

MOTOR TERMINAL MARKINGS AND CONNECTIONS **GUIDE**

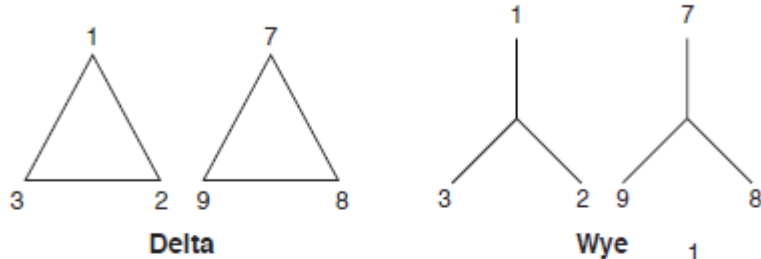
TECHNICAL INFORMATION EDUCATION SERIES



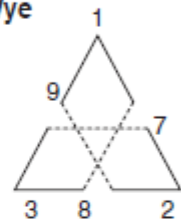
TERMINAL MARKINGS AND CONNECTIONS

PART WINDING START

NEMA NOMENCLATURE—6 LEADS



OPER. MODE	L1	L2	L3	OPEN
START	1	2	3	7,8,9
RUN	1,7	2,8	3,9	—



Double Delta
(Extended Delta)

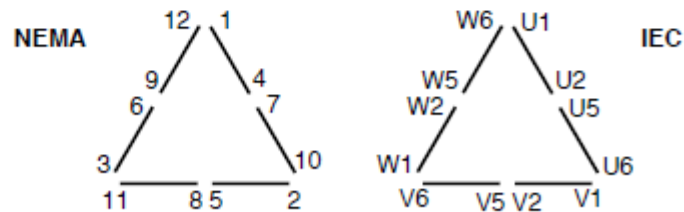
NEMA NOMENCLATURE—9 LEADS

WYE CONNECTED (LOW VOLTAGE ONLY)

	T1	T2	T3	T7	T8	T9	Together
MOTOR LEADS	1	2	3	7	8	9	4&5&6

NEMA AND IEC NOMENCLATURE—12 LEADS

SINGLE VOLTAGE OR LOW VOLTAGE OF DUAL-VOLTAGE MOTORS



	T1	T2	T3	T7	T8	T9
NEMA	1,6	2,4	3,5	7,12	8,10	9,11
IEC	U1,W2	V1,U2	W1,V2	U5,W6	V5,U6	W5,V6

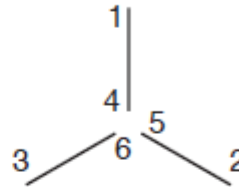
TERMINAL MARKINGS AND CONNECTIONS

THREE-PHASE MOTORS—SINGLE SPEED

NEMA NOMENCLATURE—6 LEADS

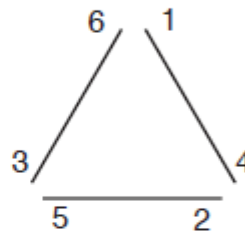
SINGLE VOLTAGE EXTERNAL WYE CONNECTION

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

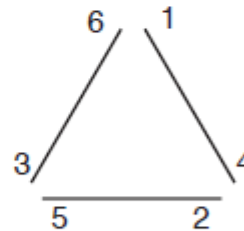
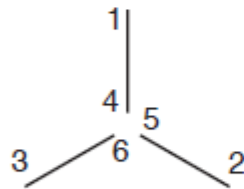


SINGLE VOLTAGE EXTERNAL DELTA CONNECTION

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



SINGLE AND DUAL VOLTAGE WYE-DELTA CONNECTIONS



SINGLE VOLTAGE

OPERATING MODE	CONNECTION	L1	L2	L3	JOIN
START	WYE	1	2	3	4&5&6
RUN	DELTA	1,6	2,4	3,5	—

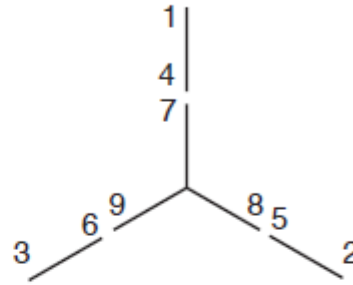
DUAL VOLTAGE*

VOLTAGE	CONNECTION	L1	L2	L3	JOIN
HIGH	WYE	1	2	3	4&5&6
LOW	DELTA	1,6	2,4	3,5	—

*Voltage ratio: 1.732 to 1.

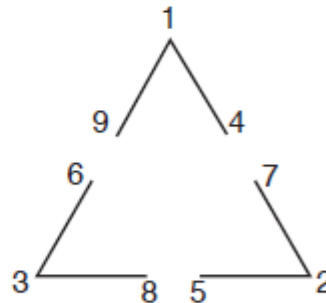
TERMINAL MARKINGS AND CONNECTIONS THREE-PHASE MOTORS—SINGLE SPEED

NEMA NOMENCLATURE—9 LEADS



DUAL VOLTAGE WYE-CONNECTED

VOLTAGE	L1	L2	L3	JOIN
HIGH	1	2	3	4&7,5&8,6&9
LOW	1,7	2,8	3,9	4&5&6



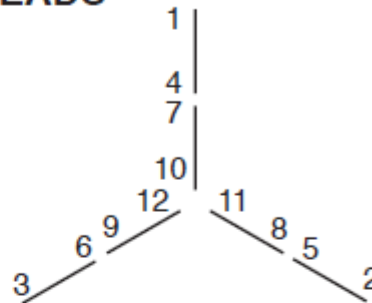
DUAL VOLTAGE DELTA-CONNECTED

VOLTAGE	L1	L2	L3	JOIN
HIGH	1	2	3	4&7,5&8,6&9
LOW	1,6,7	2,4,8	3,5,9	—

TERMINAL MARKINGS AND CONNECTIONS

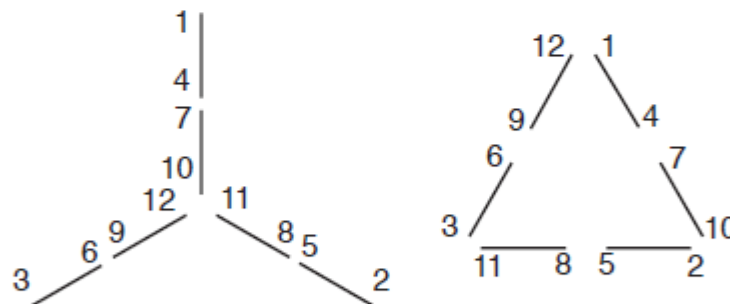
THREE-PHASE MOTORS—SINGLE SPEED

NEMA NOMENCLATURE—12 LEADS



DUAL VOLTAGE EXTERNAL WYE CONNECTION

VOLTAGE	L1	L2	L3	JOIN
HIGH	1	2	3	4&7,5&8,6&9, 10&11&12
LOW	1,7	2,8	3,9	4&5&6, 10&11&12



DUAL VOLTAGE WYE-CONNECTED START DELTA-CONNECTED RUN

VOLTAGE	CONN.	L1	L2	L3	JOIN
HIGH	WYE	1	2	3	4&7,5&8,6&9, 10&11&12
	DELTA	1,12	2,10	3,11	4&7,5&8,6&9
LOW	WYE	1,7	2,8	3,9	4&5&6, 10&11&12
	DELTA	1,6,7, 12	2,4,8, 10	3,5,9, 11	—

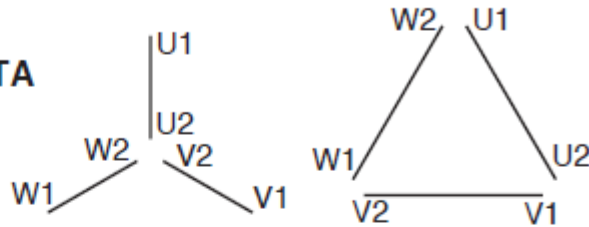
TERMINAL MARKINGS AND CONNECTIONS

THREE-PHASE MOTORS—SINGLE SPEED

IEC NOMENCLATURE—6 AND 12 LEADS

SINGLE AND DUAL VOLTAGE WYE-DELTA CONNECTIONS

SINGLE VOLTAGE

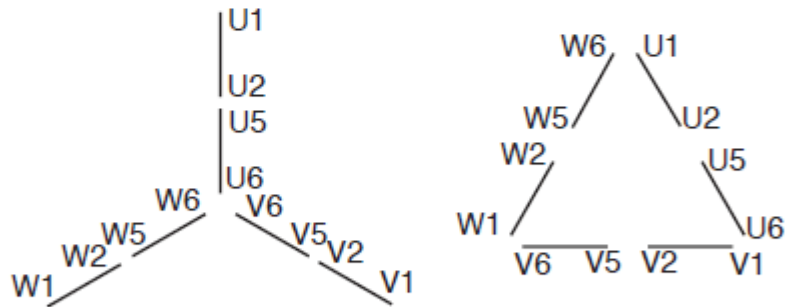


OPER. MODE	CONN.	L1	L2	L3	JOIN
START	WYE	U1	V1	W1	U2&V2&W2
RUN	DELTA	U1,W2	V1,U2	W1,V2	—

DUAL VOLTAGE*

VOLT.	CONN.	L1	L2	L3	JOIN
HIGH	WYE	U1	V1	W1	U2&V2&W2
LOW	DELTA	U1,W2	V1,U2	W1,V2	—

*Voltage ratio: 1.732 to 1.



DUAL VOLTAGE WYE-CONNECTED START DELTA-CONNECTED RUN

VOLT.	CONN.	L1	L2	L3	JOIN
HIGH	WYE	U1	V1	W1	U2&U5, V2&V5, W2&W5, U6&V6&W6
	DELTA	U1,W6	V1,U6	W1,V6	U2&U5, V2&V5, W2&W5
LOW	WYE	U1,U5	V1,V5	W1,W5	U2&V2&W2, U6&V6&W6
	DELTA	U1,U5, W2,W6	V1,V5, U2,U6	W1,W5, V2,V6	—

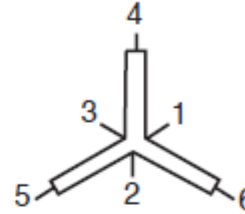
TERMINAL MARKINGS AND CONNECTIONS

THREE-PHASE MOTORS—TWO SPEED, SINGLE WINDING

NEMA NOMENCLATURE—6 LEADS

CONSTANT TORQUE CONNECTION

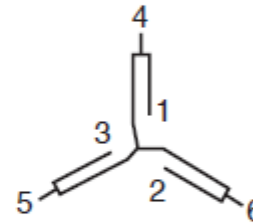
Low-speed horsepower is half of high-speed horsepower.*



SPEED	L1	L2	L3		TYPICAL CONNECTION
HIGH	6	4	5	1&2&3 JOIN	2 WYE
LOW	1	2	3	4-5-6 OPEN	1 DELTA

VARIABLE TORQUE CONNECTION

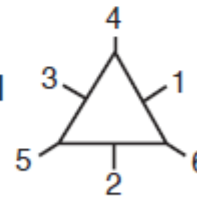
Low-speed horsepower is one-fourth of high-speed horsepower.*



SPEED	L1	L2	L3		TYPICAL CONNECTION
HIGH	6	4	5	1&2&3 JOIN	2 WYE
LOW	1	2	3	4-5-6 OPEN	1 WYE

CONSTANT HORSEPOWER CONNECTION

Horsepower is the same at both speeds.



SPEED	L1	L2	L3		TYPICAL CONNECTION
HIGH	6	4	5	1-2-3 OPEN	1 DELTA
LOW	1	2	3	4&5&6 JOIN	2 WYE

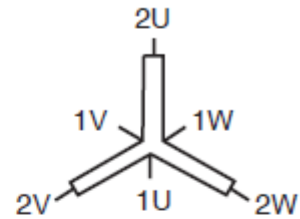
* CAUTION: On European motors horsepower variance with speed may not be the same as shown above.

TERMINAL MARKINGS AND CONNECTIONS

THREE-PHASE MOTORS—TWO SPEED, SINGLE WINDING

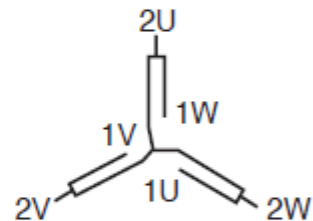
IEC NOMENCLATURE—6 LEADS

CONSTANT TORQUE CONNECTION



SPEED	L1	L2	L3		TYPICAL CONN.
HIGH	2W	2U	2V	1U&1V&1W JOIN	2 WYE
LOW	1U	1V	1W	2U-2V-2W OPEN	1 DELTA

VARIABLE TORQUE CONNECTION



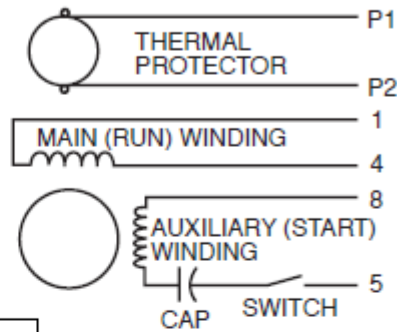
SPEED	L1	L2	L3		TYPICAL CONN.
HIGH	2W	2U	2V	1U&1V&1W JOIN	2 WYE
LOW	1U	1V	1W	2U-2V-2W OPEN	1 WYE

TERMINAL MARKINGS AND CONNECTIONS

SINGLE-PHASE MOTORS—CAPACITOR-START

NEMA NOMENCLATURE

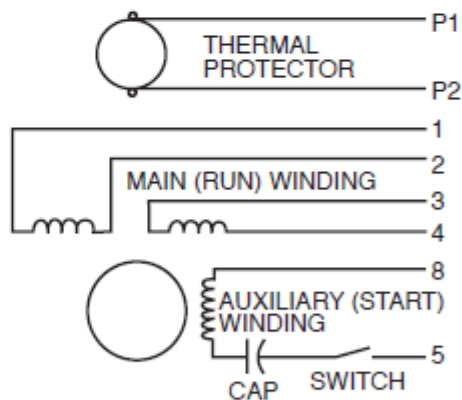
SINGLE VOLTAGE



ROTATION	L1	L2
CCW	1,8	4,5
CW	1,5	4,8

DUAL VOLTAGE (MAIN WINDING ONLY)

Auxiliary winding is always at low voltage rating; capacitor should be rated accordingly.



VOLTAGE	ROTATION	L1	L2	JOIN
HIGH	CCW	1	4,5	2&3&8
	CW	1	4,8	2&3&5
LOW	CCW	1,3,8	2,4,5	—
	CW	1,3,5	2,4,8	—

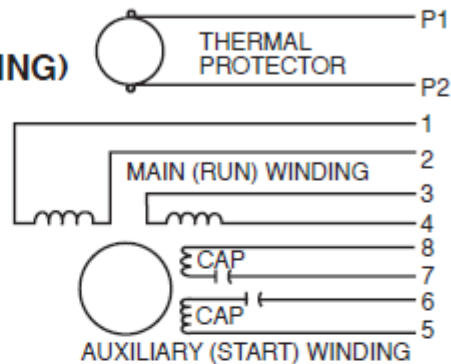
TERMINAL MARKINGS AND CONNECTIONS

SINGLE-PHASE MOTORS—CAPACITOR-START

NEMA NOMENCLATURE

DUAL VOLTAGE (MAIN AND AUXILIARY WINDING)

Capacitors in auxiliary windings are rated for lower voltage.



VOLTAGE	ROTATION	L1	L2	JOIN
HIGH	CCW	1,8	4,5	2&3,6&7
	CW	1,5	4,8	2&3,6&7
LOW	CCW	1,3,6,8	2,4,5,7	—
	CW	1,3,5,7	2,4,6,8	—

The switch in the auxiliary winding circuit has been omitted from this diagram. The connections to the switch must be made so that *both* auxiliary windings become de-energized when the switch is open.

ROTATION: CCW – Counter-clockwise
CW – Clockwise

The direction of shaft rotation can be determined by facing the end of the motor opposite the drive.

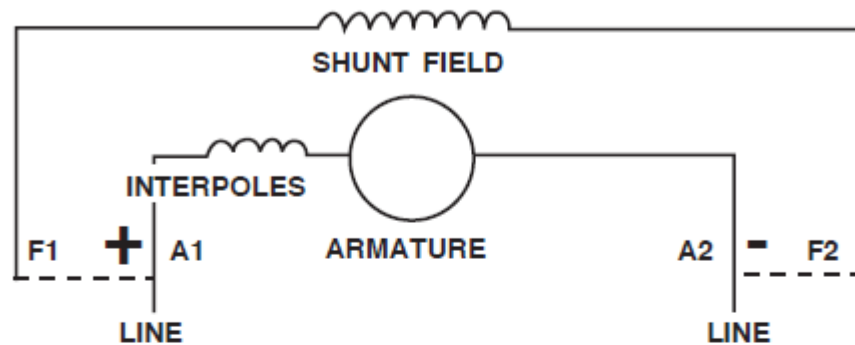
TERMINAL MARKINGS IDENTIFIED BY COLOR

1-Blue	5-Black	P1-No color assigned
2-White	6-No color assigned	P2-Brown
3-Orange	7-No color assigned	
4-Yellow	8-Red	

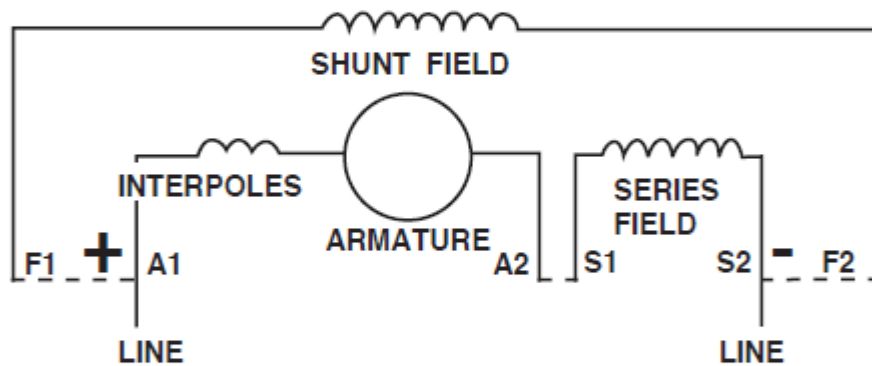
NEMA MG 1-1998 (Rev. 3), 2.41. Note: May not apply for some definite-purpose motors.

TERMINAL MARKINGS AND CONNECTIONS FOR DC MOTORS (NEMA NOMENCLATURE)

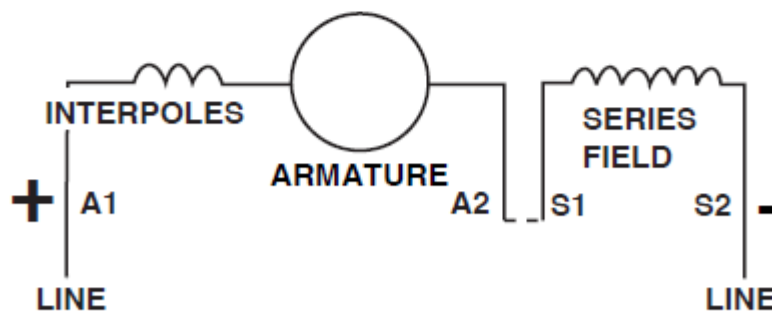
SHUNT MOTOR



COMPOUND MOTOR



SERIES MOTOR

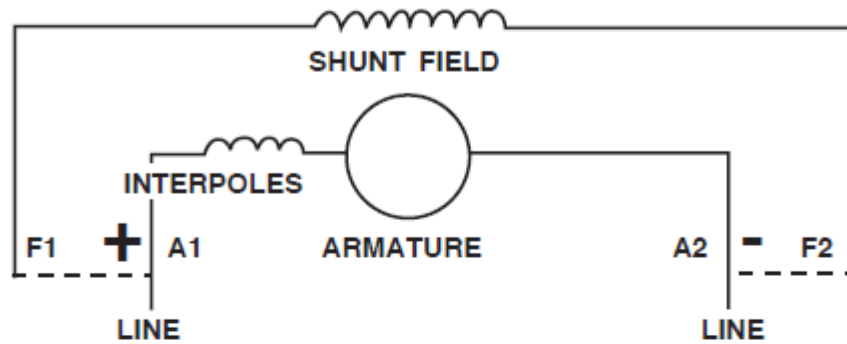


All connections are for counterclockwise rotation facing the end opposite the drive. For clockwise rotation, interchange A1 and A2. Some manufacturers connect the interpole winding on the A2 side of the armature.

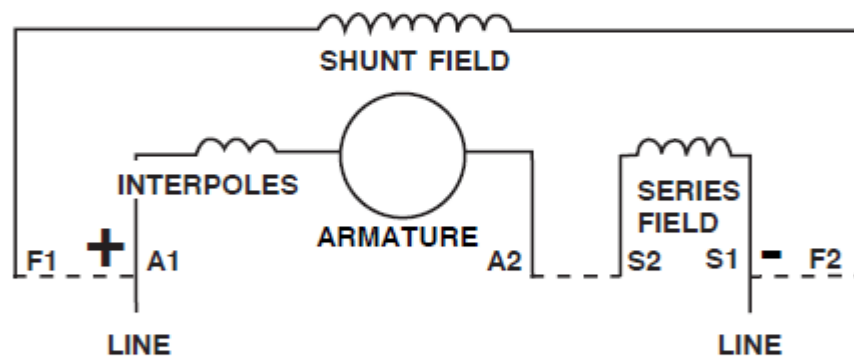
When the shunt field is separately excited, the same polarities must be observed for a given rotation.

TERMINAL MARKINGS AND CONNECTIONS FOR DC GENERATORS (NEMA NOMENCLATURE)

SHUNT GENERATOR



COMPOUND GENERATOR



All connections are for counterclockwise rotation facing the end opposite the drive. For clockwise rotation, interchange A1 and A2.

Some manufacturers connect the interpole winding on the A2 side of the armature.

For the above generators, the shunt field may be either self-excited or separately excited. When it is self-excited, connections should be made as shown by the dotted lines. When the shunt field is separately excited, it is usually isolated from the other windings of the machine, but the polarity or the voltage applied to the shunt field should be as shown for the particular rotation and armature polarity.

NEMA MG 1-1998 (Rev. 3), 2.14, Note 5.



Source The Electrical Engineering Pocket Handbook
Electrical Apparatus Service Association



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