Product Data

Subject **NEMA VOLTAGE AND HORSEPOWER RATINGS** *File* General

PRODUCT DATA

GENERAL. New NEMA standard ratings have been adopted for all low voltage AC magnetic contactors and starters. These new ratings are the final result of a whole series of changes in standards that have taken place over the years beginning with a new standard for 3 phase motor voltages as early as 1965. The new NEMA standard for industrial control basically consists of the following changes:

A. Voltage ratings have been changed from the old standard of 115, 208, 220, 440 and 550V for AC 60 hertz multiphrase devices to a new standard of 115, 200, 230, 460 and 575V.

B. Appropriate horsepower ratings have been established for the new 200V motor rating and vary quite differently from its predecessor the old 208V motor rating.

C. A 380 volt, 50 hertz rating has been added to the standard.

Control device standard voltage ratings now line up with the standard motor voltage ratings. This has not been the case over the years and has led to a lot of confusion. In order to fully appreciate this major change in the standards, a review of the events over the years is necessary.

MOTOR VOLTAGES. Early in 1965 the National Electrical Manufacturers Association (NEMA) adopted a new standard for future design of motors. The old 220, 440, 550V ratings were out; new 230, 460, and 575V ratings were in (NEMA MG1-10.30-a). This change came about to make motors more closely fit the modern power systems on which they are being applied. Operating characteristics would be improved, and a major cause of motor burnouts would be eliminated - all by closer matching of motor design to prevailing power system voltage levels.

SYSTEM VOLTAGES. There has been no changes in the area of voltage standards for distribution systems (240, 480 and 600V) these have remained the same. However, changes in application practices and the character of power systems generally have changed. Factors in modern power distribution systems that tend to increase voltage at the motor terminals are as follows:

1. Transformers have moved indoors along side the secondary unit substations (such as load center unit substations or switch board unit substations centralized in manufacturing areas) and this decreases line drop.

2. Power capacitors are widely used for improvement of plant power factor -- again decreasing line drop.

3. Shorter power runs make stiffer distribution systems -- also decreasing line drop.

4. Power companies have stiffer distribution systems. This tends to hold rated system voltage under maximum load conditions, and let voltage go higher under light loads (ASA standard C-84 allows the maximum voltage of the tolerable zone to be 254V on a 240V system, and 500V on a 480V system).

Therefore, higher voltage is now attained at the motor terminals.

SPECIAL CHANGES. At the time of the introduction of the new NEMA standard for 3 phase motor voltages in 1965, nothing was changed in the 208V range. However, 208V applications would have to be supplied with a motor specially wound for 208V and the old practice of using 208-220V motors on 208V power systems would be gradually eliminated.

Later in January, 1970, the NEMA Motor and Generator Section revised the standard for three phase motor voltage ratings by changing the 208 volt rating to 200 volts. This action was taken at the specific request of the American National Standards Institute, Inc. Committee C84 on preferred voltage ratings for AC systems and equipment. That committee, in its development of a revision of the standard for preferred voltage ratings for AC systems and equipment considered the existing relationship between the voltages of distribution systems and the voltage ratings of three phase motors, 120-115, 208-200, 240-230, 480-460 and 600-575, and noted particularly the inconsistency between the 208 volt system voltage and the three phase motor voltage ratings of 208 volts. The new NEMA standards for industrial control reflects this change by including a 200 volt rating.

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AJR

The 380 volt, 50 hertz system has been with us for some time, however, a 380 volt, 50 hertz rating was never included in the NEMA standards for low voltage industrial control. This led to some confusion in selecting control devices for this system. NEMA recognized this and has added the 380 volt, 50 hertz ratings to the standards.

REVISED RATING TABLES FOR NEMA STANDARD MOTOR CONTROLLERS

GENERAL. In selecting a motor controller for any application not only should the horsepower rating and the full load current of the motor be within the limits shown for a particular NEMA size device but locked-rotor currents must also be questioned. For three phase motors having locked-rotor KVA per horsepower in excess of that for the motor code letters in the following table, do not apply the controller at its maximum rating without consulting the factory. In most cases, the next higher horsepower rated controller should be used.

Maximum Controller HP Rating	Maximum Allowable Motor Code Letter
1-1/2-2	L
3-5	K
7-1/2 & above	H

MANUAL STARTERS

Size of Controller	Electrical Ratings		
	Max. HP		
	Volts	Polyphase	Single Phase
M-O	115	---	1
	200-230	3	2
	380-575	5	---
M-1	115	---	2
	200-230	7-1/2	3
	380-575	10	---
M-1P	115	---	3
	230	---	5

ACROSS THE LINE CONTACTORS AND STARTERS

REDUCED VOLTAGE STARTERS. Primary resistor and **auto-transformer** reduced voltage starter electrical ratings for non-plugging and non-jogging duty are identical to ratings for across the line contactors and starters for non-plugging and non-jogging duty. Refer to table on page 3 for these ratings. There has been no final agreement as yet on the NEMA standards Committee on specific changes in the ratings for plugging and jogging duty.

Wye Delta and **part winding** reduced voltage starter revised ratings have not as yet been finalized by the NEMA Standards Committee. For 200V, 60 hertz and 380V, 50 hertz starter applications our new catalog will refer customers to the factory.

MULTISPEED STARTERS. Electrical ratings for these three phase multispeed starters for **constant-torque** and **variable-torque** motors are identical to ratings for across the line contactors and starters for non-plugging and non-jogging duty. Refer to table on page 3. For **constant horsepower** multispeed starters (2, 3 and 4 speed) refer to the following table:

Non-Plugging and Non-Jogging Duty

Size of Controller	Horsepower			
	200V	230V	380V	460 or 575V
0	2	2	3	3
1	5	5	7-1/2	7-1/2
2	7-1/2	10	20	20
3	20	25	40	40
4	30	40	60	75
5	60	75	100	150
6	100	150	200	300
7	---	225	---	450
8	---	350	---	700

ELECTRICAL RATINGS

NEMA Size	Volts	Maximum Horsepower Rating — Non-plugging and Non-jogging Duty		Maximum Horsepower Rating — Plugging and Jogging Duty †		Continuous Current Rating, Amperes — 600 Volt Max.	Service-Limit Current Rating, Amperes *	Tungsten and Infrared Lamp Load, Amperes — 250 Volts Max. ★	Resistance Heating Loads, KW — other than Infrared Lamp Loads §		KVA Rating for Switching Transformer Primaries at 50 or 60 Cycles □		3 Phase Rating for Switching Capacitors •
		Single Phase	Poly-Phase	Single Phase	Poly-Phase				Single Phase	Poly-Phase	Single Phase	Poly-Phase	Kvar
00	115	1/3	...	...	...	9	11	5	...	...	...	...	...
	200	...	1-1/2	...	...	9	11	5	...	...	...	...	...
	230	1	1-1/2	...	...	9	11	5	...	...	...	...	...
	380	...	1-1/2	...	...	9	11	...	...	...	...	...	...
	460	...	2	...	...	9	11	...	...	...	...	...	...
	575	...	2	...	...	9	11	...	...	...	...	...	...
0	115	1	...	1/2	...	18	21	10	...	...	0.9	1.2	...
	200	...	3	...	1-1/2	18	21	10	...	...	...	1.4	...
	230	2	3	1	1-1/2	18	21	10	...	...	1.4	1.7	...
	380	...	5	...	1-1/2	18	21	...	...	...	...	2.0	...
	460	...	5	...	2	18	21	...	...	...	1.9	2.5	...
	575	...	5	...	2	18	21	...	...	...	1.9	2.5	...
1	115	2	...	1	...	27	32	15	3	5	1.4	1.7	...
	200	...	7-1/2	...	3	27	32	15	...	9.1	...	3.5	...
	230	3	7-1/2	2	3	27	32	15	6	10	1.9	4.1	...
	380	...	10	...	5	27	32	...	...	16.5	...	4.3	...
	460	...	10	...	5	27	32	...	12	20	3	5.3	...
	575	...	10	...	5	27	32	...	15	25	3	5.3	...
1P	115	3	...	1-1/2	...	36	42	24	...	...	...	...	...
	230	5	...	3	...	36	42	24	...	...	...	...	...
2	115	3	...	2	...	45	52	30	5	8.5	1.9	4.1	...
	200	...	10	...	7-1/2	45	52	30	...	15.4	...	6.6	11.3
	230	7-1/2	15	5	10	45	52	30	10	17	4.6	7.6	13
	380	...	25	...	15	45	52	...	...	28	...	9.9	21
	460	...	25	...	15	45	52	...	20	34	5.7	12	26
	575	...	25	...	15	45	52	...	25	43	5.7	12	33
3	115	7-1/2	...	...	...	90	104	60	10	17	4.6	7.6	...
	200	...	25	...	15	90	104	60	...	31	...	13	23.4
	230	15	30	...	20	90	104	60	20	34	8.6	15	27
	380	...	50	...	30	90	104	...	...	56	...	19	43.7
	460	...	50	...	30	90	104	...	40	68	14	23	53
	575	...	50	...	30	90	104	...	50	86	14	23	67
4	200	...	40	...	25	135	156	120	...	45	...	20	34
	230	...	50	...	30	135	156	120	30	52	11	23	40
	380	...	75	...	50	135	156	...	...	86.7	...	38	66
	460	...	100	...	60	135	156	...	60	105	22	46	80
	575	...	100	...	60	135	156	...	75	130	22	46	100
5	200	...	75	...	60	270	311	240	...	91	...	40	69
	230	...	100	...	75	270	311	240	60	105	28	46	80
	380	...	150	...	125	270	311	...	...	173	...	75	132
	460	...	200	...	150	270	311	...	120	210	40	91	160
	575	...	200	...	150	270	311	...	150	260	40	91	200
6	200	...	150	...	125	540	621	480	...	182	...	79	139
	230	...	200	...	150	540	621	480	120	210	57	91	160
	380	...	300	...	250	540	621	...	...	342	...	148	264
	460	...	400	...	300	540	621	...	240	415	86	180	320
	575	...	400	...	300	540	621	...	300	515	86	180	400
7	230	...	300	...	...	810	932	720	180	315	...	...	240
	460	...	600	...	...	810	932	...	360	625	...	...	480
	575	...	600	...	...	810	932	...	450	775	...	...	600
8	230	...	450	...	...	1215	1400	1080	...	...	...	...	360
	460	...	900	...	...	1215	1400	...	...	...	...	...	720
	575	...	900	...	...	1215	1400	...	...	...	...	...	900

Tables and footnotes are taken from NEMA Standards Publication No. IC 1-1965 Section 2, Part 11 for Magnetic Contactors and Section 3, Parts 21B, 21C, 21D and 21F for Magnetic Starters and includes 1971 revisions for 200V. and 380V. ratings.

†Ratings shown are for applications requiring repeated interruption of stalled motor current or repeated closing of high transient currents encountered in rapid motor reversal, involving more than five openings per minute such as plug-stop, plug-reverse or jogging duty. Ratings apply to single speed and multispeed controllers.

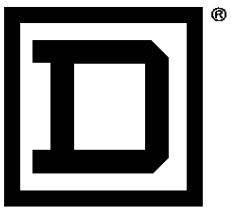
*Per NEMA Standards paragraph IC 1-21A.20, the service-limit current represents the maximum rms current, in amperes, which the controller may be expected to carry for protracted periods in normal service. At service-limit current ratings, temperature rises may exceed those obtained by testing the controller at its continuous current rating. The ultimate trip current of overcurrent (overload) relays or other motor protective devices shall not exceed the service-limit current ratings of the controller.

★ FLUORESCENT LAMP LOADS — 300 VOLTS AND LESS — The characteristics of fluorescent lamps are such that it is not necessary to derate Class 8502 contactors below their normal continuous current rating. Class 8903 contactors may also be used with fluorescent lamp loads. For controlling tungsten and infrared lamp loads, Class 8903 ac lighting contactors are recommended. These contactors are specifically designed for such loads and are applied at their full rating as listed in the Class 8903 section. Do not use Class 8903 contactors with motor loads or resistance heating loads.

§Ratings apply to contactors which are employed to switch the load at the utilization voltage of the heat producing element with a duty which requires continuous operation of not more than five openings per minute.

□ Applies to contactors used with transformers having an inrush of not more than 20 times their rated full load current, irrespective of the nature of the secondary load.

• Kilovar ratings of contactors employed to switch power capacitor loads. When capacitors are connected directly across the terminals of an alternating current motor for power factor correction, the motor manufacturer should be consulted as to the maximum size of the capacitor and the proper rating of the motor overcurrent protective device.



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