

Technical Data

NEMA / EEMAC Ratings

General Information

Voltage ratings

NEMA and EEMAC Standards recognize that industrial control is normally applied to the point of power utilization and that this utilization voltage is somewhat lower than nominal system voltages. The NEMA Standard "Industrial Control and Systems - 1993" includes the following:

ICS 1-112.22 Rated Operational Voltage (U_o)

Low voltage ratings for industrial control apparatus are based on utilization voltages and shall be as follows:

- a) Alternating current, 60 Hertz, multiphase - 115, 200, 230, 400, 460 and 575 volts
- b) Alternating current, 60 Hertz, single phase - 115 and 230 volts
- c) Direct current - 115 and 230 volts

Individual manufacturers may choose to mark coils or control-circuit transformers at the utilization voltage (listed above) or the corresponding nominal system voltage (120, 208, 240, 416, 480 or 600 volts, 60 Hertz). Coils marked with voltage ratings in multiples of 115 volts are considered adequate for use on nominal system voltage ratings in multiples of 120 volts.

In line with the above, industrial control equipment in this catalog is listed at the utilization voltage. Circuit breakers are listed at their corresponding nominal system voltage.

| Commonly called volts | System voltage | Utilization voltage |
|-----------------------|----------------|---------------------|
| 110-115-120 | 120 | 115 |
| 208 | 208 | 200 |
| 220-230-240 | 240 | 230 |
| 440-460-480 | 480 | 460 |
| 550-575-600 | 600 | 575 |

NEMA / EEMAC "Sizes"

Motor starters are sometimes referred to by their NEMA/EEMAC sizes. The NEMA Standard "Industrial Controls and Systems - 1993" (ICS 2-321.20) lists the following horsepower ratings for these sizes for non-plugging and non-jogging duty:

| Three Phase | | | |
|--------------|-------|-----------|-------|
| 575 volts | | 230 volts | |
| Size | HP | Size | HP |
| 00 | 2 | 00 | 1 1/2 |
| 0 | 5 | 0 | 3 |
| 1 | 10 | 1 | 7 1/2 |
| 2 | 25 | 2 | 15 |
| 3 | 50 | 3 | 30 |
| 4 | 100 | 4 | 50 |
| 5 | 200 | 5 | 100 |
| 6 | 400 | 6 | 200 |
| 7 | 600 | 7 | 300 |
| 8 | 900 | 8 | 450 |
| 9 | 1600 | 9 | 800 |
| 460 volts | | 200 volts | |
| Size | HP | Size | HP |
| 00 | 2 | 00 | 1 1/2 |
| 0 | 5 | 0 | 3 |
| 1 | 10 | 1 | 7 1/2 |
| 2 | 25 | 2 | 10 |
| 3 | 50 | 3 | 25 |
| 4 | 100 | 4 | 40 |
| 5 | 200 | 5 | 75 |
| 6 | 400 | 6 | 150 |
| 7 | 600 | 7 | - |
| 8 | 900 | 8 | - |
| 9 | 1600 | 9 | - |
| Single Phase | | 115 volts | |
| 230 volts | | Size | HP |
| Size | HP | Size | HP |
| 00 | 1 | 00 | 1/3 |
| 0 | 2 | 0 | 1 |
| 1 | 3 | 1 | 2 |
| 1P | 5 | 1P | 3 |
| 2 | 7 1/2 | 2 | 3 |

NEMA/EEMAC sizes are not shown in our catalog listings but are easily converted to HP and voltage by reference to the above tabulation. It should be recognized that the NEMA/EEMAC Standard on Motors and Generators (MG-1-1998) list more HP ratings than that are shown above. For many of these "in-between sizes", Moeller Electric offers contactors and starters, with performance guaranteed, sized for the motor HP, at more economical prices than the NEMA/EEMAC sizes.

NEC 2002

- General, 430.1 through 430.18
- Motor Circuit Conductors, 430.21 through 430.29
- Motor and Branch Circuit Overload Protection, 430.31 through 430.44
- Motor Branch Circuit Short-Circuit and Ground-Fault Protection, 430.51 through 430.58
- Motor Feeder Short-Circuit and Ground-Fault Protection, 430.61 through 430.63
- Motor Control Circuits, 430.71 through 430.74
- Motor Controllers, 430.81 through 430.91
- Motor Control Centers, 430.92 through 430.91
- Disconnecting Means, 430.101 through 430.127
- Over 600 Volts, Nominal, 430.121 through 430.127
- Protection of Live Parts - All Voltages, 430.131 through 430.133
- Grounding - All Voltages, 430.141 through 430.145
- Tables, Tables 430.147 through 430.151(B)

- Part I
- Part II
- Part III
- Part IV
- Part V
- Part VI
- Part VII
- Part VIII
- Part IX
- Part X
- Part XI
- Part XII
- Part XIII

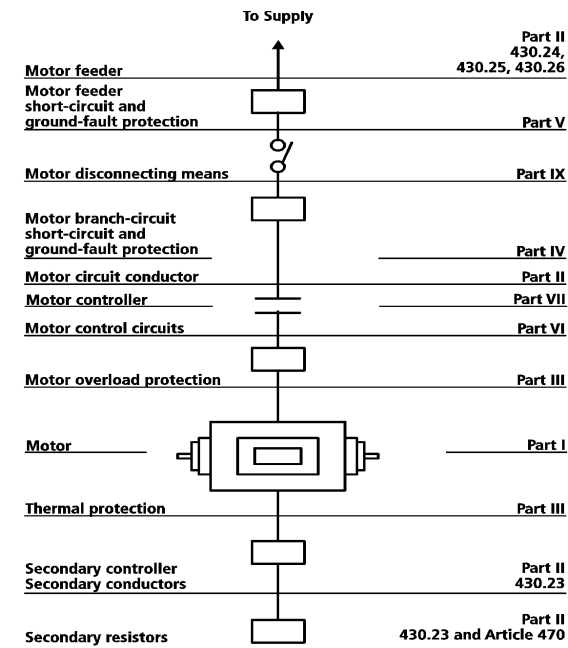


Diagram 430.1 from NEC Article 430

Useful Electrical Formulas

| To find | AC System | | DC System |
|---------------------------|---|---|--|
| | 3 phase | 1 phase | |
| HP output | $\frac{1 \times E \times 1.73 \times \%Eff \times \cos \phi}{746}$ | $\frac{1 \times E \times \%Eff \times \cos \phi}{746}$ | $\frac{1 \times E \times \%Eff}{746}$ |
| Amperes when HP is known | $\frac{HP \times 746}{E \times 1.73 \times \%Eff \times \cos \phi}$ | $\frac{HP \times 746}{E \times \%Eff \times \cos \phi}$ | $\frac{HP \times 746}{E \times \%Eff}$ |
| kVA | $\frac{1 \times E \times 1.73}{1000}$ | $\frac{1 \times E}{1000}$ | |
| Amperes when kVA is known | $\frac{kVA \times 1000}{1.73 \times E}$ | $\frac{kVA \times 1000}{E}$ | |
| kW | $\frac{1 \times E \times 1.73 \times \cos \phi}{1000}$ | $\frac{1 \times E \times \cos \phi}{1000}$ | $\frac{1 \times E}{1000}$ |
| Amperes when kW is known | $\frac{kW \times 1000}{1.73 \times E \times \cos \phi}$ | $\frac{kW \times 1000}{E \times \cos \phi}$ | $\frac{kW \times 1000}{E}$ |

I = Amperes
E = Volts
kVA = Kilo-volt-amperes
kW = Kilowatts
%Eff = per cent efficiency
cos φ = power factor

Technical Data

Rating Codes, Environmental Protection Standards

Rating Codes for AC Control Circuit: Contacts at 50 and 60 Hz

| Contact rating code designation ¹⁾ | Thermal continuous test current | Maximum current, A ²⁾ | | | | | | | | VA | |
|---|---------------------------------|----------------------------------|-------|------|-------|------|-------|------|-------|------|-------|
| | | Make | Break | Make | Break | Make | Break | Make | Break | Make | Break |
| A 150 | 10 | 60 | 6.00 | – | – | – | – | – | – | 7200 | 720 |
| A 300 | 10 | 60 | 6.00 | 30 | 3.00 | – | – | – | – | 7200 | 720 |
| A 600 | 10 | 60 | 6.00 | 30 | 3.00 | 15 | 1.50 | 12 | 1.20 | 7200 | 720 |
| B 150 | 5 | 30 | 3.00 | – | – | – | – | – | – | 3600 | 360 |
| B 300 | 5 | 30 | 3.00 | 15 | 1.50 | – | – | – | – | 3600 | 360 |
| B 600 | 5 | 30 | 3.00 | 15 | 1.50 | 7.5 | 0.75 | 6 | 0.60 | 3600 | 360 |
| C 150 | 2.5 | 15 | 1.5 | – | – | – | – | – | – | 1800 | 180 |
| C 300 | 2.5 | 15 | 1.5 | 7.5 | 0.75 | – | – | – | – | 1800 | 180 |
| C 600 | 2.5 | 15 | 1.5 | 7.5 | 0.75 | 3.75 | 0.375 | 3.00 | 0.30 | 1800 | 180 |
| D 150 | 1.0 | 3.60 | 0.60 | – | – | – | – | – | – | 432 | 72 |
| D 300 | 1.0 | 3.60 | 0.60 | 1.80 | 0.30 | – | – | – | – | 432 | 72 |
| E 150 | 0.5 | 1.80 | 0.30 | – | – | – | – | – | – | 216 | 36 |

Rating Codes for DC Control Circuit Contacts

| Contact rating code designation ¹⁾ | Thermal continuous test current | Max. Make or Break Current, A ³⁾ | | | Max. Make and break VA at 300V or less |
|---|---------------------------------|---|------|-------------|--|
| | | 125V | 250V | 301 to 600V | |
| N 150 | 10 | 2.2 | – | – | 275 |
| N 300 | 10 | 2.2 | 1.1 | – | 275 |
| N 600 | 10 | 2.2 | 1.1 | 0.40 | 275 |
| P 150 | 5.0 | 1.1 | – | – | 138 |
| P 300 | 5.0 | 1.1 | 0.55 | – | 138 |
| P 600 | 5.0 | 1.1 | 0.55 | 0.20 | 138 |
| Q 150 | 2.5 | 0.55 | – | – | 69 |
| Q 300 | 2.5 | 0.55 | 0.27 | – | 69 |
| Q 600 | 2.5 | 0.55 | 0.27 | 0.10 | 69 |
| R 150 | 1.0 | 0.22 | – | – | 28 |
| R 300 | 1.0 | 0.22 | 0.11 | – | 28 |

Notes:

- ¹⁾ The numerical suffix designates the maximum voltage design values, which shall be 600V, 300V, and 150V for suffixes 600, 300, and 150 respectively.
- ²⁾ For maximum ratings at voltages between the maximum design value and 120V, the maximum make-and-break ratings shall be obtained by dividing the volt-ampere rating by the applicable voltage. For voltages below 120V, the maximum make current shall be the same as for 120V and the maximum break current shall be obtained by dividing the break volt-ampere by the application voltage, but shall not exceed the thermal continuous test current.
- ³⁾ For maximum ratings at 300V or less, the maximum make-and-break ratings shall be obtained by dividing the volt-amperes rating by the application voltage, but shall not exceed the thermal continuous test current.

Source: CSA standard C22.2 No. 24-M 1995, UL 508 Tables 123.1 and 123.2 1999 (17th edition)