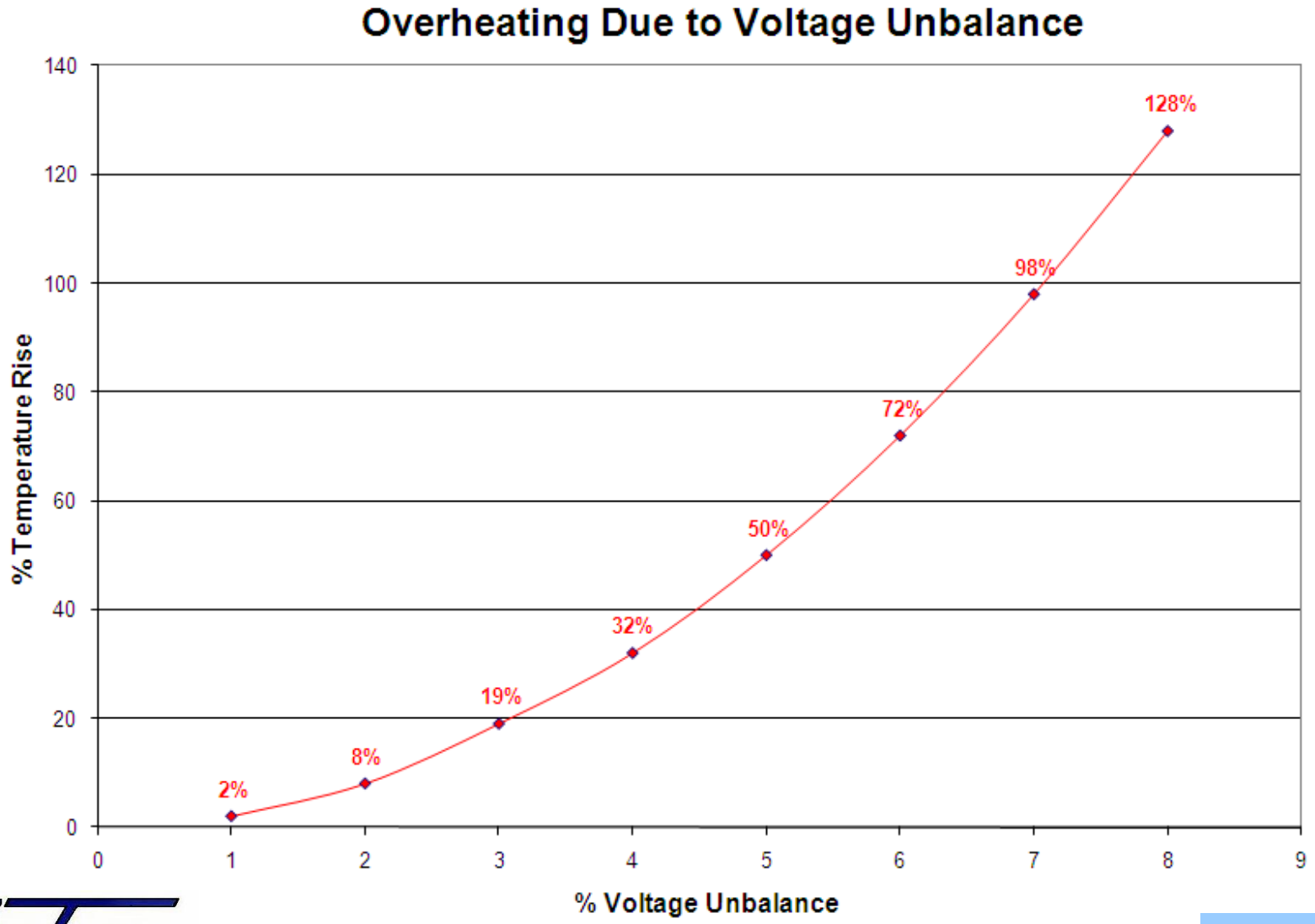
Service Factor - A multiplier, when applied to the rated HP, indicates the permissible loading at rated voltage and frequency.

Its purpose is to accommodate voltage variances, higher than ambient temperatures, and small overloads due to the driven machine.

Unbalanced Three Phase Voltage

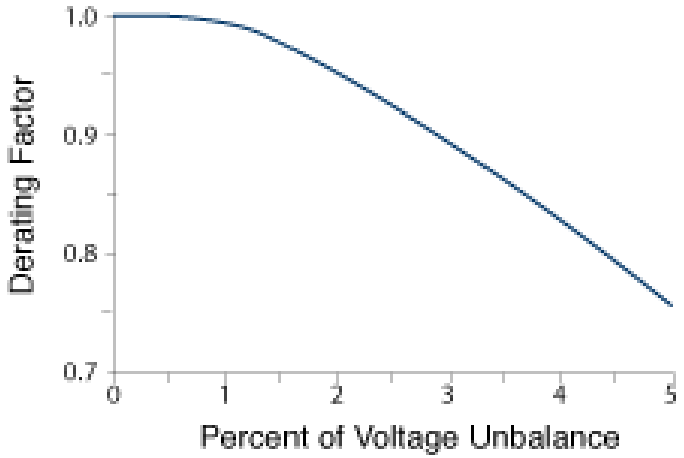
- Unbalanced phase voltage is the most common electrical problem found in pump installations.
- A small percentage of voltage unbalance can result in a much larger current unbalance.
- Unbalanced current increases the operating temperature and reduces stator life.

Unbalanced Three Phase Voltage



Unbalanced Three Phase Voltage

Derating Factor



Voltage Unbalance	Approximate Derating
1%	None
2%	95%
3%	88%
4%	82%
5%	75%

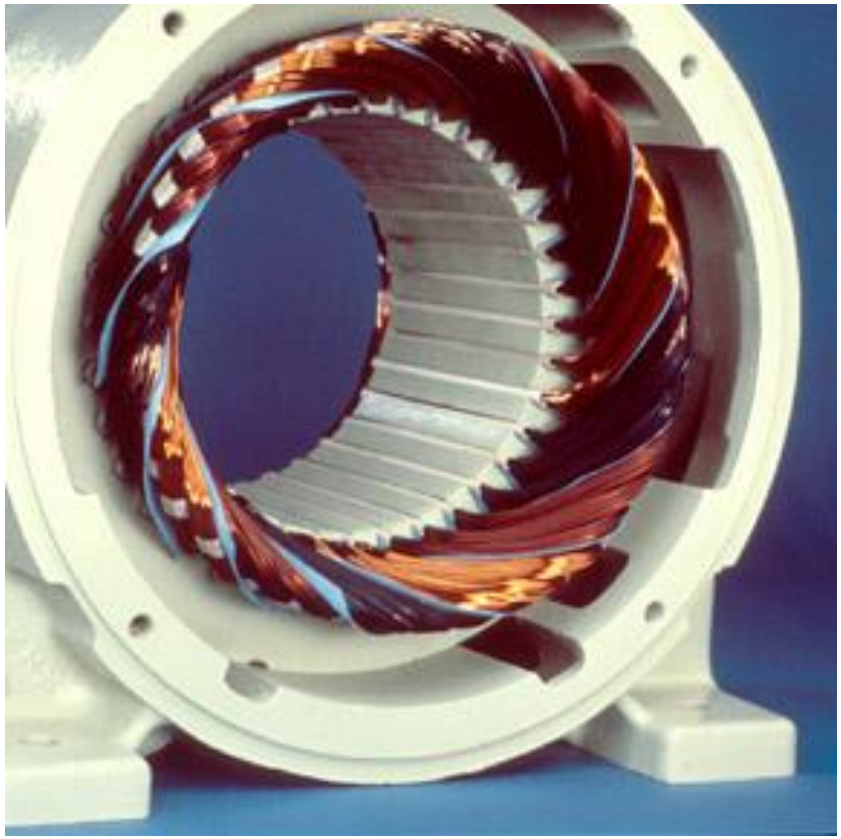
Unbalanced Three Phase Voltage

Effect on Winding Temperature & Motor Life

% voltage unbalance	Winding temp. (°C)	I^2R losses (% of total)	Efficiency reduction	Expected winding life (years)
0	120	30%	—	20 years
1	130	33%	Up to 1/2%	10
2	140	35%	1-2%	5
3	150	38%	2-3%	2.5
4	160	40%	3-4%	1.25
5	180	45%	5% or more	Less than 1

Unbalanced Three Phase Voltage

Winding Failure Due to High Unbalance



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Measuring Voltage Unbalance

- Measure L1/L2, L2/L3, L3/L1 voltages (pump on & off)
  - Add together and divide by 3 (average voltage)
  - Determine the greatest variation from the average
  - %Unbalance = 100 X (variation / average)
  - For every 1% of voltage unbalance you can expect 5 – 8% of current unbalance

Voltage Unbalance - Example

- L1/L2 = 462 L2/L3 = 465 L3/L1 = 447
- 462 + 465 + 447 = 1374
- 1374 / 3 = 458
- Largest variation from average: 458 - 447 = 11
- %Unbalance = 100 X (11/458) = 2.4%

Voltage Unbalance – Fixes

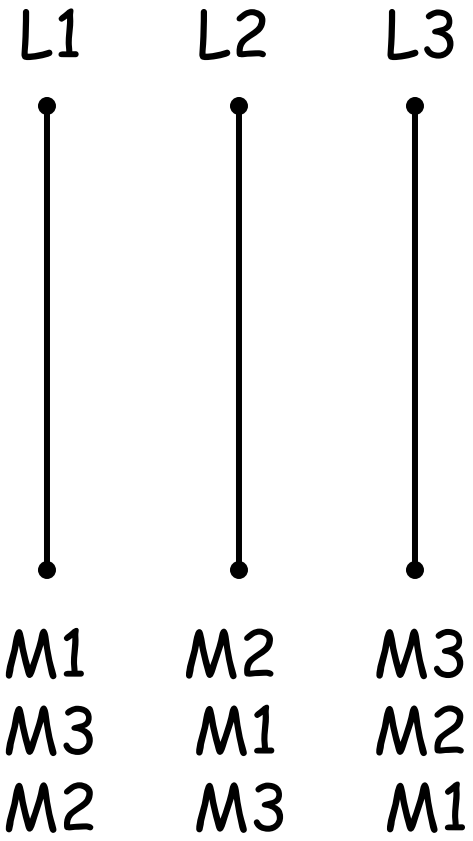
- If voltage unbalance is greater than 1% with the motor off, contact your utility

- If voltage unbalance is greater than 1% with the motor running, roll the motor leads

Voltage Unbalance – Rolling the Leads

- Step 1 - on the motor side of the contactor move M1 to M2, M2 to M3, and M3 to M1
- Step 2 - start the motor and measure voltage unbalance
- Step 3 - Repeat step 1 by moving M1 to M3, M2 to M1 and M3 to M2
- Step 4 - repeat Step 2

Voltage Unbalance – Rolling the Leads



Voltage Unbalance – Rolling the Leads

- If the voltage unbalance is 1% or less with one of the alternative connections, use that connection.
- If unbalance cannot be corrected by rolling the leads, its source must be located and corrected.

Voltage Unbalance
Locating the Source

- If the leg with the most imbalance stays with the same incoming power lead, the power source is the problem.

- If the leg with the most imbalance moves with the motor lead, the motor side is the problem.

Unbalanced Three Phase Voltage

Causes & Fixes

Power Side – worn or corroded contactor, inconsistent conductor size, unbalanced single phase loads, line voltage regulator settings, power factor correction capacitors, harmonic distortion from non-linear loads (voltage??)

Motor Side – damaged cable, bad splice, poor connections, faulty motor winding

AC Motor Design Considerations

Efficiency

Torque

Power Factor

Frame Size

Motor Efficiency

Energy Policy Act (EPACT)
Oct 1997 1 - 200 HP
EPACT Efficiency
NEMA MG1, Table 12-11

Energy Independence and Security Act (EISA)
Dec 19, 2010 1 – 500 HP
Premium Efficiency
NEMA MG1 Table 12-12

Motor Efficiency

Table 12-12

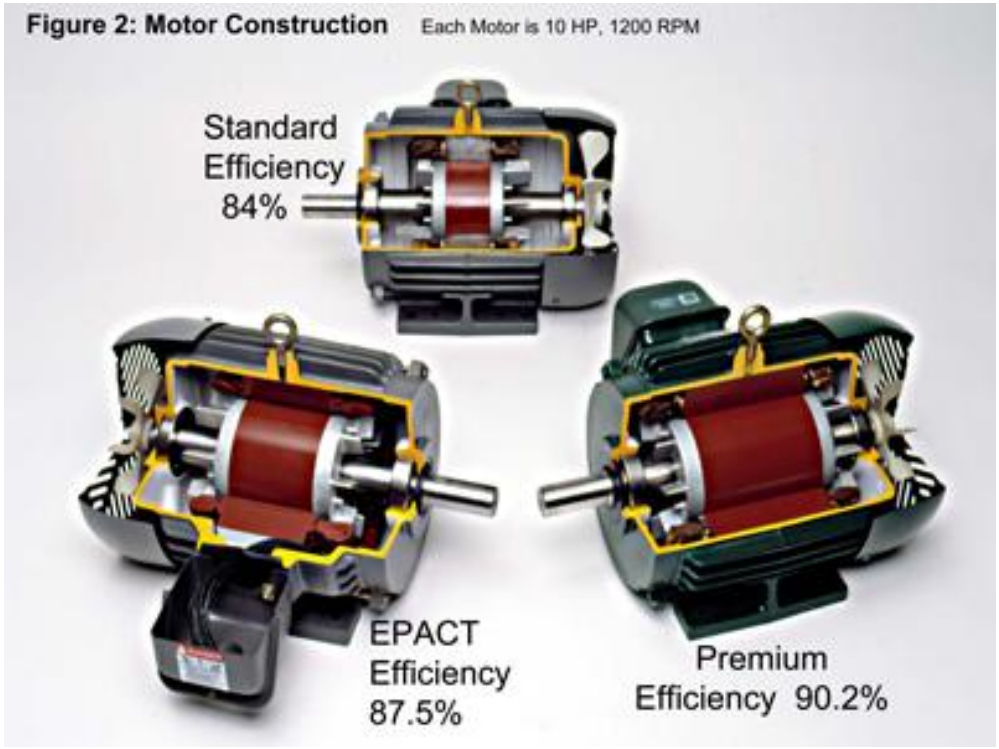
FULL-LOAD EFFICIENCIES FOR 60 HZ NEMA PREMIUM® EFFICIENCY ELECTRIC MOTORS RATED 600 VOLTS OR LESS (RANDOM WOUND)

	OPEN MOTORS					
	2 POLE		4 POLE		6 POLE	
HP	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	86.5	84.0
2	85.5	82.5	86.5	84.0	87.5	85.5
3	85.5	82.5	89.5	87.5	88.5	86.5
5	86.5	84.0	89.5	87.5	89.5	87.5
7.5	88.5	86.5	91.0	89.5	90.2	88.5
10	89.5	87.5	91.7	90.2	91.7	90.2
15	90.2	88.5	93.0	91.7	91.7	90.2
20	91.0	89.5	93.0	91.7	92.4	91.0
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	94.1	93.0	93.6	92.4

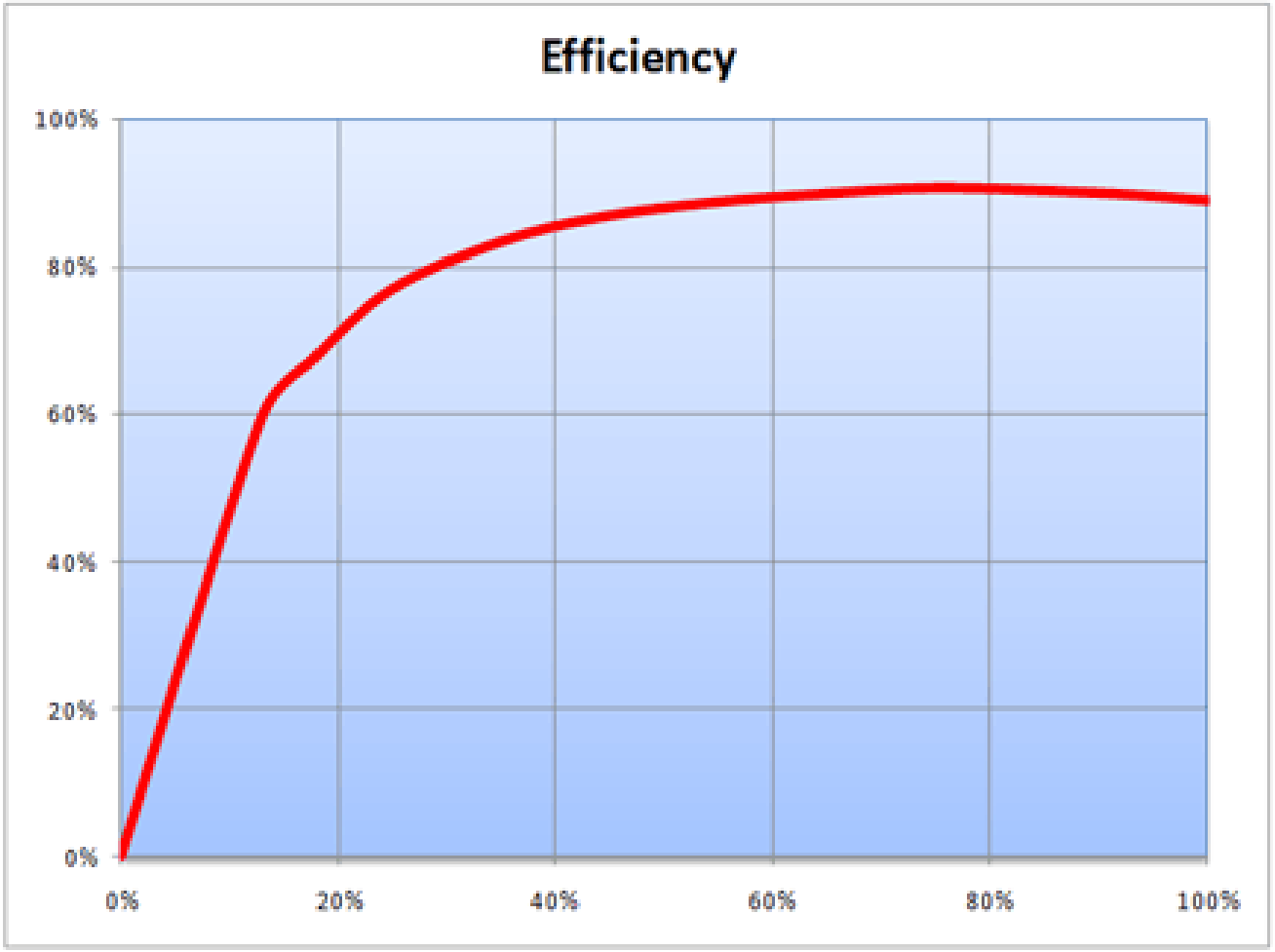
Motor Efficiency

40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.0	94.1	94.5	93.6
100	93.6	92.4	95.4	94.5	95.0	94.1
125	94.1	93.0	95.4	94.5	95.0	94.1
150	94.1	93.0	95.8	95.0	95.4	94.5
200	95.0	94.1	95.8	95.0	95.4	94.5
250	95.0	94.1	95.8	95.0	95.4	94.5
300	95.4	94.5	95.8	95.0	95.4	94.5
350	95.4	94.5	95.8	95.0	95.4	94.5
400	95.8	95.0	95.8	95.0	95.8	95.0
450	95.8	95.0	96.2	95.4	96.2	95.4
500	95.8	95.0	96.2	95.4	96.2	95.4

Motor Efficiency



Motor Efficiency versus Load



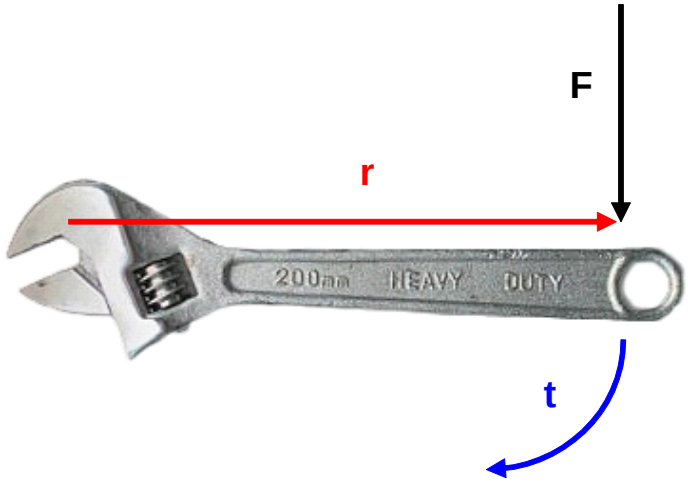
Work and Torque

Work (Linear)

Work = force x distance

Torque (Rotational)

Torque = force x radius
(+ the angle)



Power and Torque

Power = work / time

Power = torque / time

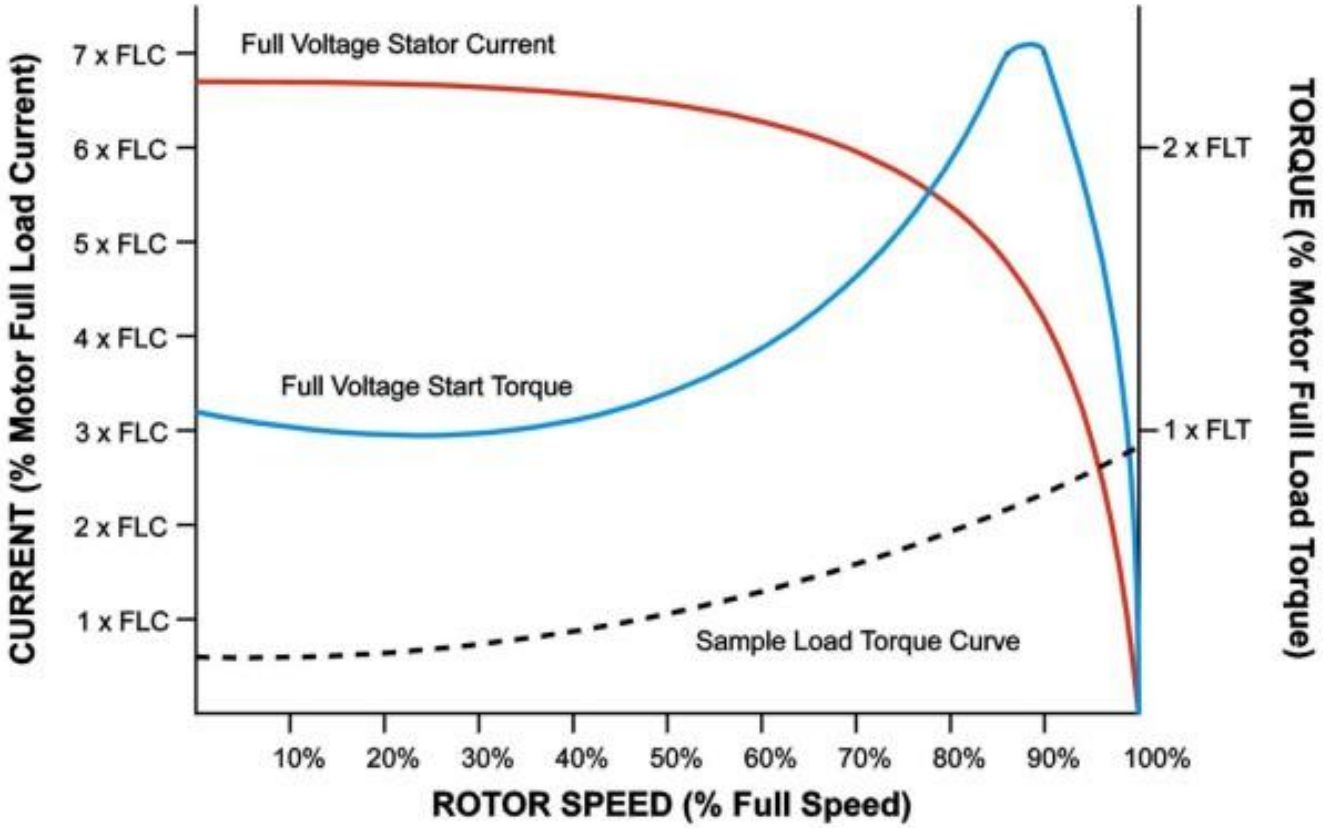
Torque varies inversely with rotational speed

For a 100 HP Motor:

3600 RPM = 146 lbft

1800 RPM = 292 lbft

Power and Torque

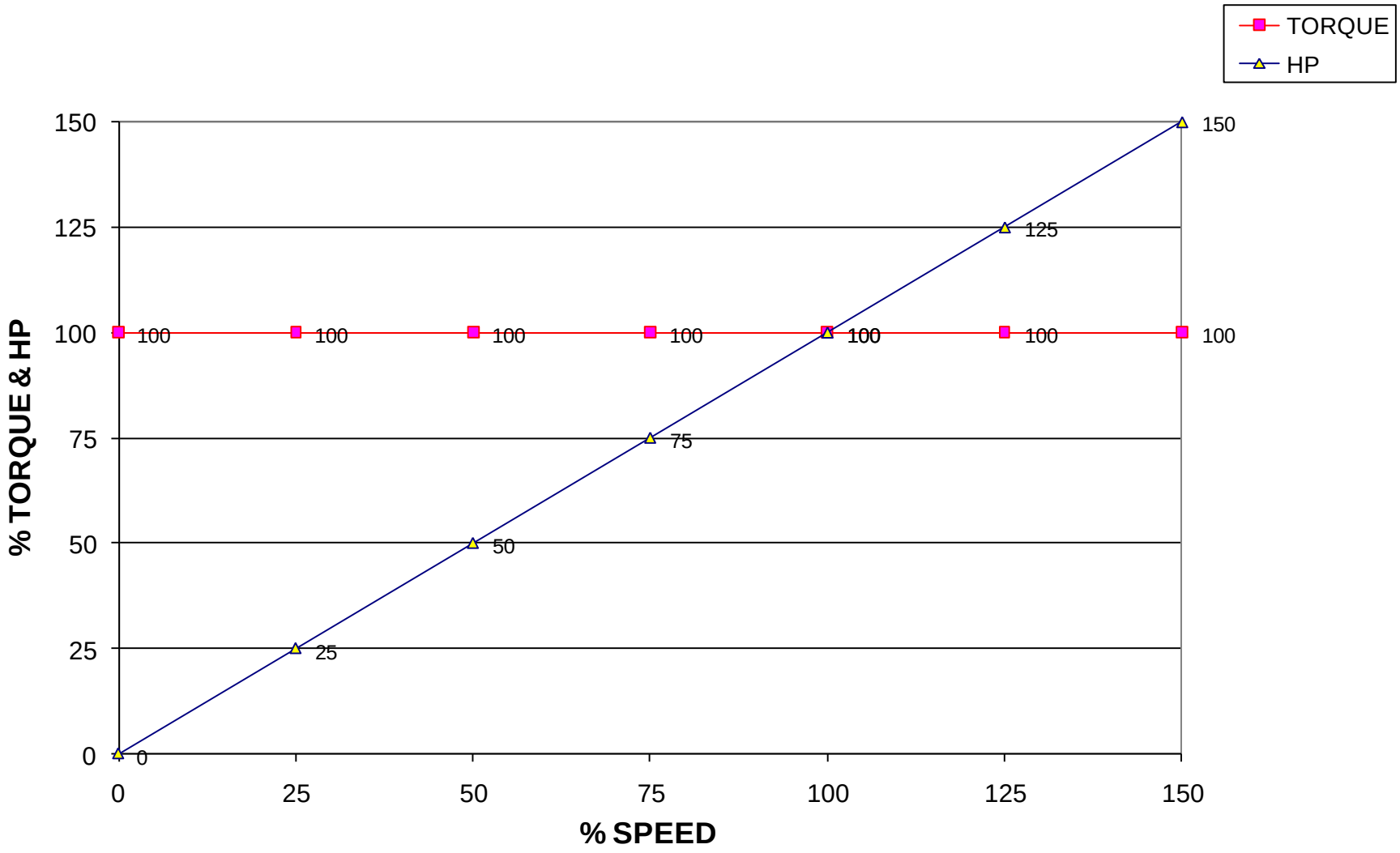


Motor Load Types

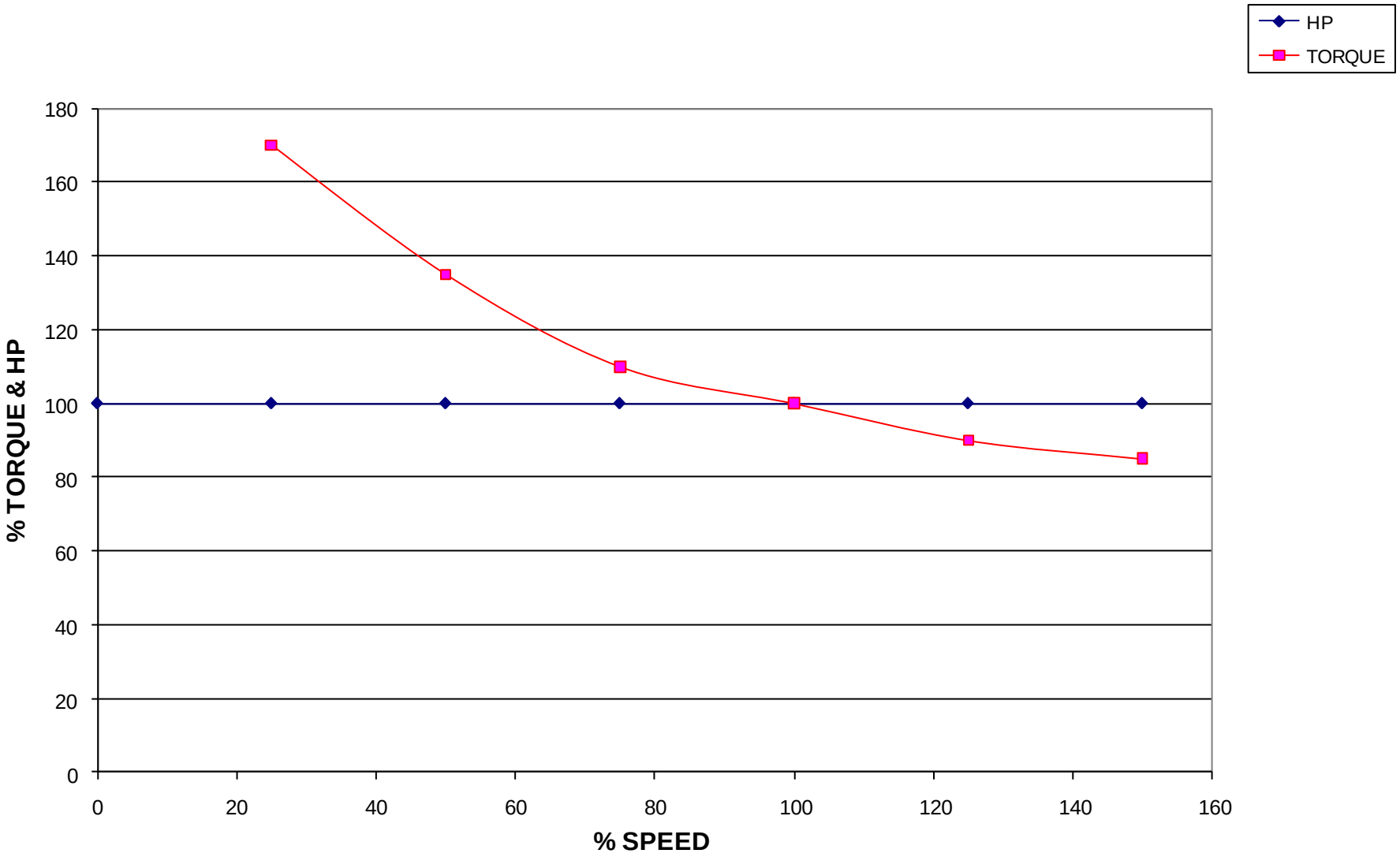
Constant Torque

Constant Horsepower

Variable Torque

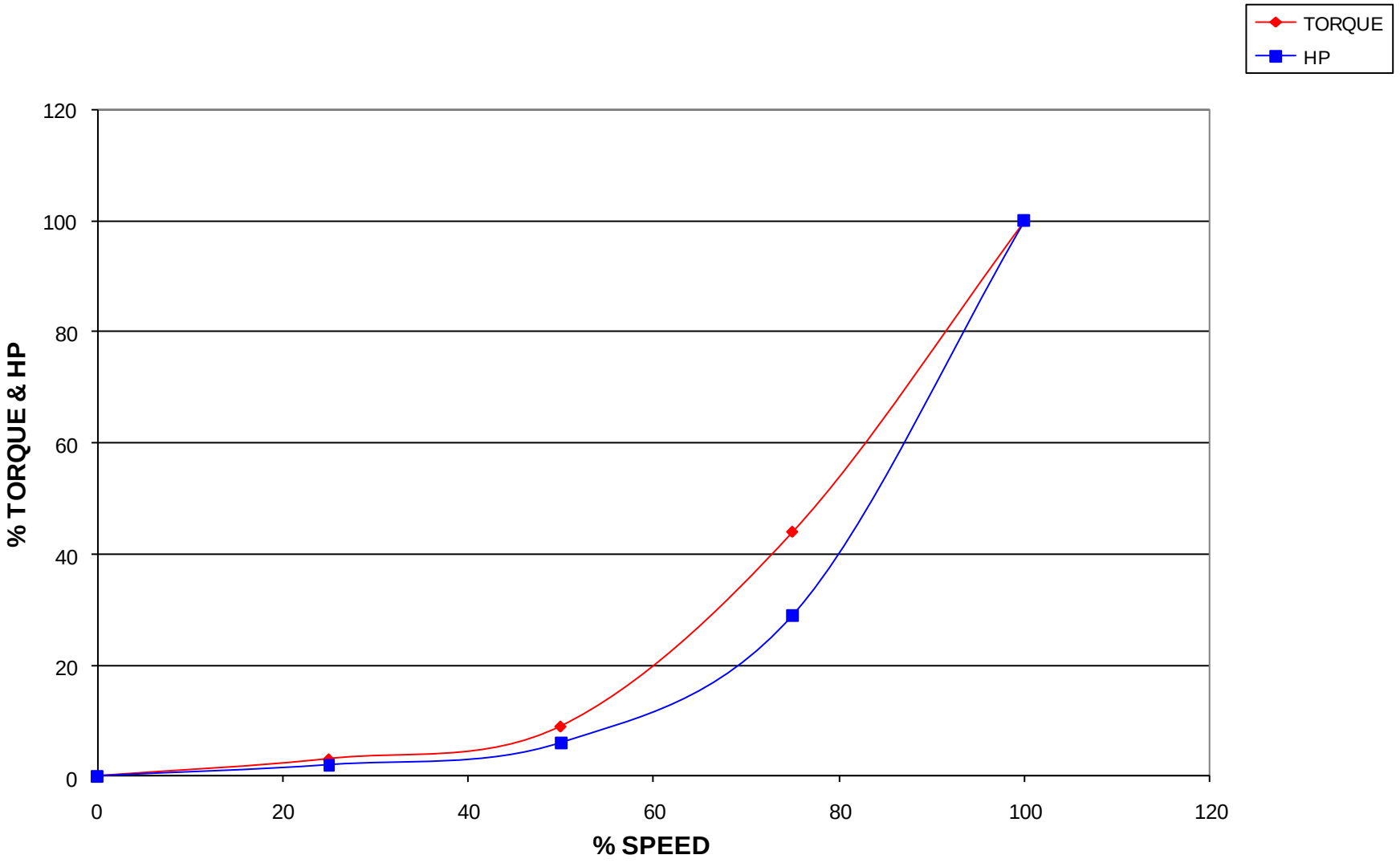

CONSTANT TORQUE
TORQUE
HP
% TORQUE & HP
% SPEED
150
125
100
75
50
25
0
0
25
50
75
100
125
150
100
100
100
100
100
100
100
0
25
50
75
125
150

CONSTANT HORSEPOWER



Lathes, Milling Machines, Drill Presses

VARIABLE TORQUE



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